

# Systems Thinking and the endangered Laysan Duck.





The Laysan duck  
was only found  
on Laysan Island  
(elevation 2.5 m)



Fresh water seeps  
for ducklings

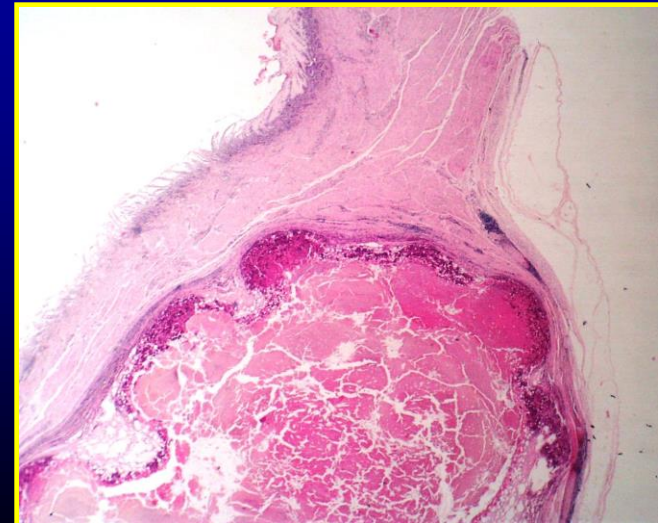
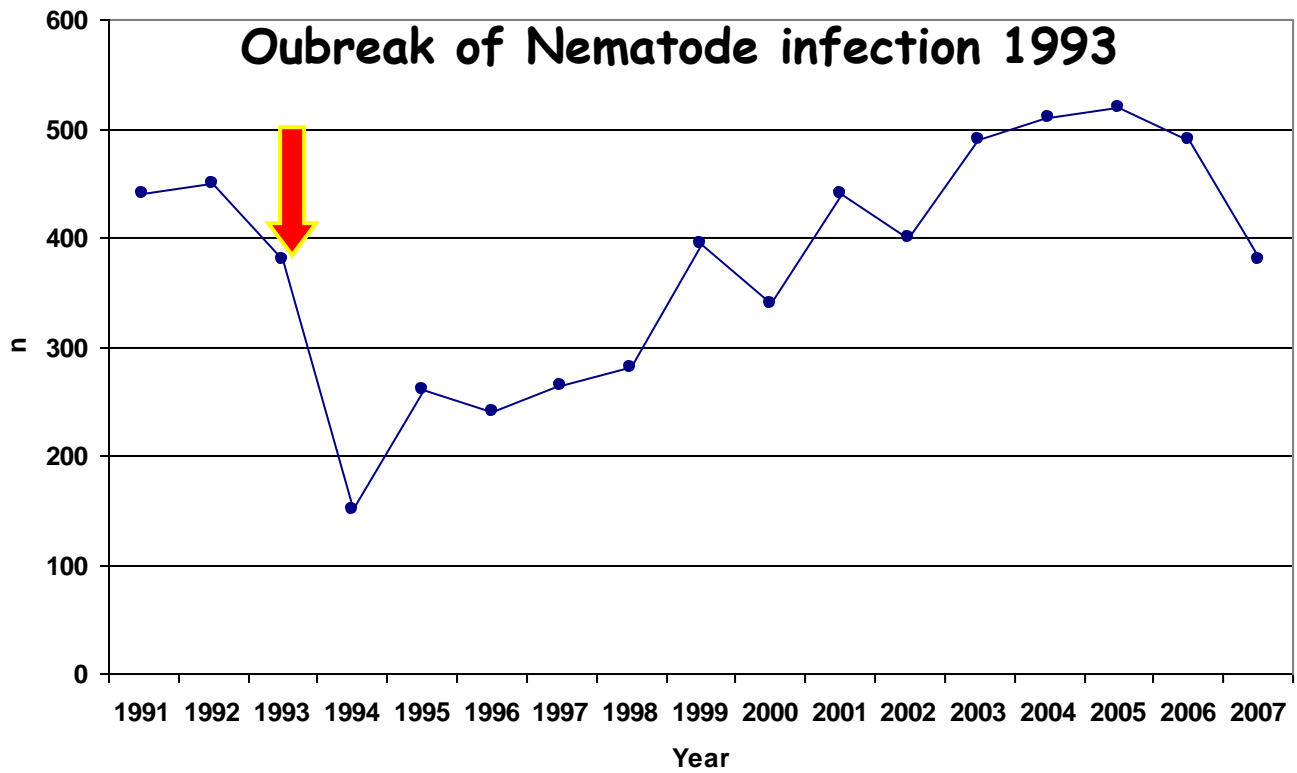


