

Rapidly hybrid speciation in Darwin's finches

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- Background

- Results

- Discussion

- **Background**

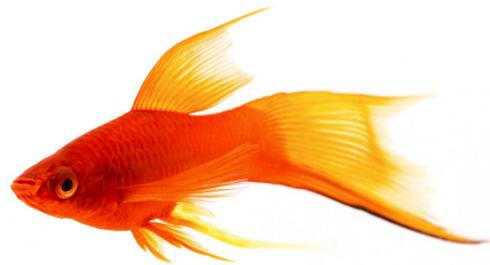
- Results

- Discussion

- Homoploid hybrid speciation in animals has been inferred frequently from patterns of variation, but few examples have withstood critical scrutiny.



Heliconius butterflies

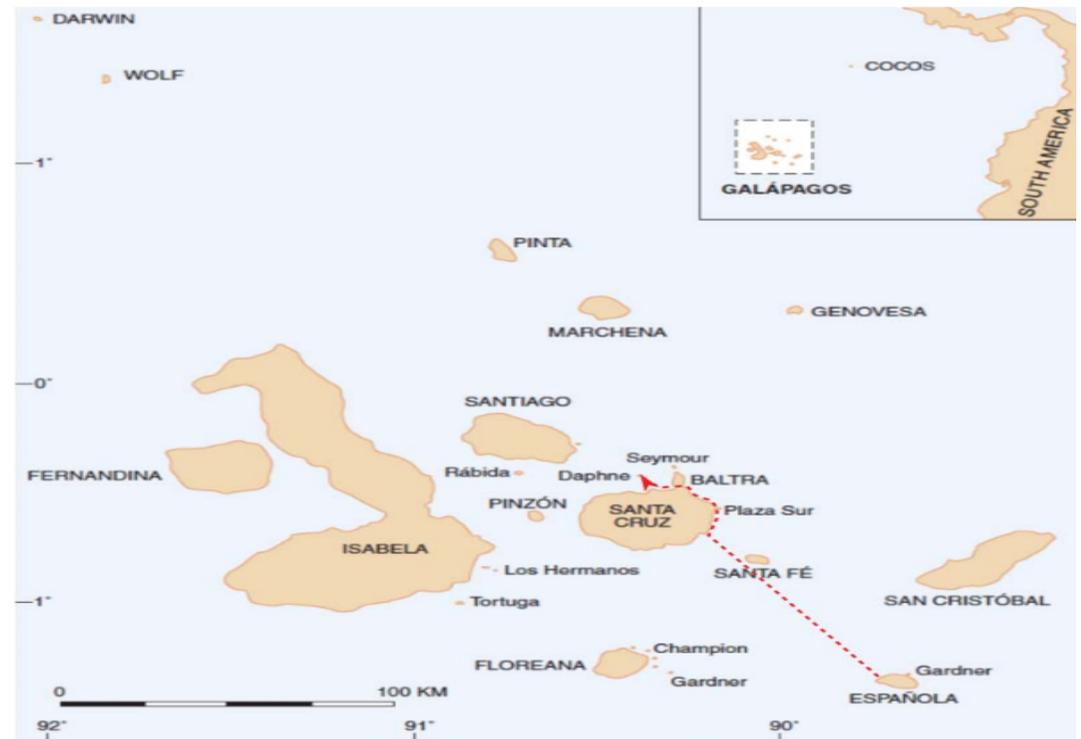


swordtail fish



Sparrow

- An immigrant Darwin's finch to Daphne Major in the Galápagos archipelago initiated a new genetic lineage by breeding with a resident finch (*Geospiza fortis*).

