

# Biology of the Galapagos

Wikelski reading, Web links



26 March 2009, Thurs  
ECOL 182R UofA  
K. E. Bonine

Alan Alda  
Video?

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Student Chapter of the  
Tucson Herpetological  
Society

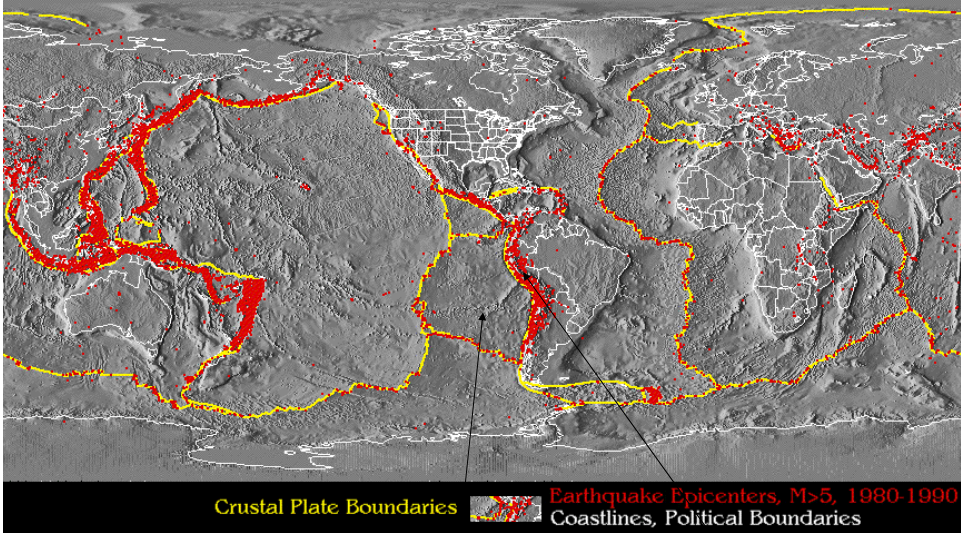
**COME  
JOIN!!!!**







Plate Tectonics

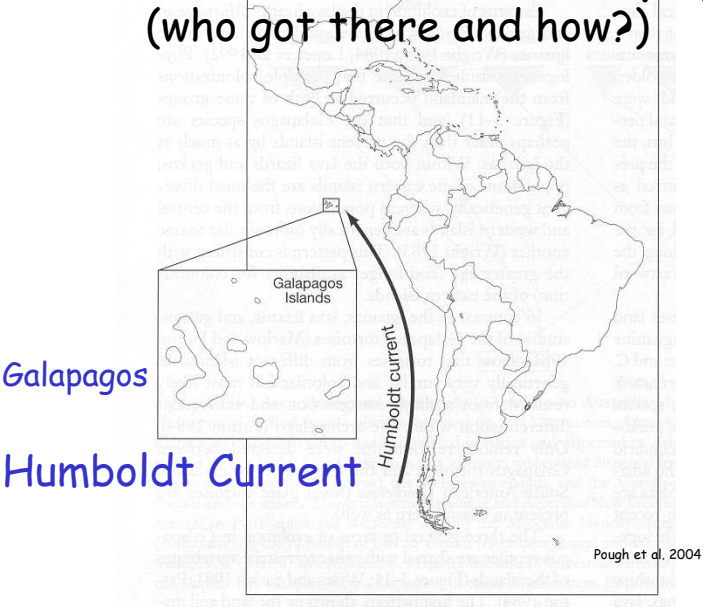


Nazca Plate

Andes

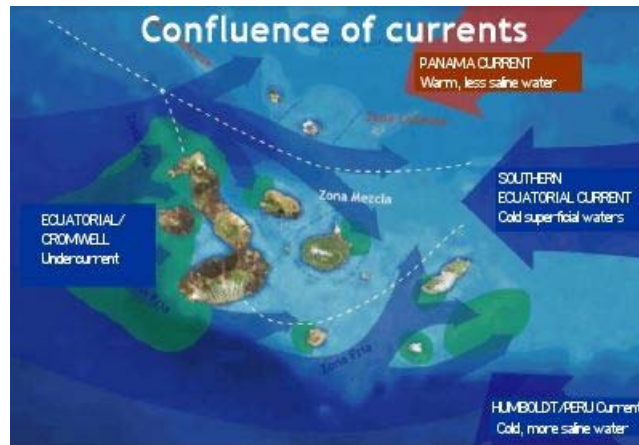
7

# Colonization of the Galapagos (who got there and how?)



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# Colonization of the Galapagos (who got there and how?)



