

# Advantages of Reproductive Synchronization in the Caribbean Flamingo



By Francisco Martinez

SoCo: Darwin, Evolution, and the Galapagos

Prof. Bill Durham

## **Abstract**

The Caribbean Flamingo with its pink plumage and almost comical appearance has become an icon for tropical climates. This amazing creature is incredibly adept, with colonies as far north as France and as far south as the bottom tip of South Africa (Juan A. Amat, September 2005, Pages 183-192). This paper will address one of the many facets of the Caribbean Flamingo, reproductive synchronization, and how this feature allows it to survive in Galapagos.

This paper will start with giving some basic taxonomical information and population distribution. A brief summary of “Flamenco Dance” will be addressed as it is crucial in understanding the plasticity of reproductive synchronization for this species.

The majority of the paper will focus on two possible hypotheses explaining the advantages of reproductive synchronization in the Caribbean Flamingo. The first hypothesis is: reproductive synchronization allows for the flexibility of choosing a time and place to mate in order to provide an optimum chance for successful reproduction. The second hypothesis is: by virtue of all flamingos laying eggs and rearing chicks at the same time a degree of group protection via reciprocal altruism can assist in the survival of fledglings in a very vulnerable stage in life. Together both hypotheses seek to address the question of “How can the flamingo maintain a steady population in such a harsh and demanding Galapagos?”



## **Background**

The Caribbean Flamingo (*Phoenicopterus ruber*), also known as the Galapagos Flamingo but only in reference to the resident species in the Galapagos, is an instantly recognizable bird with prolonged legs and a flexible giraffe sized neck. The Flamingo also have a unique way of getting food, they are filter feeders and use their tongue to pump water and filter the crustaceans and microorganism that live in the brackish lagoons.

Although Caribbean Flamingos live in a very wide range of latitudes, the colony in the Galapagos is in way endemic because the population does not migrate outside the archipelago. The Galapagos Flamingo lives primarily on the islands of Isabella, Santiago, and Santa Cruz however they have been sightings of flamingos living in many more islands throughout the archipelago (F. H. Vargas, 2008: 253). The total population is very small, about 500, however since census data has been available the population size has remained constant despite dramatic climate events like El Nino (F. H. Vargas 2008: 255).

After performing elaborate courtship rituals of synchronized marching, preening, and honking the flamingos mate. The Caribbean flamingos produce only one white chalky egg, which is laid on a mud mound in shallow water. Both parents switch off incubating the egg

which takes 27-31 days to hatch (Fitter 2000: 50). After the chick hatch they are fed a substance called "crop milk" which comes from the parents' upper digestive tract (Fitter 2000: 50). Either parent can feed the chick this way and other flamingos can act as foster feeders. When the chicks are old enough to walk they gather together in creches that are watched over by a few adult birds. By the time young flamingos reach 2 - 3 years of age they will have gained their full adult plumage (Kricher 2002: 160)



### **The Flamingo Dance and Reproductive Synchronization**

Whenever conditions are suitable for mating flamingos will gather in the brackish lagoons and perform an elaborate courtship dance. Some male will start off the dance by marching around the lagoon, with his neck stiffened straight up to reach its tallest height (Allen 1956). Seeing this behavior both males and females will join the march, forming a parade like event. During the parading the flamingos will perform a host of different mating behaviors. Both males and females will Head-Flag which consists of rapidly turning their head and holding the position for a second and repeating in the opposite direction (Kricher 2002: 160). The males will wing-salute to show off their primary and secondary black flight feathers. They will also

Twist-Preen, to presumably show off the condition of their feathers as well as the flexibility of their neck. In addition the Flamingos also perform Wing-Leg Stretch and Inverted Wing-Salute, false feed, and broken neck (Kricher 2002: 160). These behaviors have been reported to last as short as a few hours but can be continued for days.

Flamingos are incredibly social birds, and their flamingo dance is key in allowing for reproductive synchronization to occur. Reproductive synchronization is used to describe the behavior and consequence of the flamingo dance. John Kricher connected the flamingo dance with reproductive synchronization when he was observing the Galapagos Flamingo, “The function of the collective display is to permit the endocrine systems of the participants to come into synchrony, to prepare each bird to mate, and to have the mating occur, and thus the nesting occurs in a relatively narrow time frame.” (Kricher 2002: 161). In other words reproductive synchronization is the ability to activate and prepare the body to mate on demand and in conjunction with a group. The flamingo dance serves two purposes one it allows for the selection of a mate and two it also stimulates the hormones that can make mating possible.