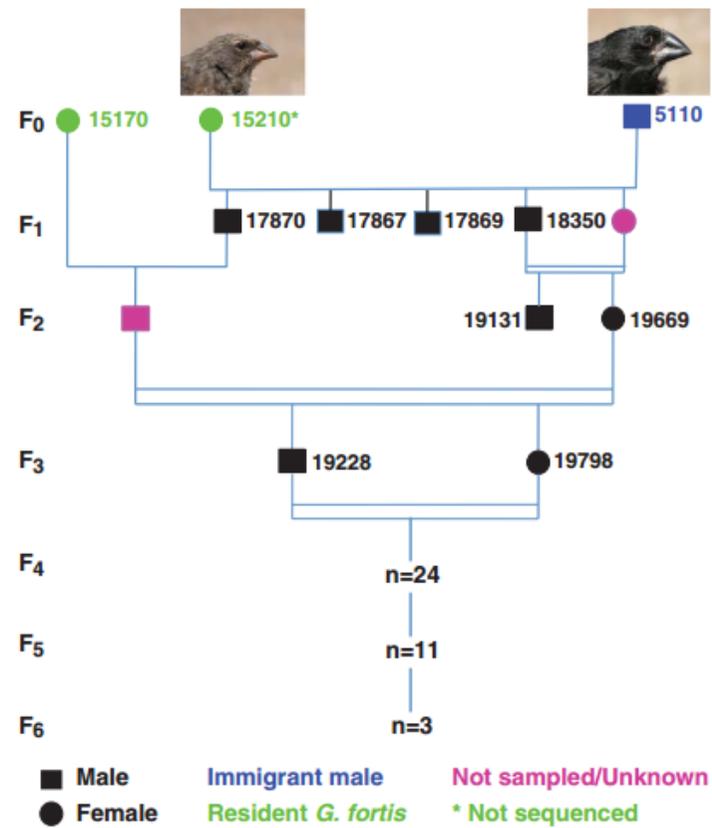


- Background

- **Results**

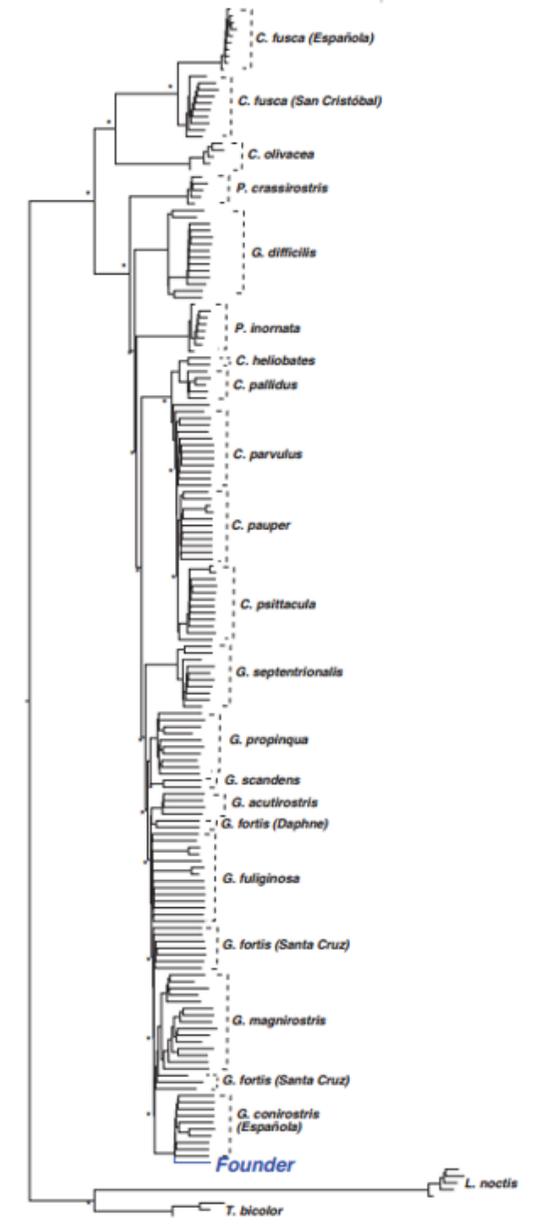
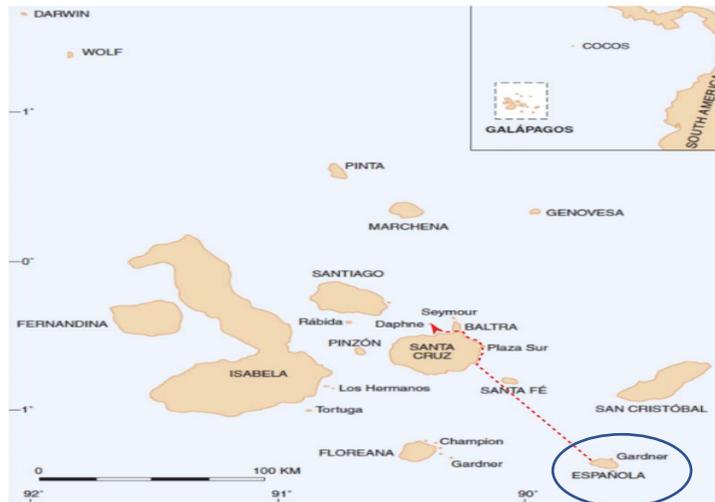
- Discussion

The Big Bird lineage through the sixth generation.