Island supports  
~500 ducks





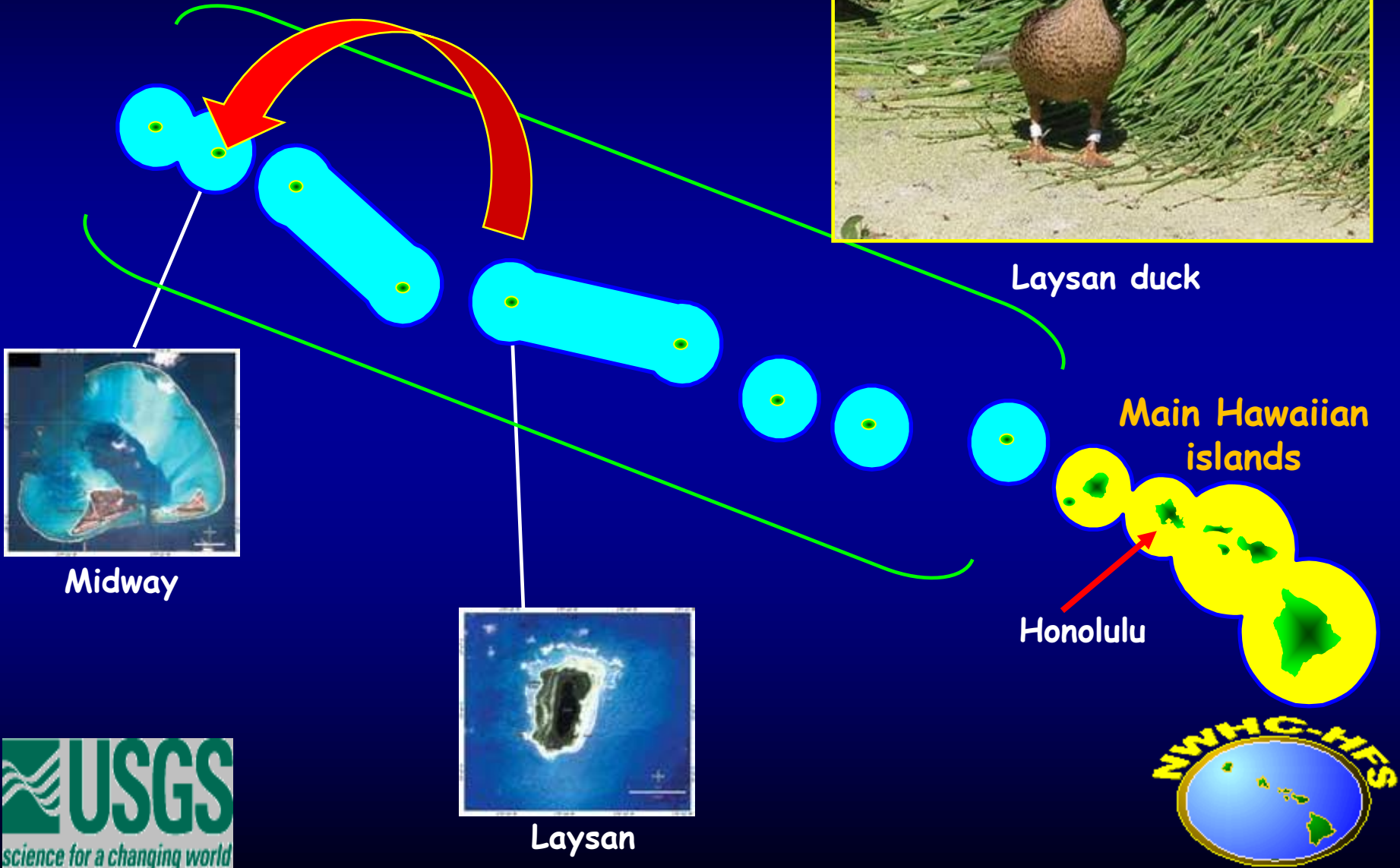




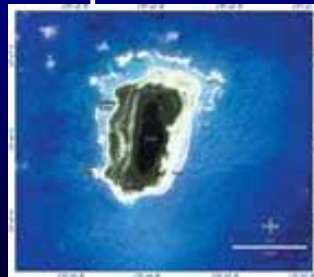
Translocate ducks from Laysan to Midway to enhance population