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## HOW MANY?

- Birds
- Frogs
- Lizards & Snakes
- Mammals
- Marine or Terrestrial?
- Plants

Galapagos difficult to colonize.  
Some taxa make the journey better  
than others.

Many \_\_\_\_\_ species than \_\_\_\_\_ .

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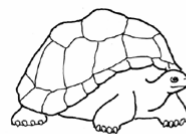


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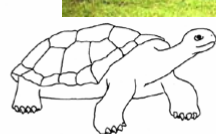
... is the diversification of a single or small groups of species into a **large number of descendant species** that occupy various ecological niches.

This is an evolutionary process driven by natural selection.

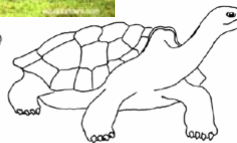
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domed



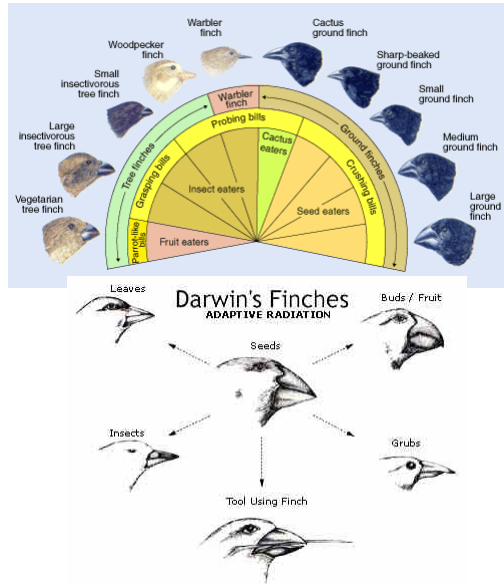
intermediate



saddle

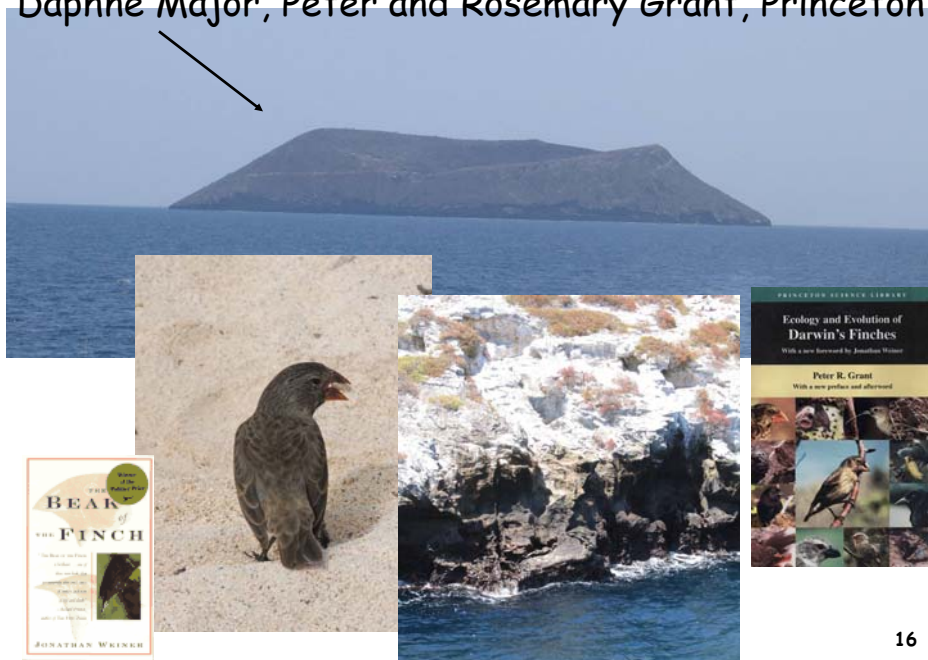






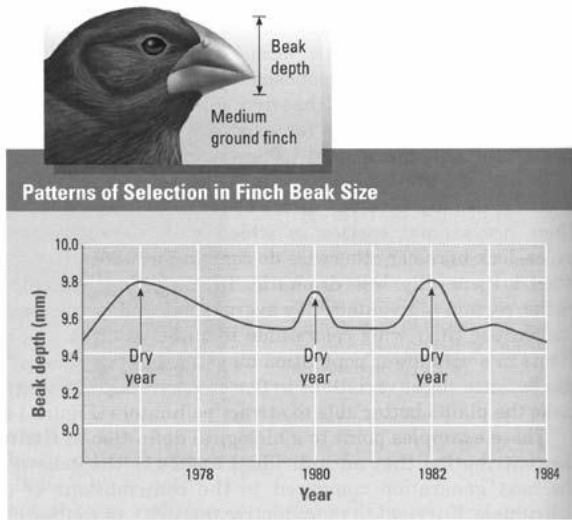
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Daphne Major, Peter and Rosemary Grant, Princeton



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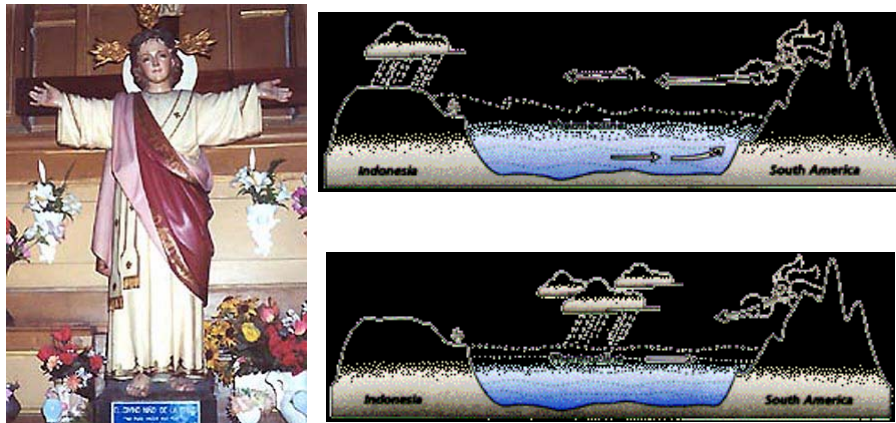




▲ **Figure 14-31** The Grants documented changes in beak size among medium ground finches over many years.

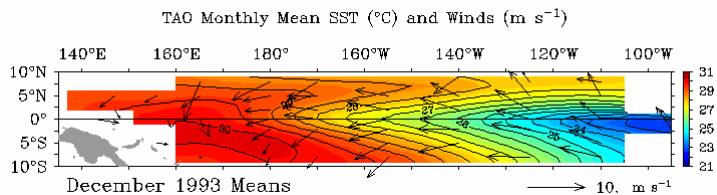
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El Niño  
is an oscillation of the ocean-atmosphere system in  
the tropical Pacific