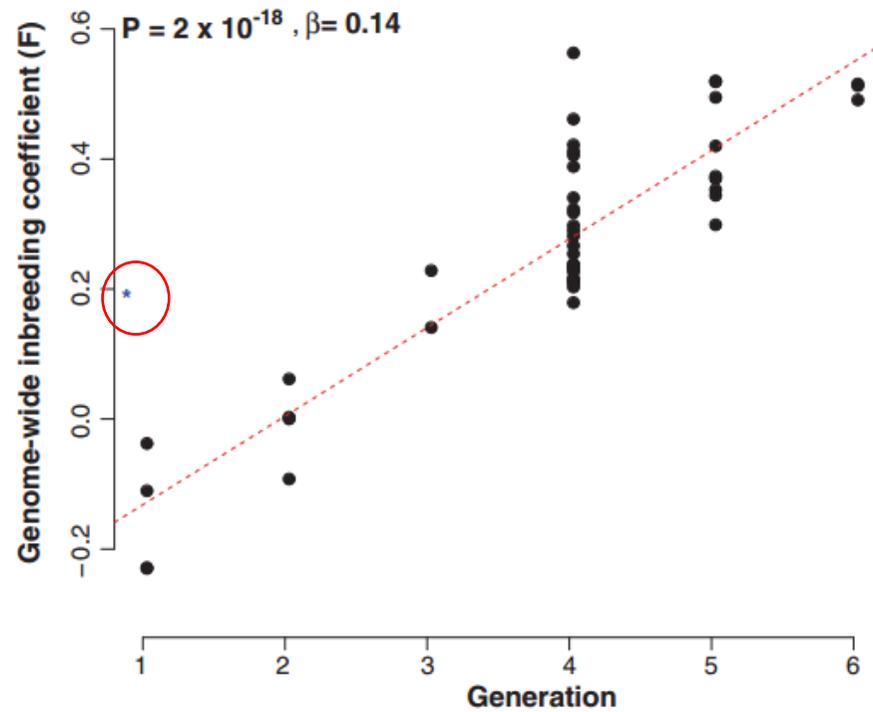


Assigned the founder male to species and source population

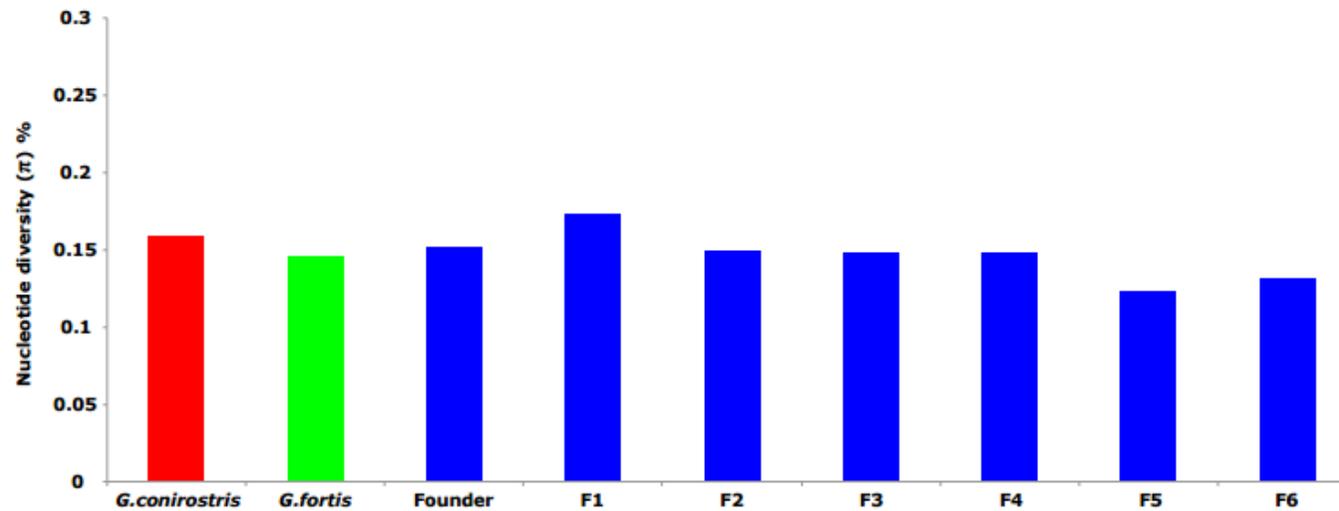
A phylogenetic tree analysis showed that the founder male (individual 5110) was not a *G. fortis* × *G. scandens* hybrid as previously hypothesized, but rather a ***G. conirostris***. This species (large cactus finch) occurs on Española and its satellite Gardner and nowhere else in the Galápagos archipelago.



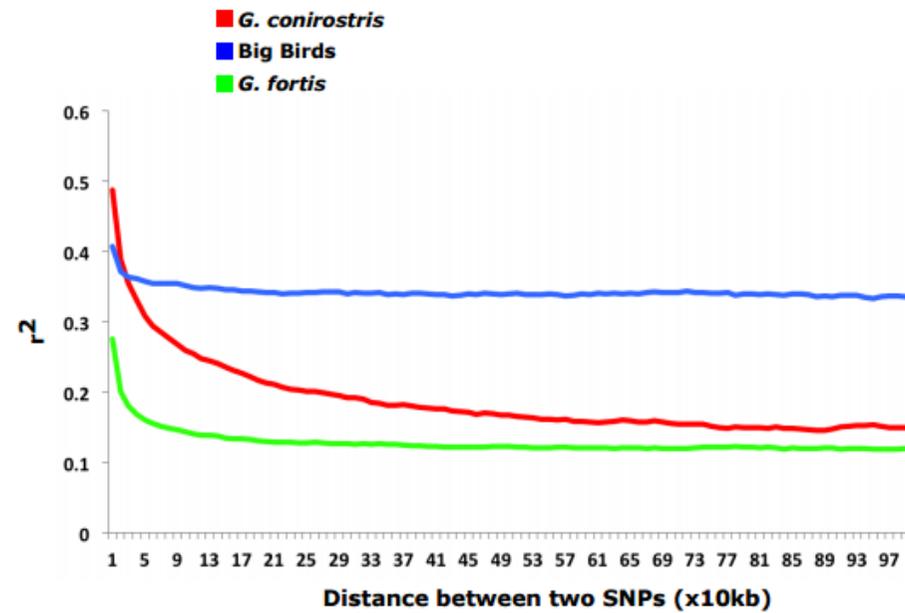
The inbreeding coefficient in the Big Bird lineage



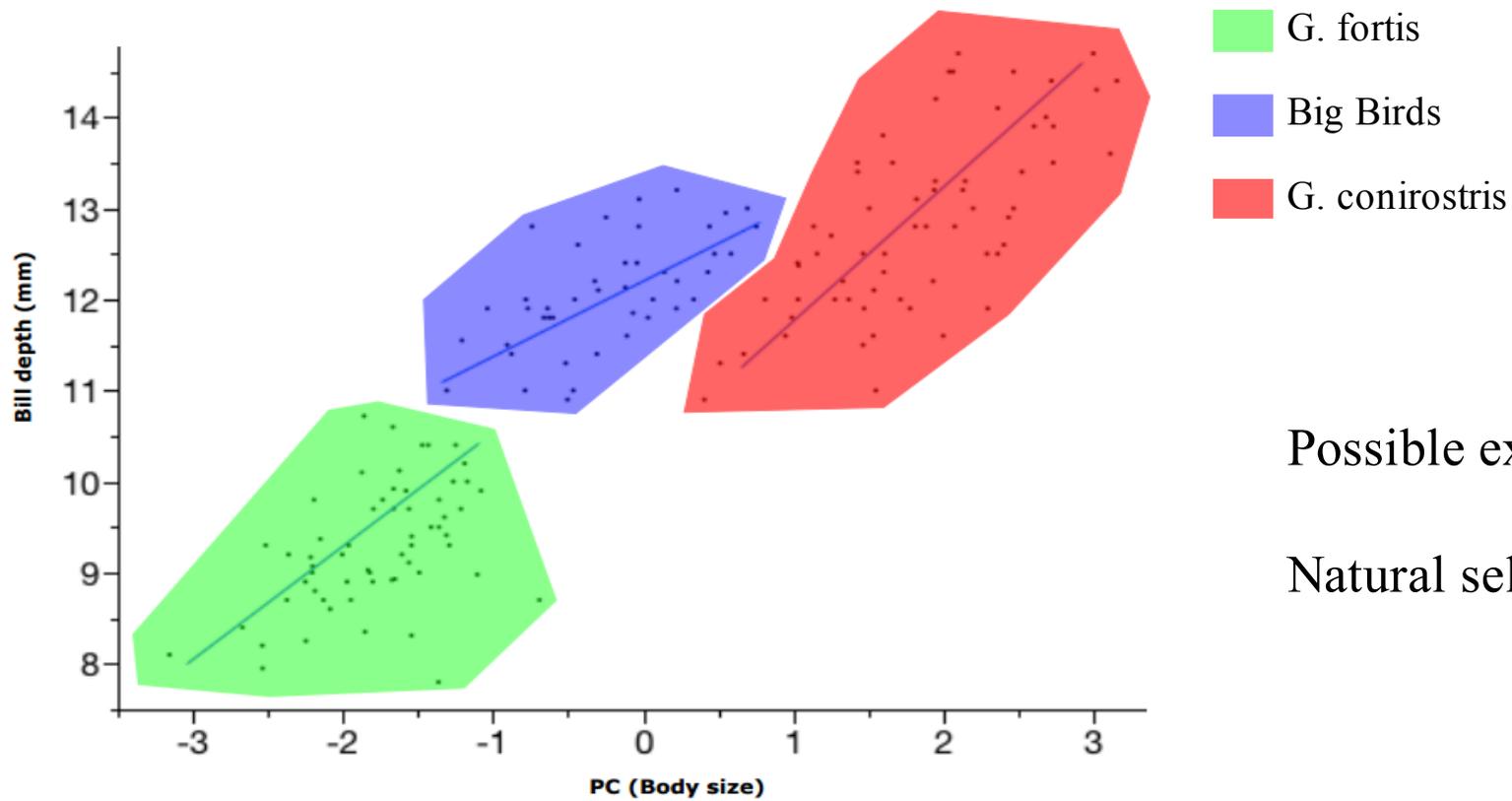
Average genome-wide nucleotide diversity (π) in two parental populations, the founder and subsequent generations 1-6