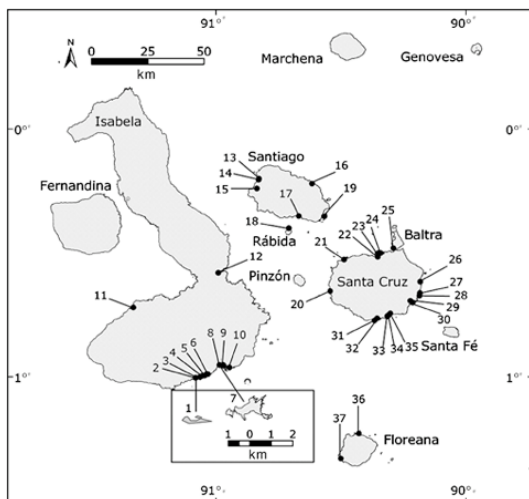
# Hypothesis

## Reproductive Flexibility Hypothesis

The Reproductive Flexibility Hypothesis provides a possible explanation for why the Galapagos Flamingo can maintain a steady population despite facing a harsh environment and dramatic climate events. The Reproductive Flexibility Hypothesis is: reproductive synchronization allows for the flexibility of choosing a time and place to mate in order to provide an optimum chance for successful reproduction. This means that reproduction, *visa vi* reproductive synchronization, makes the flamingo able to reproduce independent of a specific location or season.

Reproductive synchronization is an adaptation that allows for mating to occur when conditions in the lagoon are suitable. However reproductive synchronization is not to be confused as an adaptation for the species, such that the group display and mating behaviors occur for the “survival of the species.” Reproductive Synchronization is necessary for an individual

**Figure 1**



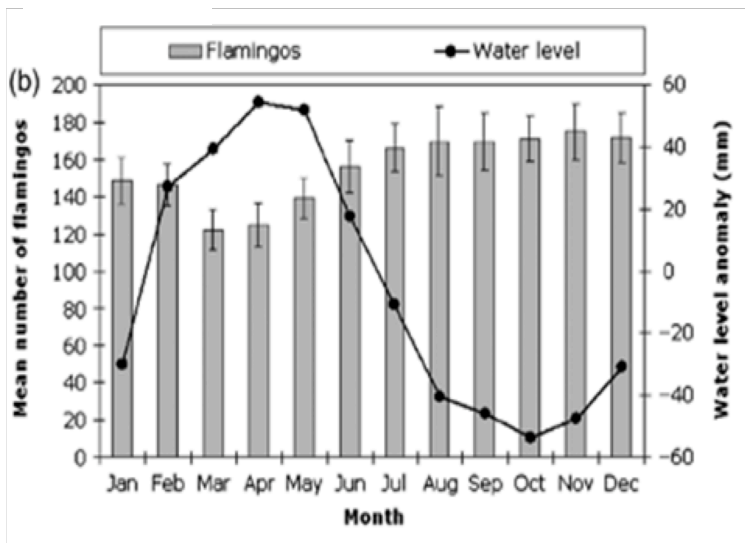
Location of flamingo colonies (F. H. Vargas, 2008: 255)

flamingo to be successful in the sense that the individual has a greater chance of reproducing strong and fertile offspring. The individual can increase his or her chance of finding a mate by participating in the ritualized displays of the flamingo dance. John Krishner put it as “the group activity is one of collective selfishness in that it is the overwhelming advantage of each individual to get to the center of the lagoon and join the march,” (Kricher 2002: 161). Since the Galapagos is an

incredibly harsh climate with lagoon water levels always subject to droughts and flooding, an individual must somehow optimize a way to reproduce successfully. Reproductive synchronization allows for a flamingo to respond to these fluctuating conditions by having the flexibility of choosing whatever time the conditions are most favorable for mating.