Laysan duck



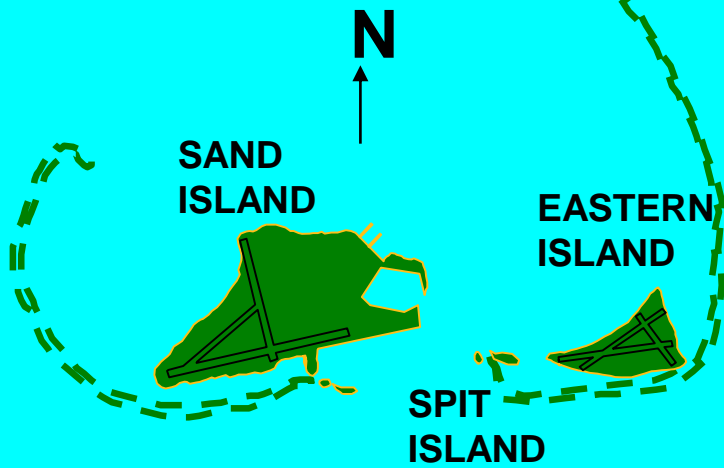
Midway



Laysan



# MIDWAY ATOLL



## Laysan albatross (and many other seabirds)



## Monk seals



## Sea turtles



**Midway is Emergency  
Landing strip for  
trans-pacific ocean  
flights**



**Midway has many  
missions:**

- **Wildlife refuge**
- **Emergency landing strip**
