THE EFFECT OF EL NIÑO EVENTS ON HATCHING TIME OF WEDGE TAILED SHEARWATERS

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FREEMAN BIRD PRESERVE

• In 2007 Hawaii Audubon Society was gifted a one acre parcel of land at Black Point and created a nature preserve
  • This location is a historical location for Wedge-tailed Shearwater nesting
• Volunteers maintain the property:
  • Remove invasive plants
  • Open blocked burrows
  • Predator control

![Graph showing the number of active nests from 2009 to 2014]

(July 14 census)

(r² = 0.84)
Reproductive Cycle

What parts of life cycle are not shown in this diagram?

**Prospecting:**
Birds visit colony (many non-breeders)

**Pre-breeding Exodus:**
Yolk formation happens during this period (at-sea)

**Guarding:**
One or both parents remain with chick (sleep in colony)

Annual cycle of breeding, migration, and molt of Wedge-tailed Shearwater

(Whittow, 1997)
CHICK HATCH DATE

- Chick hatch date can determine its survival by:
  - Peak mass is higher when chicks are hatched earlier
  - Early hatched chicks become more socially dominant and therefore have higher survival
  - Earlier hatched young have a longer period of time to complete development before migrating
  - When predation is high, early nesting/hatching allows for more time to “renest” if necessary
  - Earlier hatch date in relation to food availability allows for larger mass
EL NINO SOUTHERN OSCILLATION (ENSO)

• OCCURS WHEN THE TRADE WINDS WEAKEN IN THE CENTRAL AND WESTERN PACIFIC LEADING TO A SHALLOWER THERMOCLINE. THIS REDUCES THE AMOUNT OF UPWELLING OCCURRING.
  • EFFECTS SEA SURFACE TEMPERATURE
  • REDUCES THE AMOUNT OF NUTRIENT SUPPLY TO THE SURFACE WATERS
• OCCURS IRREGULARLY BETWEEN 3-6 YEARS ON AVERAGE
• PREDICTED TO OCCUR MORE FREQUENTLY WITH WARMING CLIMATE
Monthly Sea Surface Temperature °C

La Nina Conditions December 1998

Normal Conditions December 1993

El Nino Conditions December 1997

TAO Project Office/PMEL/NOAA
Figure 1. Time series plots of the Niño 3.4 SST indices as five month running means using data from NOAA and relative to a base period climatology from 1950-79. Values exceeding threshold ± 0.4°C for Niño 3.4 are stippled to indicate ENSO events.
FOOD AVAILABILITY

• WARM SEA SURFACE TEMPERATURE CHANGES FOOD AVAILABILITY FOR FORAGING
  • LESS NUTRIENTS AVAILABLE IN THE SURFACE REDUCE THE AMOUNT OF PHYTOPLANKTON BLOOMS AND ORGANIC MATTER MOVING UP THE TROPHIC PYRAMID
  • MANY SEABIRDS ASSOCIATE WITH SUBSURFACE PREDATORS FOR FORAGING SUCCESS
HYPOTHESIS

• H1: WHEN EL NIÑO EVENTS OCCUR, WEDGE TAILED SHEARWATER CHICKS WILL HAVE A LATER HATCH DATE
ANALYSES

- WITH THE DATA THAT HAS BEEN COLLECTED FOR THE PAST SEVEN YEARS AT FREEMAN SEABIRD PRESERVE IT ALLOWS TO DETERMINE AVERAGE HATCH DATE PER YEAR AND TOTAL COINCIDING PEAK MASS FOR CHICKS

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RESULTS

• H1 (WHEN EL NIÑO EVENTS OCCUR, WEDGE TAILED SHEARWATER CHICKS WILL HAVE A LATER HATCH DATE) IS CORRECT
  • AT TIMES WE CAN SEE THE EFFECT OF AN EL NIÑO EVENT FOR A COUPLE YEARS FOLLOWING
IMPLICATIONS

WEDGE TAILED SHEARWATERS IN A WARMING CLIMATE

• 2015-2016 IS AN EXTREMELY STRONG EL NIÑO YEAR

• INCREASE OF AVERAGE TEMPERATURE HAS INDICATIONS OF A CHANGING OCEAN:
  • EL NIÑO'S BECOME MORE COMMON
  • AVERAGE SEA SURFACE TEMPERATURE INCREASES
  • MORE ACIDIC OCEANS

• LA NINA PORTION OF ENSO AFFECT HATCH DATE?
REFERENCES