Being able to breed independent of season offers advantages, but reproductive synchronization also allows for breeding to occur independent of place. The Flamingo dance can be done anywhere so long as there are flamingos to perform it. This is evident in the sheer number of sites that flamingos have been reported mating in the archipelago. Data collected by Vargas, Barlow, Hart, Uzcátegui, Chavez, and Macdonald concludes that there are three consistent breeding sites in Isabela, Santiago, and Santa Cruz however there have

**Table 1**



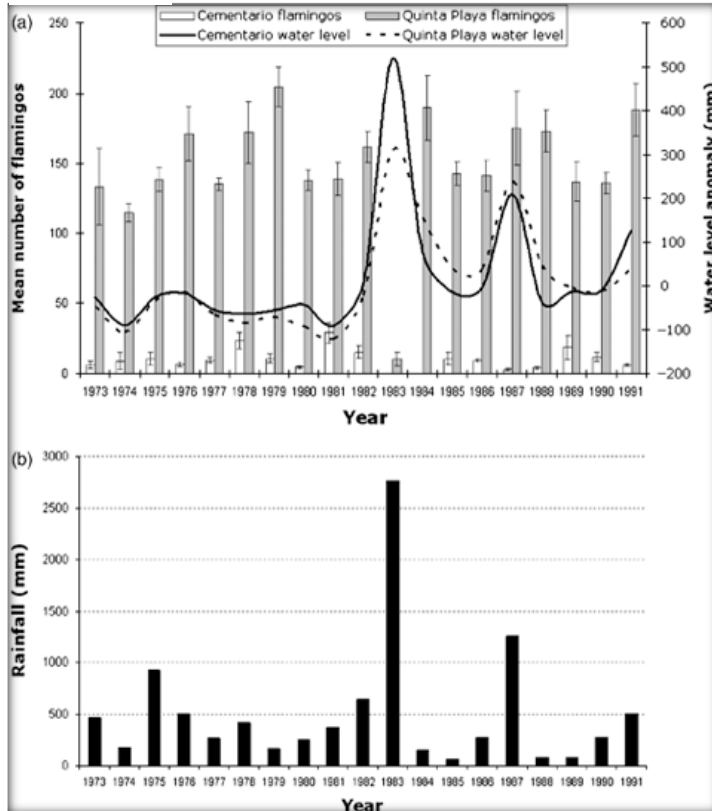
Monthly (mean±se) fluctuations of flamingo numbers in relation to mean water level anomalies at Cementerio, Isabela Island, between 1973 and 1991.

also been 34 other nesting sites used when the major lagoons are for whatever reason unfavorable (Figure 1). Being able to mate independent of a specific breeding ground allows for the flamingo to optimize reproduction and become resistant to host of climatic events.

As mentioned before the number one variable dictating breeding is water levels in the

brackish lagoons. Table 1 shows the mean number of flamingos every month vs. the water level in largest brackish lagoon on Isabela. One trend in the graph is that when water levels are below 30cm the average population of flamingos increases. (F. H. Vargas, 2008: 255).

**Table 2**



(a) Annual (mean±se) fluctuations of flamingo abundance at Cementerio and Quinta Playa in relation to changes in lagoon water levels.

These water levels become very important in an El Niño year where the water level will increase so much that the brackish lagoon is no longer suitable for the flamingo to even live in. This is clearly seen in the El Niño year of 1983, where the population in Cementerio on Isabela Island collapsed. However what is astonishing is the next year there was an actual increase in population before the collapse (F. H. Vargas, 2008: 256).