Linkage disequilibrium in two parental populations and Big Bird lineage



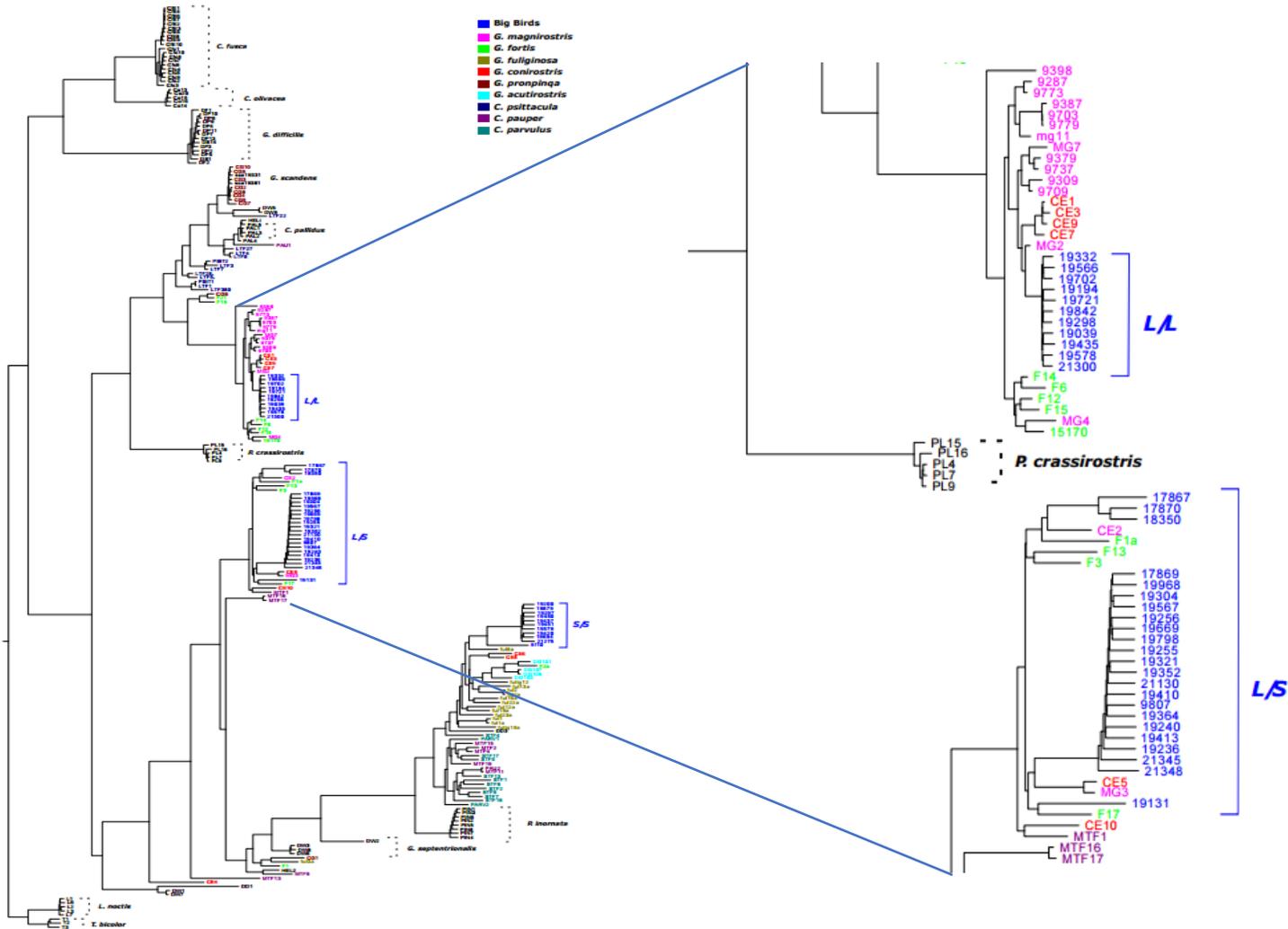
Bill depth variation in relation to body



Possible explanations:

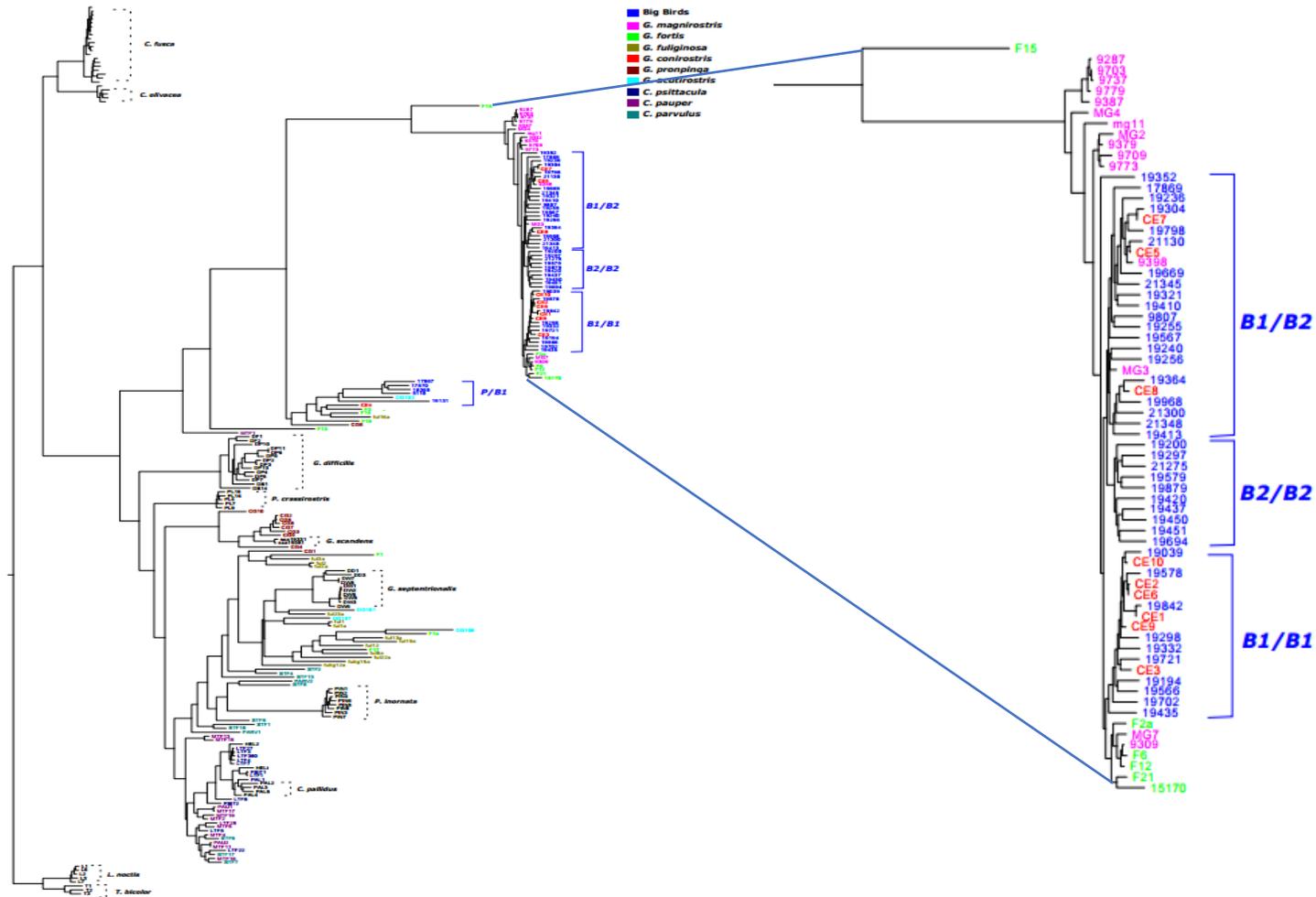
Natural selection on body size

Maximum likelihood tree based on all SNPs in the HMGA2 525 kb region



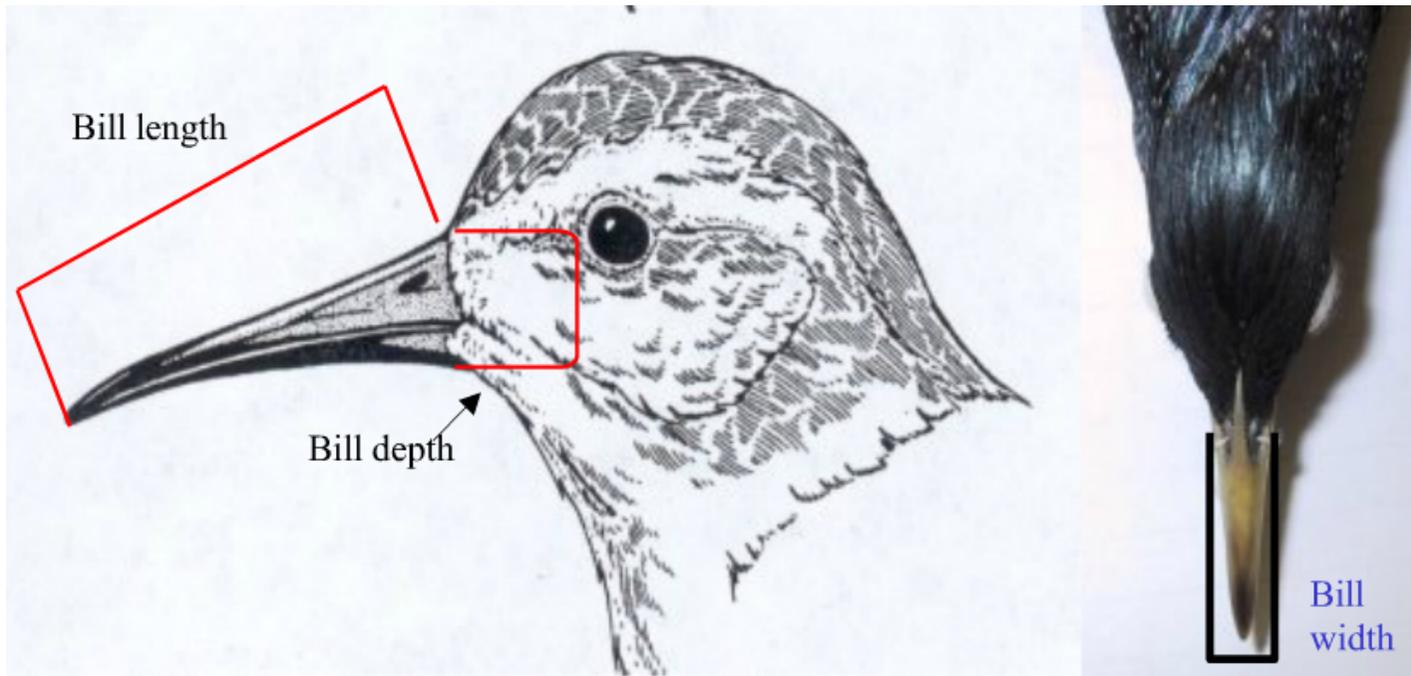
At the HMGA2 locus, the allele frequency of the L allele associated with large bill size was 60.8% in generations 4 to 6.