- **Infrastructure**





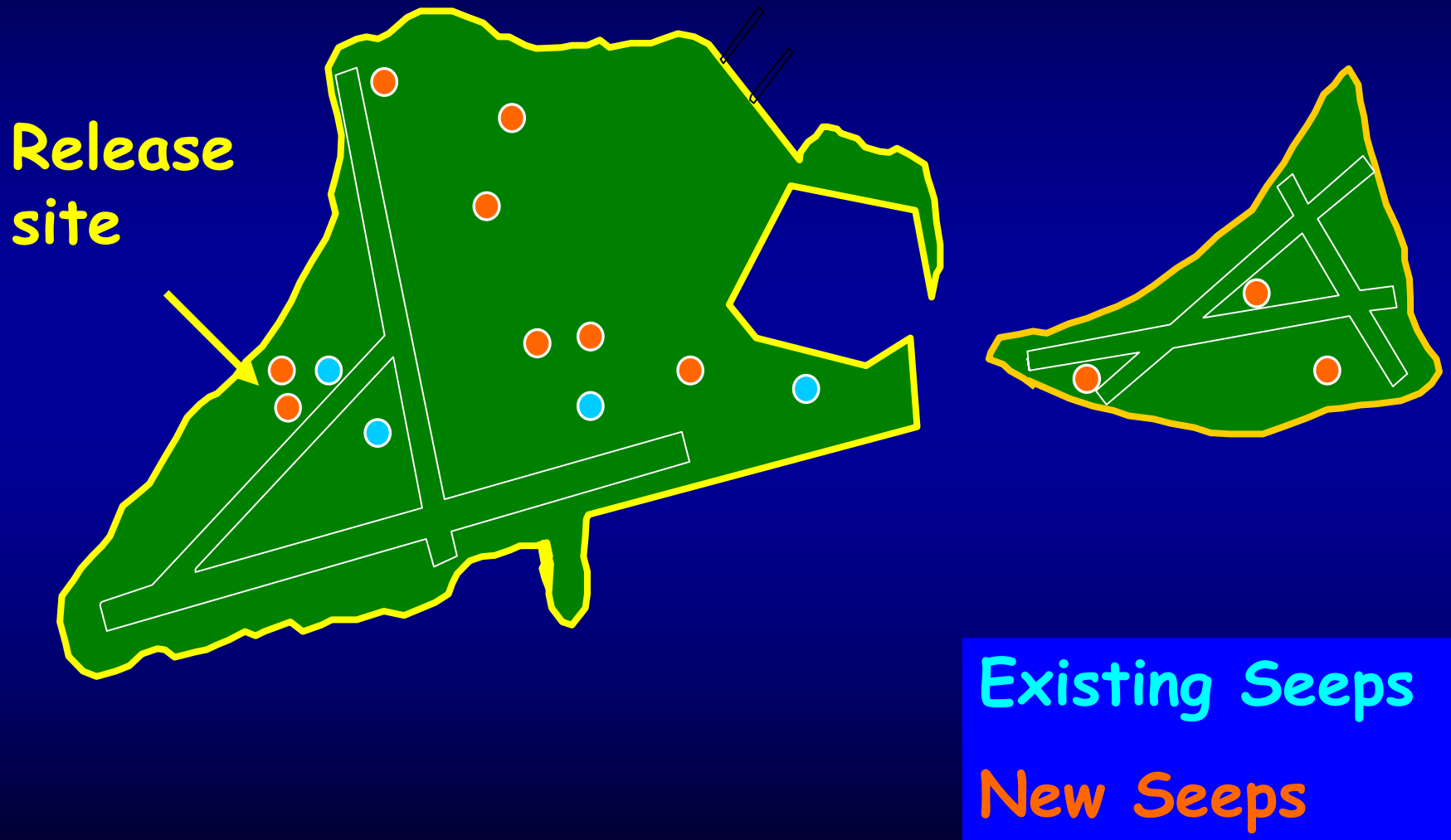
**Seep**



**Creation of freshwater seeps for Laysan ducks on Midway**



# 12 new seeps created to provide fresh water





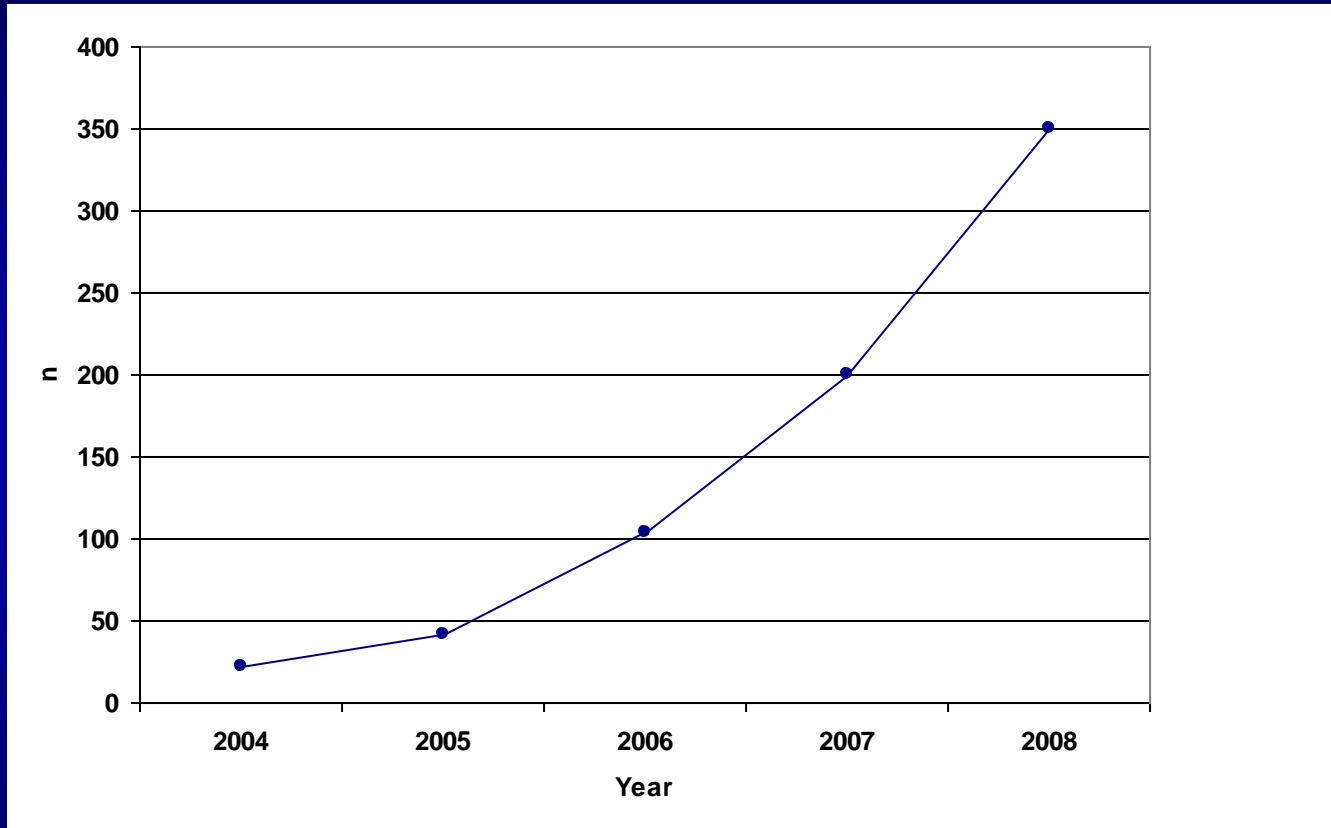






# Translocation success!

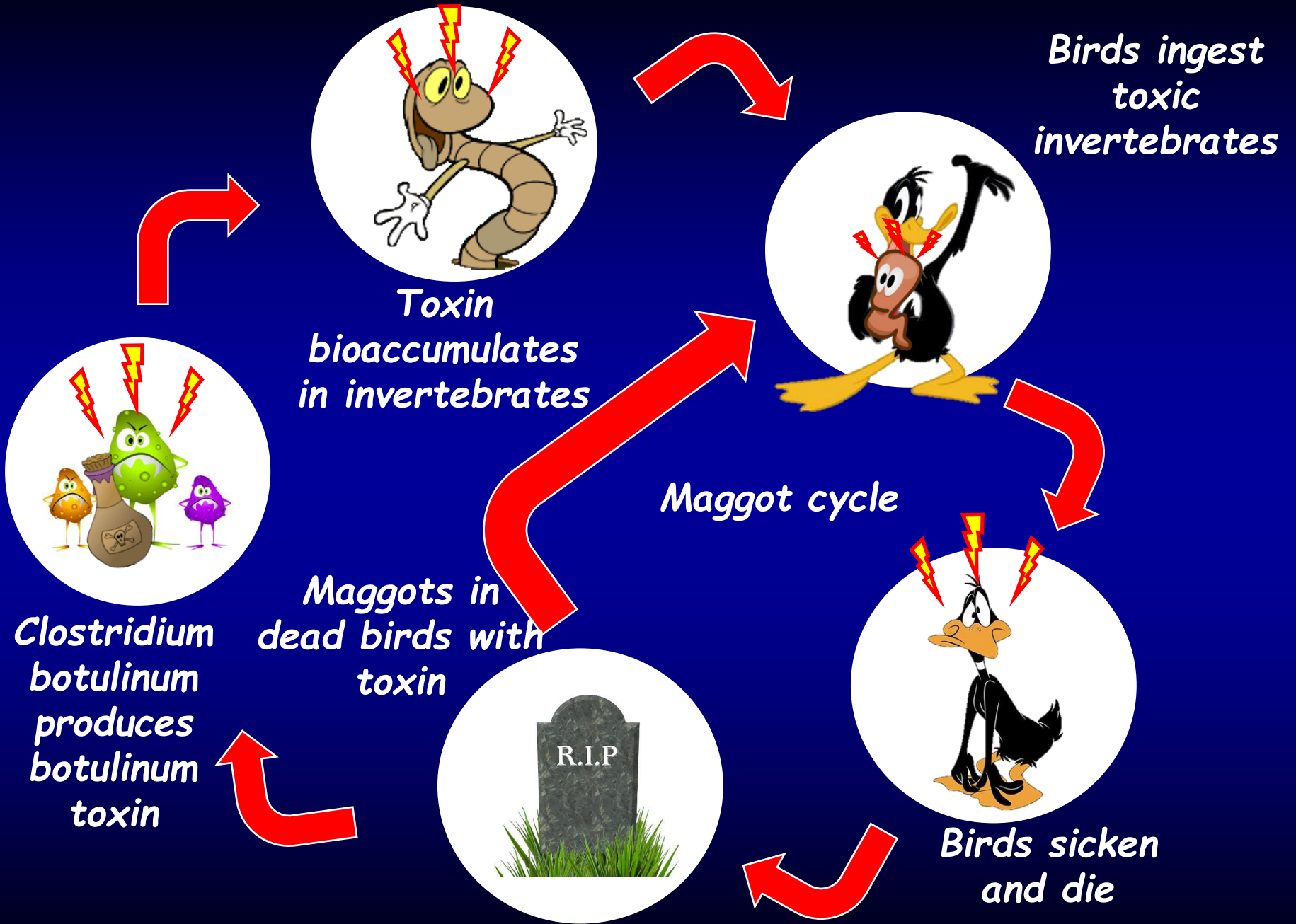
## Post-release demographics Midway Atoll NWR