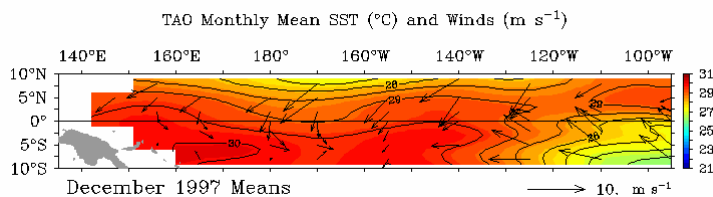


<http://kids.earth.nasa.gov/archive/nino/intro.html> <sup>18</sup>

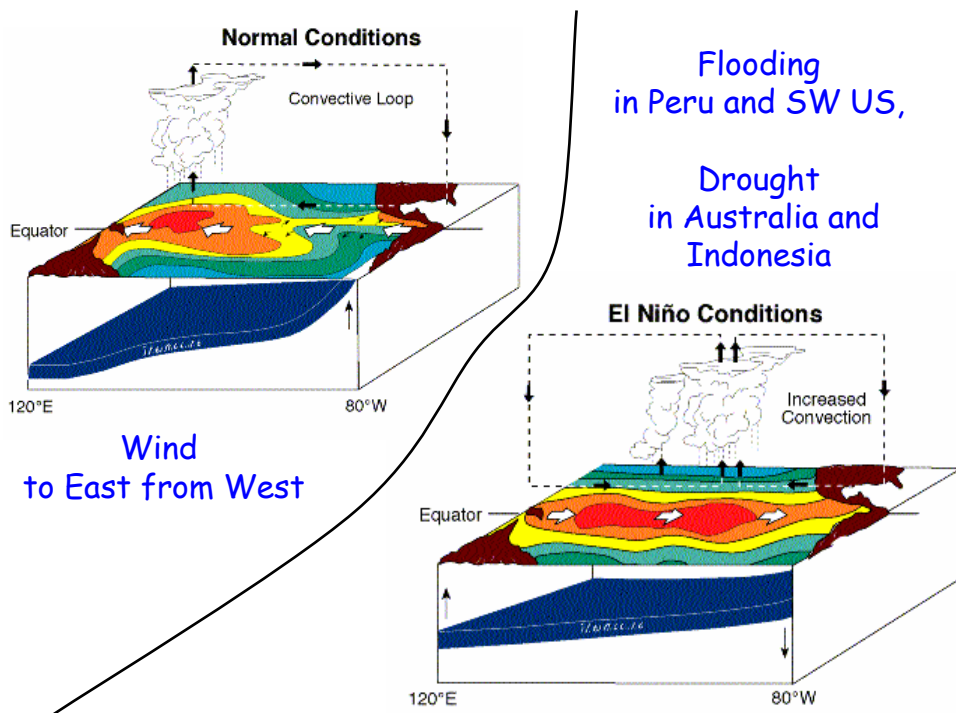
### Normal Conditions:



### El Nino Conditions:



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Cold up-welling of Cromwell current brings \_\_\_\_\_ to western Galapagos.

Without it, much of the marine food web is lost...



Galapagos Marine Iguana \_\_\_\_\_

Fernandina/Isabela (W)  
males to 10+ kg  
females to almost 3 kg

Genovesa (NE)  
males only to 1 kg  
females to < 1kg



*Amblyrhynchus cristatus*

Why?

Iguanas bigger on  
some islands:

1. Water
2. Current strength
3. Food Availability

Males bigger than  
females:

selection



What are sneaker males?

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Video clip about Galapagos and Marine Iguanas  
Martin Wikelski with Alan Alda, etc.  
Borrowed video from Angela

0-10 min    [intro and general biogeography](#)  
10-18 min    ~finches and beak evolution on Daphne Major  
18-30 min    [marine iguanas](#)  
30-39 min    nazca boobies and siblicide  
39-52:40    conservation etc.

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Discovered 1530s



## Invasive Herbivores



Goats



No Goats



<http://www.darwinfoundation.org/en/our-work/featured-projects/project-isabela>

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## Judas Goats on Isabela, Galapagos



<http://www.darwinfoundation.org/en/our-work/featured-projects/project-isabela>

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**Invasive Species Threaten Galapagos's Diversity**, By Juliet Eilperin  
 Washington Post Staff Writer, Monday, February 27, 2006; A06

The eight-year battle to **remove wild goats, donkeys and pigs** from Santiago, Santa Cruz and northern Isabela islands has cost at least **\$5.2 million** and is still just shy of completion. The United Nations covered three-quarters of the cost.