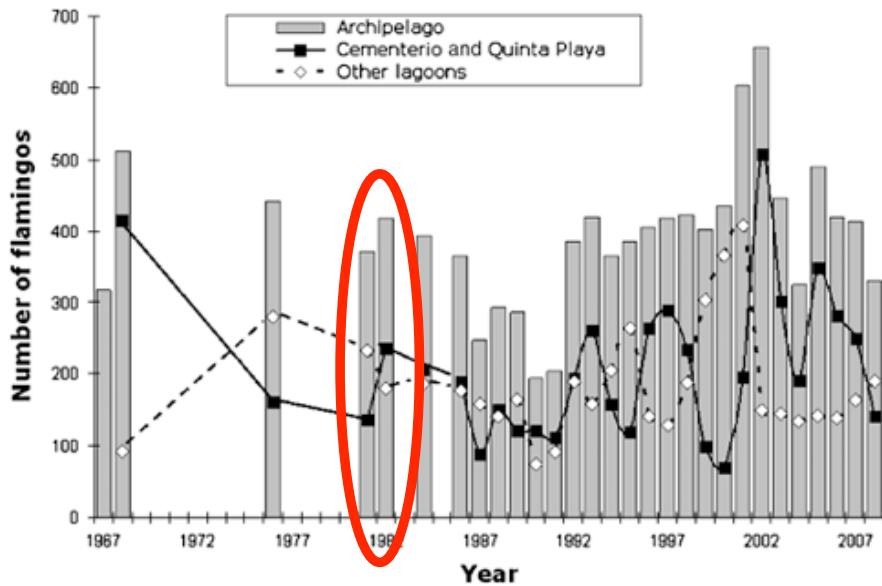
This begs the question how did the

flamingos manage to reproduce in an El Niño year that destroyed their habitat. The answer lies in the flamingo's ability to reproduce independent of time and location.

While the El Niño event did temporarily destroy the habitat on Isabela Island it also produced new lagoons elsewhere on the archipelago (F. H. Vargas, 2008: 256). The flamingos were able to regroup in these new lagoons and synchronize their reproduction systems by performing their flamingo dance, and thus were allowed to mate without a problem. This effective approach is supported by Table Three showing the total population of Galapagos Flamingos throughout the entire archipelago. It becomes evident that the population remained relatively constant from 1983 to 1984 despite El Niño events. It is also evident from the graph that the total population was able to increase despite having less flamingos present in



**Table 3**



Cementerio. Overall the flexibility in Flamingo mating provides an advantage to an individual flamingo and offers population stability against harsh climatic events.

### The Crèches and the Reciprocal Altruism Hypothesis

The Crèche and Reciprocal Altruism Hypothesis provide an alternative but not conflicting explanation of why flamingos all mate within a narrow time frame. The Crèche and Reciprocal Altruism hypothesis states: by virtue of all flamingos laying eggs and rearing chicks at the same time a degree of group protection via reciprocal altruism can assist in the survival of fledglings in a very vulnerable stage in life. In other words it is an advantage to an individual to mate at the same time as everyone else because it will protect that individual's offspring better than if he was to mate in a different time.

An adult Galapagos Flamingo has no direct predators so why would group protection have any significant impact? While adults do not have any predators the egg and fledgling

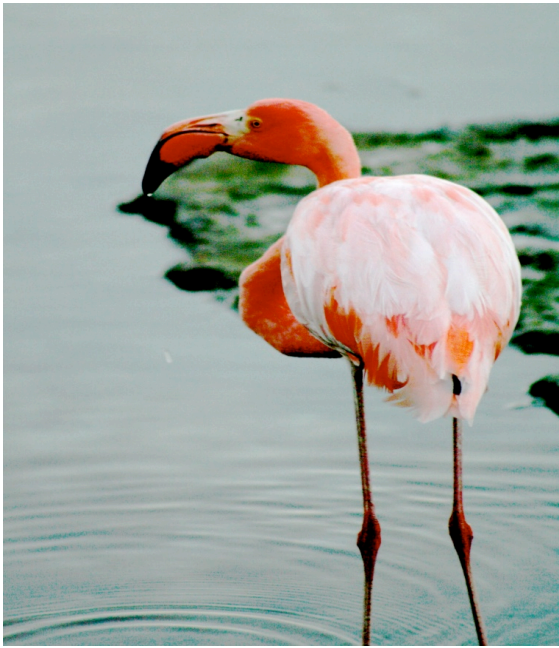


Travis Dove for The Boston Globe 1

are preyed on by everything from hawks to beetles (Interview with Galapagos Natural Guide). Being in a large group offers numerous defensive advantages. A Galapagos hawk is more deterred from attacking a fledgling surrounded by a large group rather than two parents. As flamingos are social birds if danger is around, all birds will notice. In addition being in a large group allows for the formation of crèches. Crèches are “daycares” for fledgling Galapagos Flamingos. Michael H. Jackson in *Galapagos a Natural History* describes this behavior “The chicks are fully covered with down when they hatch and are able to walk about almost immediately. Within a few days, the chicks leave the nest area and form crèches which are guarded by adults.” These crèches offer many advantages one of which is increased fledgling protection from natural predators.