# Avian botulism outbreak 2008



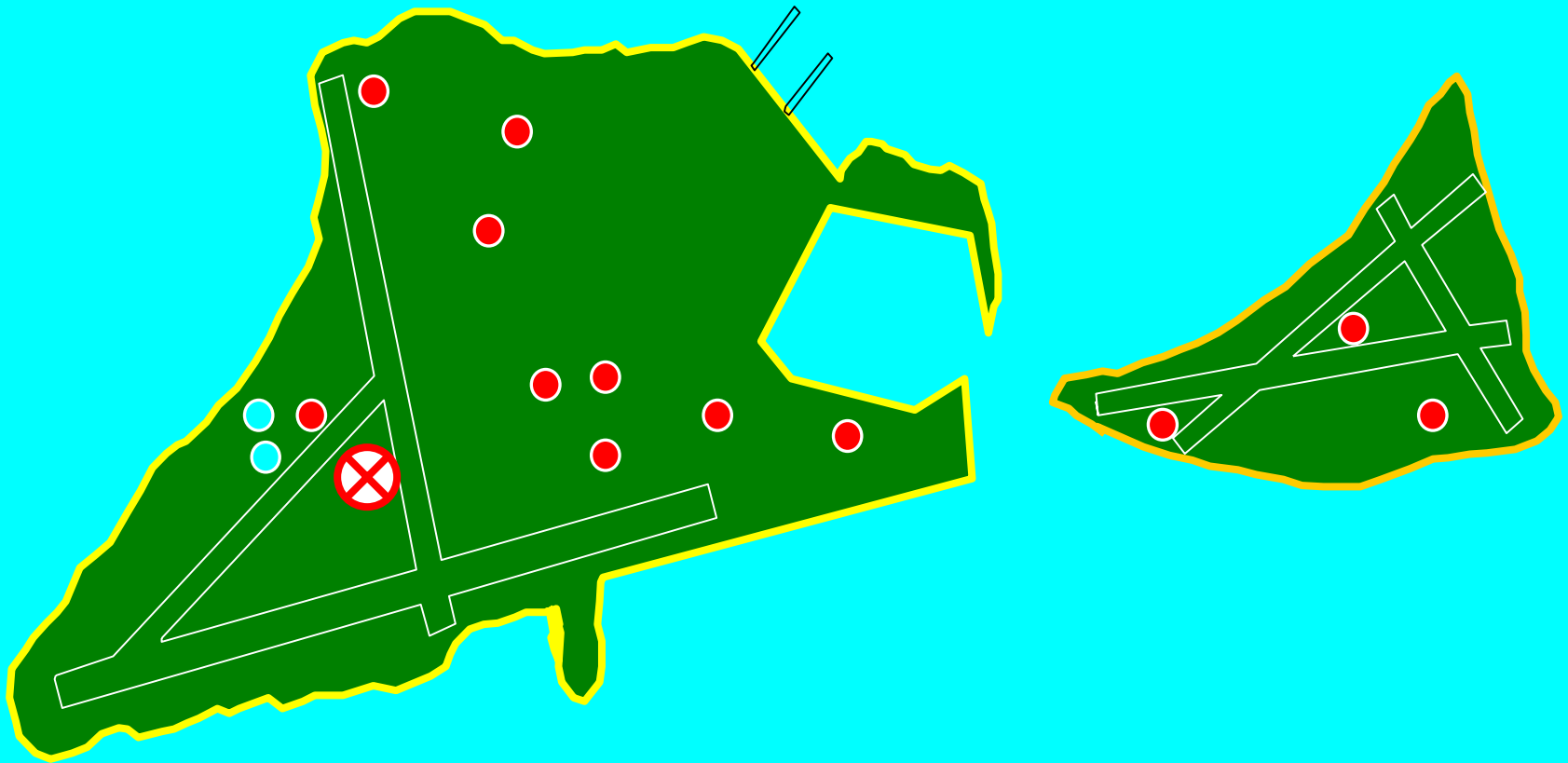




# Botulism Management

- 1) Water management: Drain, flood, change conditions to stop toxin production by bacteria
- 2) Pick up carcasses: Stop maggot cycle
- 3) Haze birds away from source

# Botulism outbreaks in multiple seeps

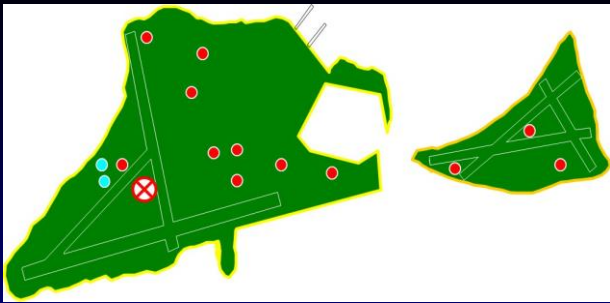


No way to manage water or haze  
birds, so carcass pick up only option!