The assault against feral goats -- along with an ongoing campaign against wild dogs, cats, pigs, donkeys and an array of invasive plants and insects -- demonstrates the challenge conservationists face in preserving this hotbed of genetic diversity. Alan Tye, interim director of sciences at the Charles Darwin Research Station on the island of Santa Cruz, said his institute focuses on just two things: "threats and threatened things."

Although 95 percent of the species that were here when humans first arrived still exist in the Galapagos, the International Union for Conservation of Nature and Natural Resources lists dozens on its "red list" of threatened species. These include the Galapagos hawk and the Galapagos fur seal, along with 57 species of Bulimulus snails.

Other species, including **plants and insects, are harder to eradicate**. At this point, the **720 introduced** plants growing in the Galapagos outnumber the islands' **500 original** plant species. Blackberry bushes, planted by farmers, have spread widely, along with quinine trees. Newer residents are bringing in ornamental shrubs such as lantana, nicknamed "the curse of India" because it drives out other plants, and other garden plants to the Galapagos.

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Charles Darwin Research Station Fact Sheet

## Eradication of fire ants

The little fire ant, *Wasmannia auropunctata*, is one of the most aggressive invertebrate species ever introduced to Galapagos. Together with the tropical fire ant, *Solenopsis geminata*, fire ants greatly affect native invertebrates and vertebrates, presenting a serious threat to fragile Galapagos ecosystems. Their control is a priority project for the Charles Darwin Foundation (CDF).

### Arrival in Galapagos

*W. auropunctata* is native to Central and South America, but was introduced to Galapagos during 1910-1920. It first colonized Santa Cruz, but is now widely distributed on eight islands: Floreana, Isabela, Marchena, Pinzón, San Cristóbal, Santa Cruz, Santa Fe, and Santiago, and five islets.

Historically, *W. auropunctata* was probably transported between large islands on plants or in soil, and to small islands on equipment carried by people.

*S. geminata* is native to regions of the Americas. It was first reported in San Cristóbal in 1891. It has been recorded on six islands: Floreana, Isabela, San Cristóbal, Santa Cruz, Santa Fe, and Santiago, and five islets.

*S. geminata* is harder to control than *W. auropunctata* as new colonies are founded by winged females that can fly over long distances. *W. auropunctata*, on the other hand, radiates outwards from the original colony on foot to occupy extensive areas. This process is called budding.

### Impact on Galapagos

*W. auropunctata* reduces ground and tree-dwelling invertebrate species diversity in areas where it is dominant, causing a marked reduction of native scorpions, spiders and ant species. *S. geminata* is also a voracious feeder of invertebrates but its effects are patchier because of the way it colonizes new areas.

*W. auropunctata* attacks tortoise hatchlings and adult tortoises. *S. geminata* affects the nesting behavior of land iguanas and tortoises, and threatens hatching success of endemic reptiles as well as birds.

*W. auropunctata* can form an extensive colony over an entire small island putting at risk endemic species that are restricted to only one island (single island endemics).

### CDRS Research Activities

**CDF FOCUS: RESTORATION**



**Key Facts**

**Species:** *Wasmannia auropunctata*

**Common name:** Little fire ant

**Origin:** Central and South America

**Class:** Invasive

**Impact:** Affects native invertebrate populations and reptile and bird breeding

**Range:** Extensive, spread to eight islands and five islets

**Action:** Control and eradication

**Species:** *Solenopsis geminata*

**Common name:** Tropical fire ant

**Origin:** New World

**Class:** Invasive

**Impact:** similar to *W. auropunctata*

**Range:** Extensive, spread to six islands and five islets

**Action:** Control and eradication

Charles Darwin Research Station Fact Sheet

## Blackberry invasion

The five species of blackberry (local name: mora) are aggressive, invasive species that have had a negative impact on several Galapagos Islands. They compete with native and endemic species for light, water, and nutrients, and affect local agriculture. Eradication of blackberry is a major focus for the Charles Darwin Foundation (CDF) and the Galapagos National Park Service (GNPS).