In addition forming crèches is advantageous because the day care system allows for more time to gather food. Flamingos are very large birds and their diet consists of filtering thousands upon thousands of microorganisms from the organic ooze of the brackish lagoons. It takes an extensive amount of time to gather enough food just for the adult and takes even more time if the flamingo is rearing a chick. In the crèche system, parent flamingos will take turns watching the daycare thus allowing for the majority of the parents to gather food.

The crèche system is dependent on reciprocal altruism. Reciprocal altruism is defined as “Mutually beneficial behavior in which an individual helps another because of expected reciprocal behavior,”(Robert T. Trivers Nature.com). The Galapagos Flamingo’s crèche system works because each parent flamingo expects that its time watching over another individual’s chick will be rewarded by having their own chick be guarded. The system also works because all the individuals have mated in a narrow time frame and therefore have chicks that need guarding. Ultimately it is advantageous to an individual to participate in reproductive synchronization so that their chicks can be guarded as well as having more time to gather food.



## **Conclusion**

We have seen that reproductive synchronization is an important component in understanding how the Galapagos flamingo is able to maintain a constant population in the archipelago. Reproductive synchronization is triggered by the flamingo dance which can be done in any location and during any time. The freedom from being restricted to a certain season or geographic region allows for extreme reproductive flexibility. This flexibility is evident in population data from Cementario, and other sites across the archipelago. In addition the flexibility also provides an explanation in how the Galapagos flamingo's population is resistant to harsh climatic events like "El Nino" which usually cause population crashes in other Galapagos species. In addition reproductive synchronization results in the population rearing and raising chicks at the same time. This allows for the birds to form crèches which offer multiple advantages one of which is the group protection for the young. The crèche system also is an example of reciprocal altruism, and allows for an individual Galapagos flamingo to gather more food working in this system than it could if otherwise. Overall reproductive

synchronization offers the flamingo multiple advantages both to survival and reproduction, and is key factor in understanding the Flamingos success in the Enchanted Isles.

## Bibliography

- Allen, R.P. "The Flamingos: Their Life History and Survival." Research Report No. 5, National Audubon Society, 1956.
- Barber, R.T. & Chavez, F.P. (1983). Biological consequences of El Niño. *Science* **222**, 1203–1210.
- Cezilly, F., Boy, V. & Green, R.E. (1995). Interannual variation in Greater Flamingo breeding success in relation to water levels. *Ecology* **76**, 20–26
- F. H. Vargas, S. Barlow, T. Hart, G. Jimenez-Uzcátegui, J. Chavez, S.Naranjo, D. W. Macdonald. "Effects of climate variation on the abundance and distribution of flamingos in the Galápagos Islands" Journal of Zoology (2008): 252-265.
- Fitter, Daniel and Julian and David Hosking. "Wildlife of the Galapagos." Princeton, NJ: HarperCollinsPublishers Ltd., 2000.
- Johnson, A.R., Green, R.E. & Hirons, G.J.M. (1991). Survival rates of the Greater Flamingos in the west Mediterranean region. In *Bird population studies*: 249–271. Perrins, C.M., Juan A. Amat, Miguel A. Rendón, Manuel Rendón-Martos, Araceli Garrido, José M. Ramírez."Ranging behavior of greater flamingos during the breeding and post-breeding periods: Linking connectivity to biological processes." *Biological Conservation, Volume 125, Issue 2, September 2005, Pages 183-192*
- Jackson, M.H. (1993) The Galapagos: A Natural History, University of Calgary Press, Canada
- Kricher, John (2002) Galapagos, Smithsonian Institution Press, Washington & London
- Robert T. Trivers. Nature.com [http://www.nature.com/nrg/journal/v6/n4/glossary/nrg1575\\_glossary.html](http://www.nature.com/nrg/journal/v6/n4/glossary/nrg1575_glossary.html)

Anyonymous photographer posted on <http://best-animal-wallpapers.blogspot.com/2008/06/best-flamingo-wallpapers.html>