● Botulism +

⊗ Origin





Fill in some seeps and replace with guzzlers (2000L each)



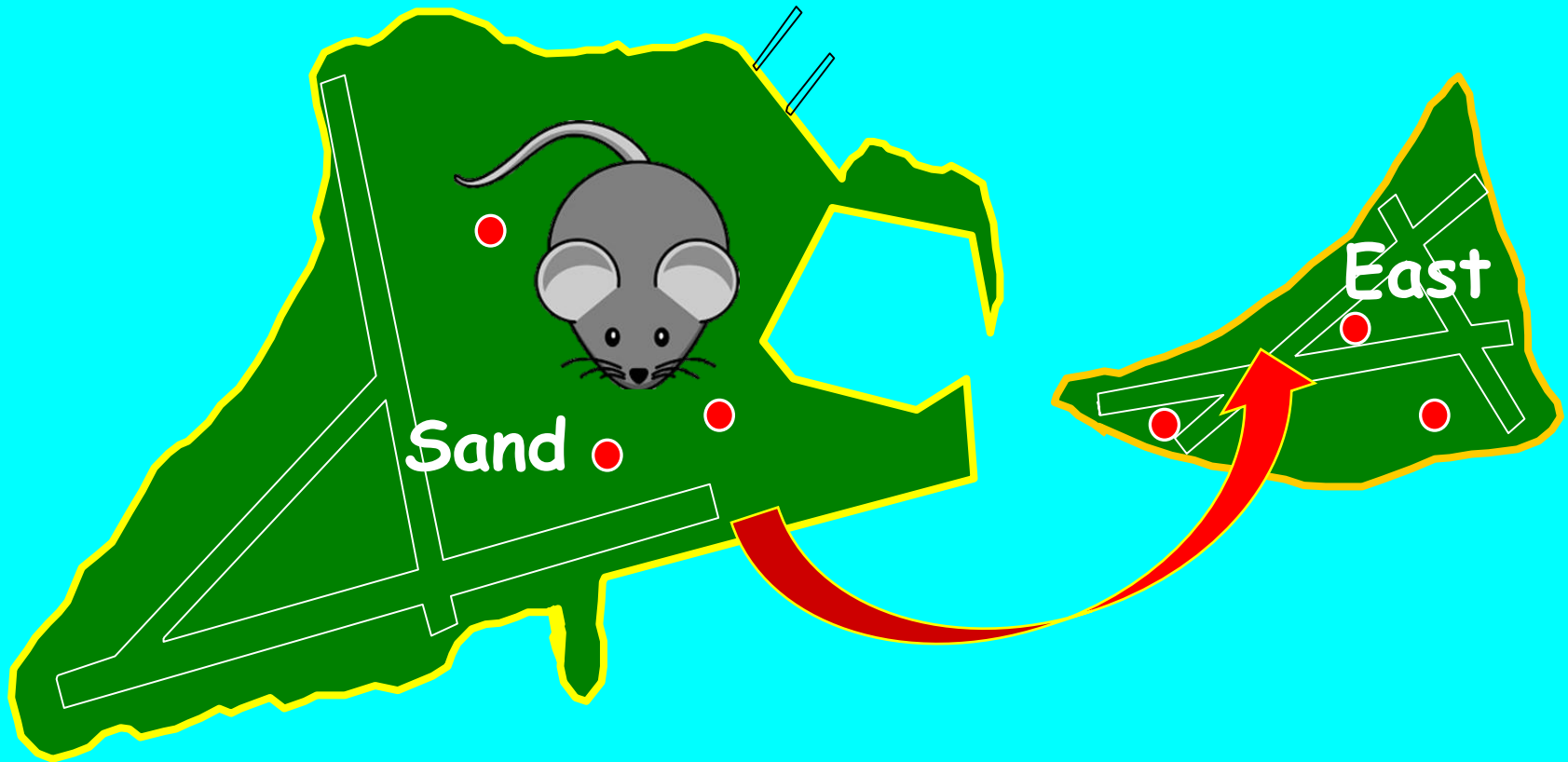
Difficult to drain and clean.  
Botulism problem persists!