### Arrival in Galapagos

Five species of Blackberry have been introduced to Galapagos over the last 40 years:

- *Rubus niveus*
- *Rubus glaucus*
- *Rubus ulmifolius*
- *Rubus adenotrichos*
- *Rubus megalococcus*

Hill Blackberry (*R. niveus*) was introduced for agricultural purposes to San Cristóbal in the 1970's and has spread to Santiago, Santa Cruz, and Isabela Islands.

Many bird species feed on the fruit and are responsible for localized spread. Most cases of dispersal between islands are thought to be due to deliberate introductions by people.

The other blackberry species have been introduced more recently and are restricted to relatively small areas at present.

### Impact on Galapagos

*R. niveus* is one of the worst weeds threatening the Galapagos National Park. It has invaded open vegetation, shrubland and forest alike. It forms dense thickets up to 4 meters high, replacing native vegetation, and threatening many rare endemic plants.

On farmland, *R. niveus* renders farmland useless and is difficult and expensive to control.

Although only found over localised areas at present, there is concern that the other four species of blackberry could become a significant problem too if they are not controlled.

**CDF FOCUS: RESTORATION**



**Key Facts**

**Family:** Rosaceae

**Species:** *Rubus niveus*, *R. glaucus*, *R. ulmifolius*, *R. adenotrichos*, *R. megalococcus*

**Common name:** Blackberry, Mora

**Class:** Invasive

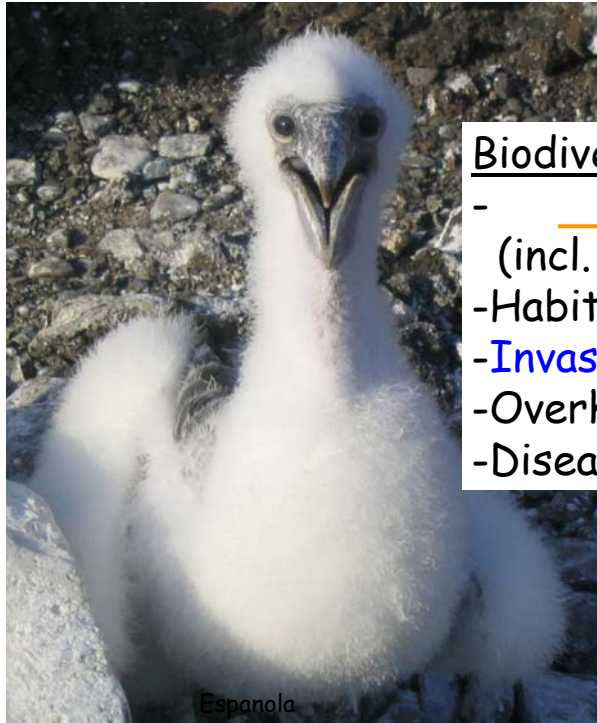
**Impact:** Replacing native and endemic vegetation, invading farmland

**Origin:** Asia (*R. Niveus*), Central to South America (*R. glaucus*, *R. adenotrichos*, *R. megalococcus*), Africa & Europe (*R. ulmifolius*)

**Description:** dense thickets up to 4m high

**Range:** San Cristóbal, Santiago, Santa Cruz, Isabela

**Action:** Eradication



## Biodiversity Threats

- (incl. climate change)
- Habitat Fragmentation
- Invasive Species
- Overharvesting
- Disease

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## Galapagos Marine Ecology (ECOL 4960/5960)

Summer Session II: July 7-Aug 1, 2009

- Spend one month this summer in the Galapagos Islands, Ecuador!
- Visit seven of the most spectacular islands in the archipelago
- Do a service project with children at a local school and the Galapagos National Park
- Do a field ecology project and learn about Galapagos ecology and evolution
- Earn 3-6 units of graduate or undergraduate credit

For more information: [www.eebweb.arizona.edu/courses/galapagos/](http://www.eebweb.arizona.edu/courses/galapagos/)  
Katrina Mangin, [mangin@email.arizona.edu](mailto:mangin@email.arizona.edu), 520-626-5076

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Thanks for a *Great* 1/3 Semester

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