Maximum likelihood tree based on all SNPs in the ALX1 240 kb region

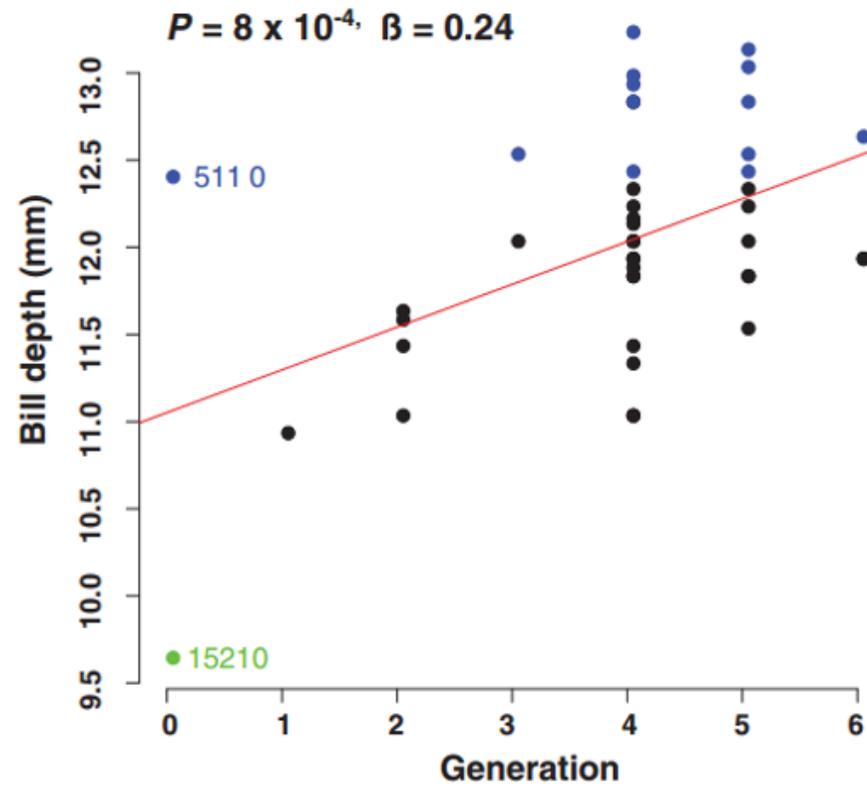


Interestingly, B2/B2 homozygotes had significantly shorter bills than the other two genotypes