# 2015 Mouse predation albatross

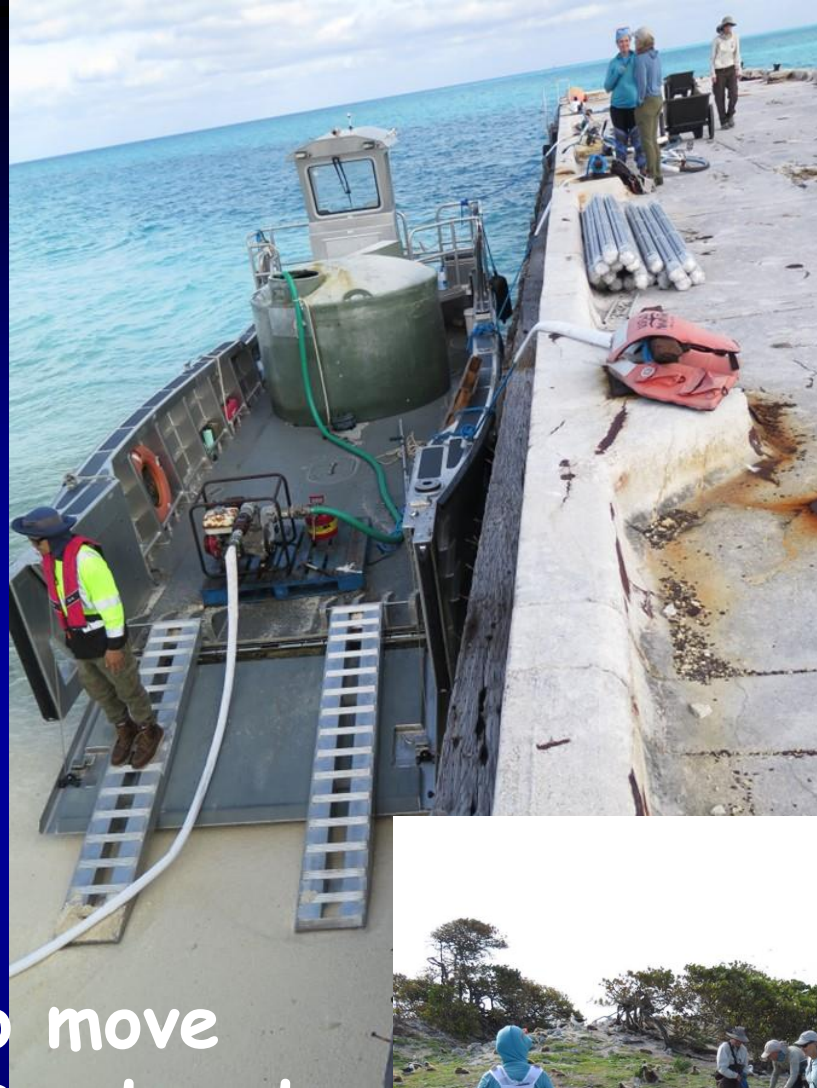




# 2023-Eradicate mice on Sand Island with Brodifacoum (anticoagulant)



Translocate entire population (~1000 ducks) to Eastern Island to avoid secondary poisoning.  
Clip wings to avoid flying back to Sand Island



Huge effort to move  
water between Sand and  
Eastern and fill/clean 10  
2000L guzzlers

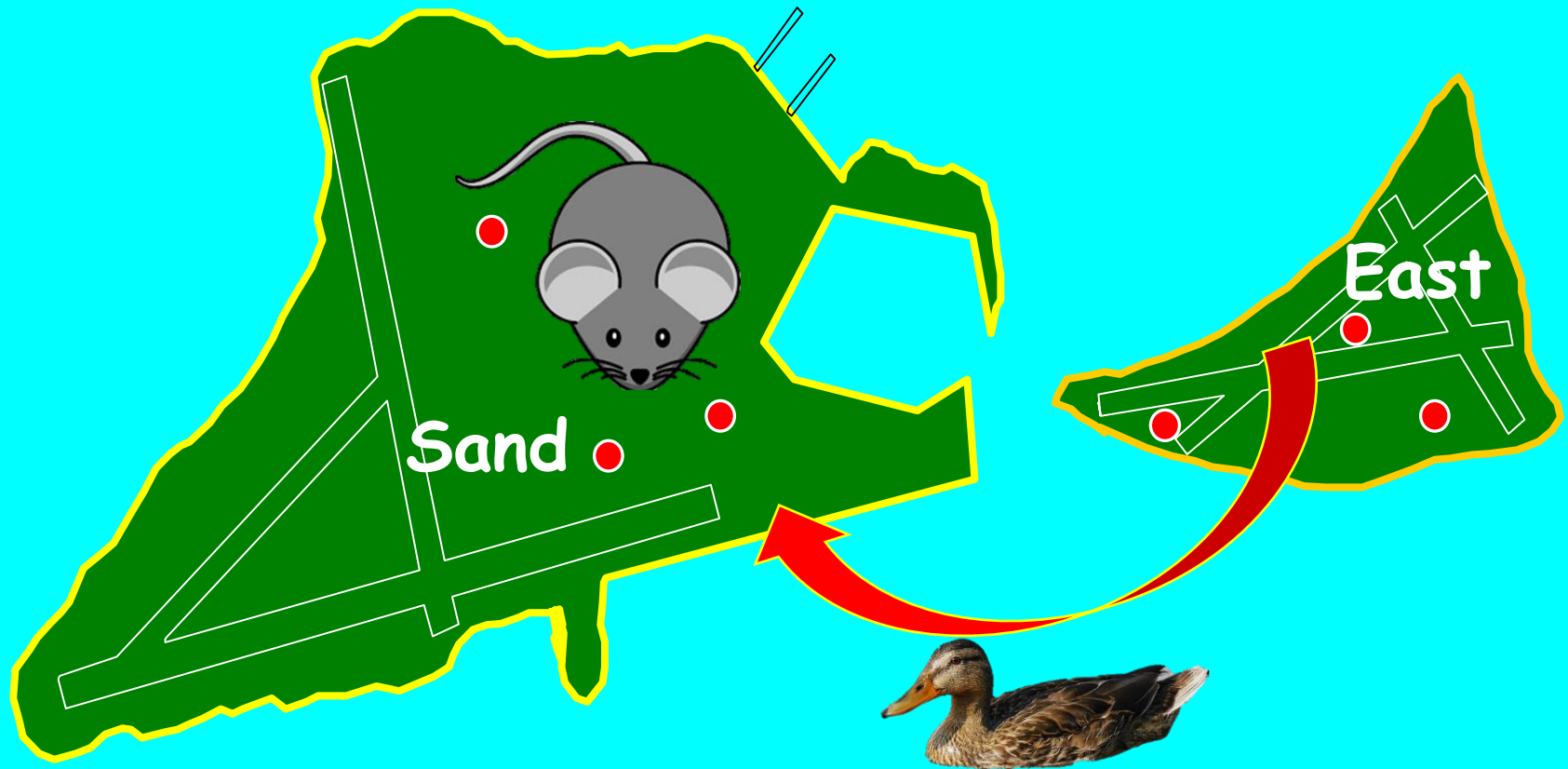




Just how much water do 1000 Laysan ducks  
need each day?

About 40 L

Ducks are swimming back to Sand at rate of  
~1/Day



Treatment for Brodifacoum: Gavage daily with  
Vitamin K for 2-3 weeks!



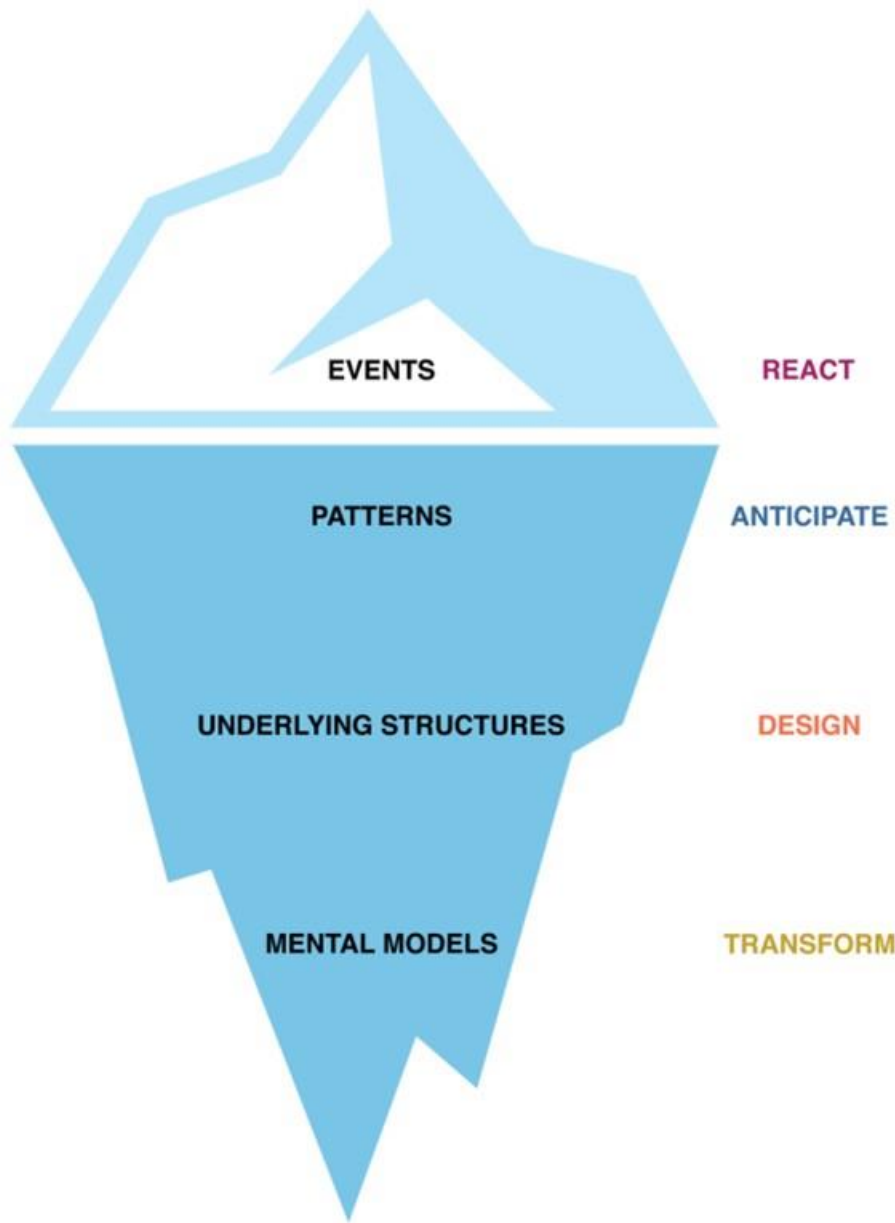


**Brodifacoum bait distribution starts in July 2023 and will last about 1 month.**

**Potentially have to deal with 30+ ducks to treat with Vitamin K for 2-3 week!**

**A huge time sink not counting all the effort to deal with water on Eastern Island**





Moving water to  
Eastern/translocate  
ducks

Pilot studies to  
estimate duck return

Developing system to  
manage water