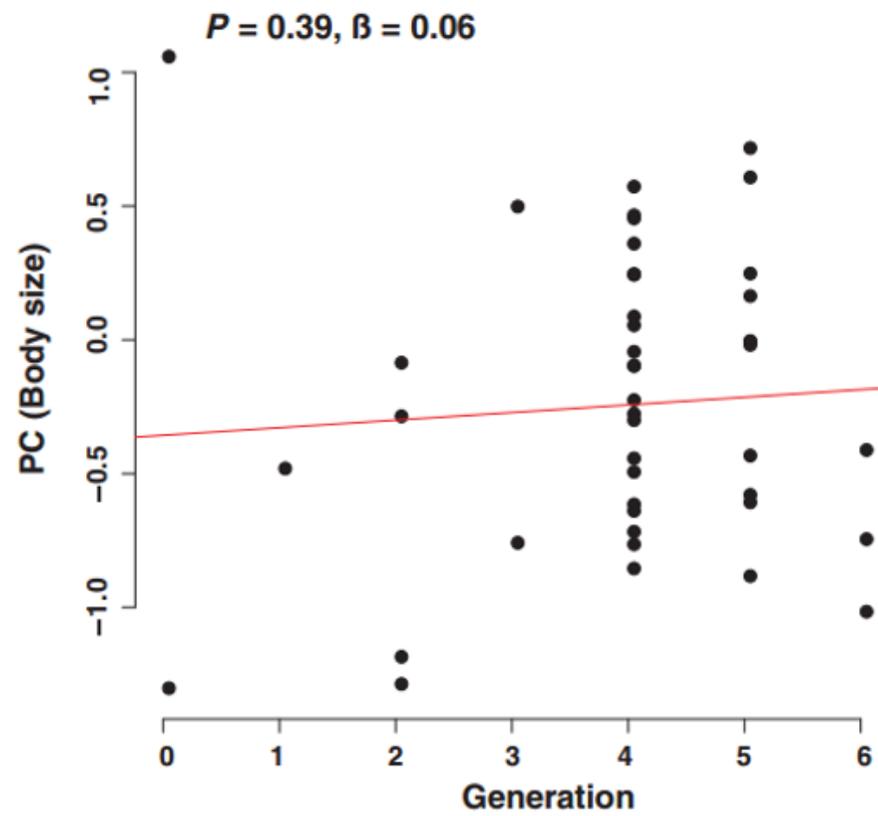
How to measure bird's bill



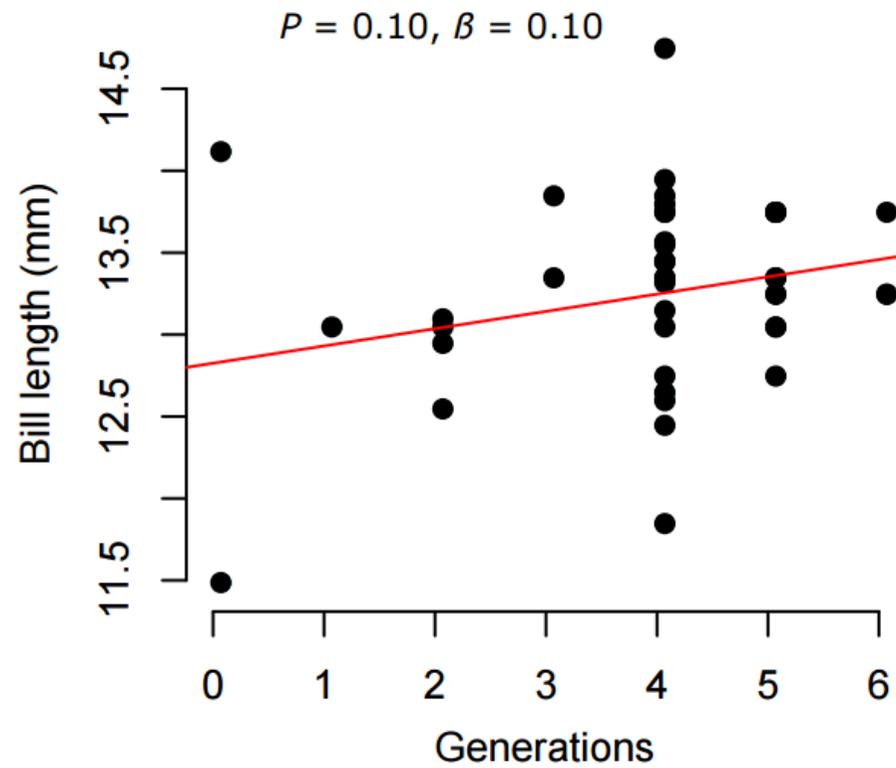
Mean bill depth increased over generations



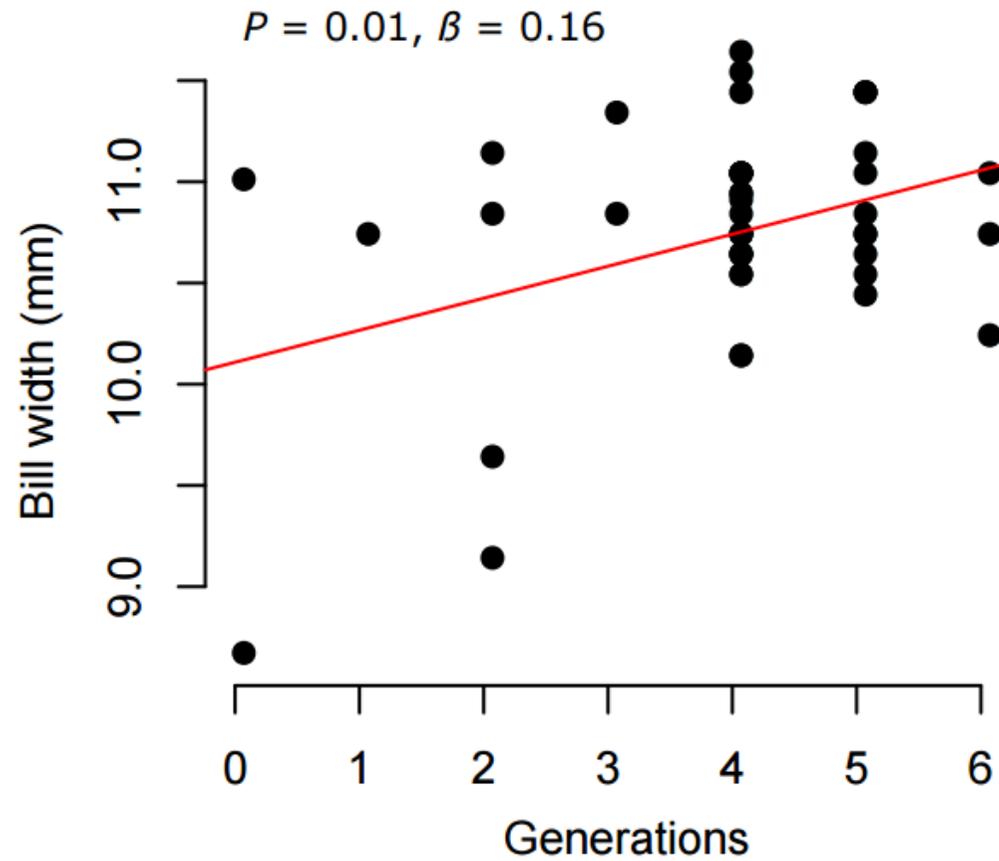
Mean body size remained unchanged across generations



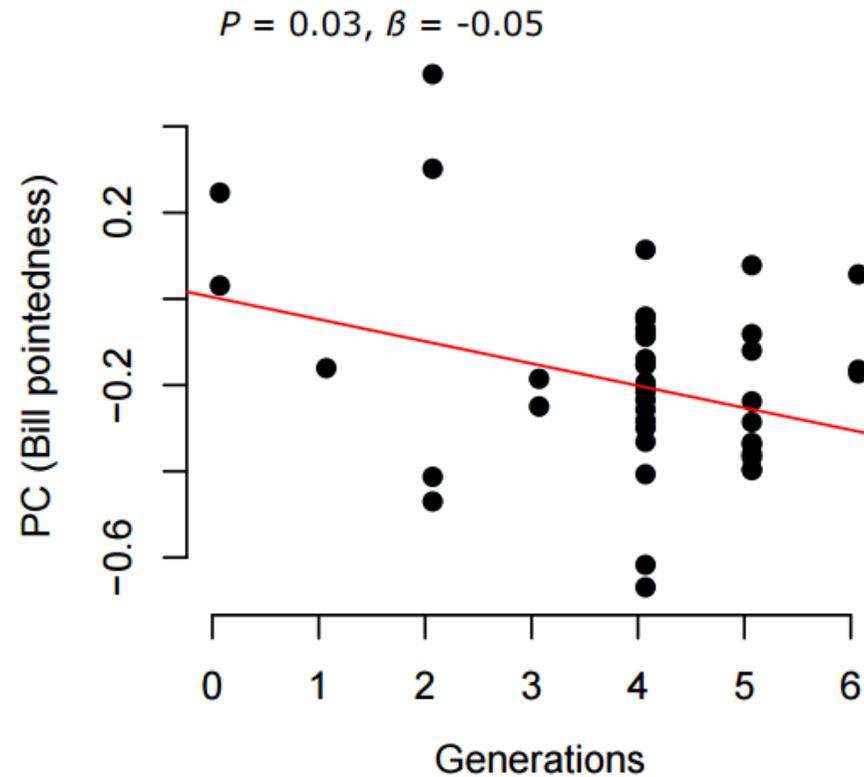
Bill length of the Big Bird lineage across generations



Bill width of the Big Bird lineage across generations

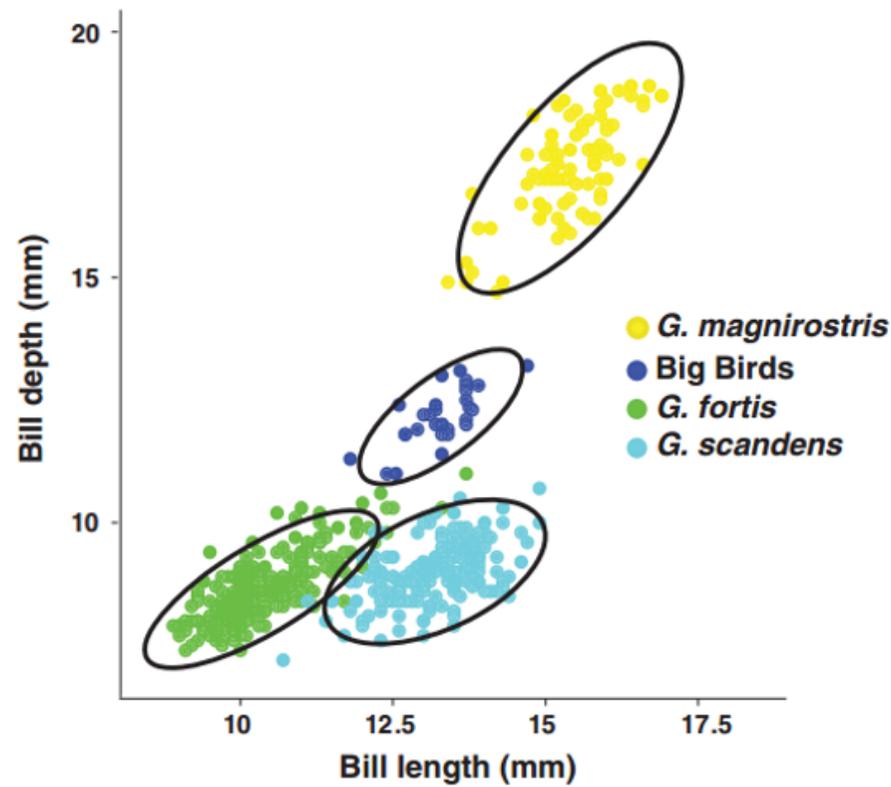


Bills became also progressively blunter



Bill length did not change in the population; hence, bills became not only larger but also progressively blunter, on average, across generations. A possible scenario is that transgressive segregation produced genotype combinations that have been favored by natural selection, causing the shift in beak morphology.

Morphologically based ecological segregation from the three sympatric competitor species, *G. fortis*, *G. scandens*, and *G. magnirostris*.



Speciation

- In Darwin's finches, a premating **barrier to interbreeding is established by a difference in song and morphology** (bill size, body size).
- The new population on Daphne is reproductively isolated from *G. fortis* and *G. conirostris* on Española.
- Additionally, males of the founder population sing a different song from *G. conirostris* on Española and Gardner, probably as a result of imperfect copying of a Daphne Major finch by the founder after it had first learned its father's song on Española (or Gardner).
- Expansion of the population from two individuals to three dozen was conditioned on the founder being a male with a distinctive song and facilitated by the chance occurrence of strong selection against large bill size in a competitor species, *G. fortis*, in 2004 to 2005.

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```
#先安装两个包
install.packages("NLP") #NLP: Natural language processing
install.packages("tm") #tm: text mining
library(NLP)
library(tm) #加载
cname <- file.path("C:/Users/dell/Documents/新建文件夹/") #这里新建一个文件夹，将txt文本放在文件夹下
docs <- Corpus(DirSource(cname))
summary(docs)
docs <- tm_map(docs,removePunctuation)
for (i in seq(docs)) {
docs[[i]] <- gsub("/", " ", docs[[i]])
docs[[i]] <- gsub("@", " ", docs[[i]])
docs[[i]] <- gsub("\\\\", " ", docs[[i]])
} #用空格替换文本中的符号
docs <- tm_map(docs,removeNumbers) #删掉数字
docs <- tm_map(docs,tolower) #把所有字符转换为小写
docs <- tm_map(docs,removeWords,stopwords("english"))
docs <- tm_map(docs,PlainTextDocument)
dtm <- DocumentTermMatrix(docs) #创建一个matrix
tdm <- TermDocumentMatrix(docs)
freq <- colSums(as.matrix(dtm)) #统计频率
head(freq)
names(freq)
ord <- order(freq)
m <- as.matrix(dtm)
freq[head(ord)]
wf <- data.frame(word=names(freq),freq=freq)
head(wf)
library(ggplot2)
p <- ggplot(subset(wf,freq>50),aes(word,freq))
p <- p+geom_bar(stat = "identity") #绘制条形图
p <- p+ theme(axis.title.x = element_text(angle = 45,hjust = 1))
p
set.seed(142)
install.packages("wordcloud")
library(wordcloud)
wordcloud(names(freq),freq) #制作词云
```

variation segregation parental originated
ecological independent
breeding reproductive **lineage**
hybrid **speciation** big success
mean rare **bill** founder however distinctive likely
large **bill** male island galepagos despite depth
survival hmgga **bill** individuals result examples eight
experiments used **bill** analysis darwin 欽樾 geospiza
gardner 欽<93> also established may eventincrease
immigrant combined across **bill** new table bred different body scandens
allele major generation drift low small different body coefficient showed
isolated pairs one transgressive onward homoploid **bill** song
mate pairs one transgressive onward homoploid **bill** song
orphology members **population** natural larger bills **size**
generations finch inbreeding
two three basis
on archipelago

