

# Seabird abundance at Cordell Bank, CA associated with changes in regional oceanographic conditions

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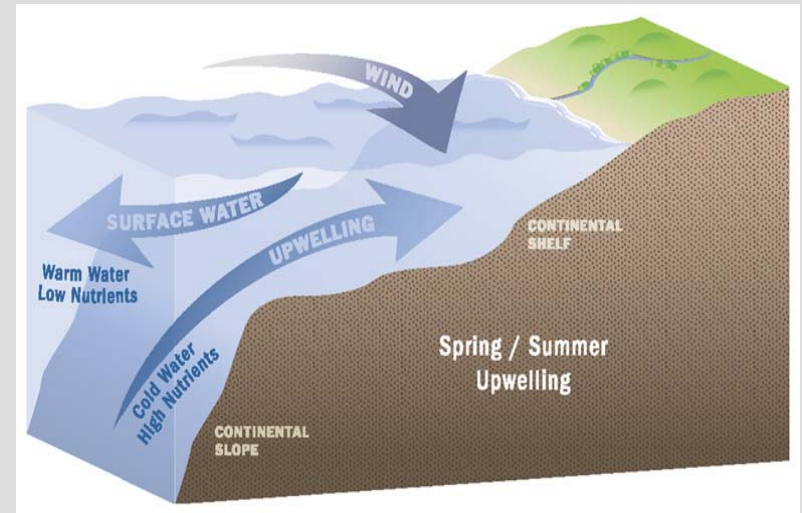
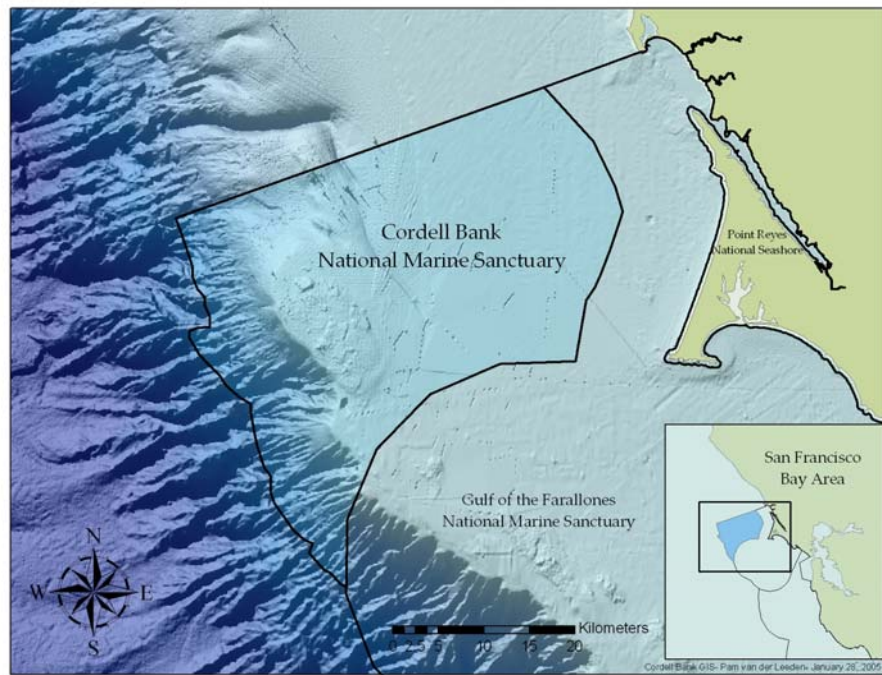
<sup>2</sup>Institute for Bird Populations



Photos: Glen Tepke



# Oceanographic and geologic setting of Cordell Bank



- Cordell Bank – 7km x 15km submerged plateau feature
- Shallow rocky habitat (shallowest depth-115m) on edge of continental shelf and near deep canyon – high bathymetric complexity within localized area
- Strong upwelling zone within California Current System





Cordell Expeditions



Cordell Expeditions

- Interaction of bathymetry and currents create conditions favorable for high productivity and accumulation of prey
- Critical foraging habitat



Jean Warren



Michael Carver



# Oceanographic conditions in northern California Current System

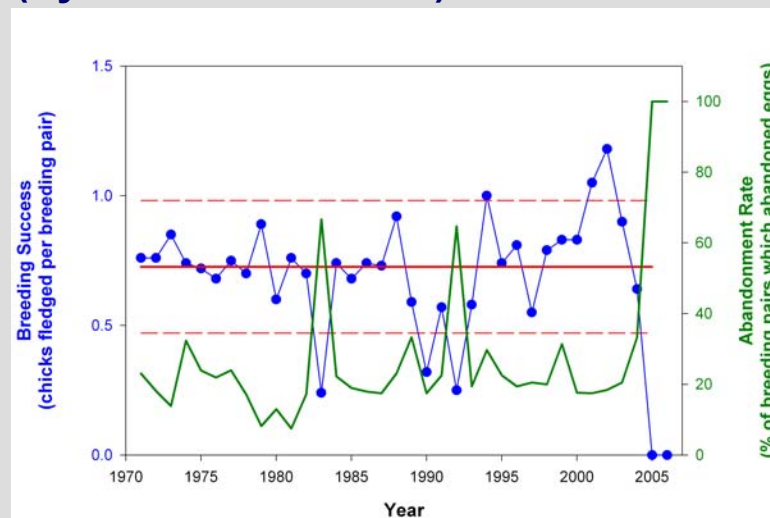
- Oceanographic seasons – upwelling, relaxation, winter
- Timing and intensity of upwelling are important factors determining the productivity and structure of California Current ecosystem
- Seasonal and interannual changes in upwelling conditions vary on multiple temporal scales: ENSO, PDO, global warming
- 2005, 2006: unique spring/summer oceanographic conditions - weak winds, warmer ocean temperatures, delayed onset of upwelling



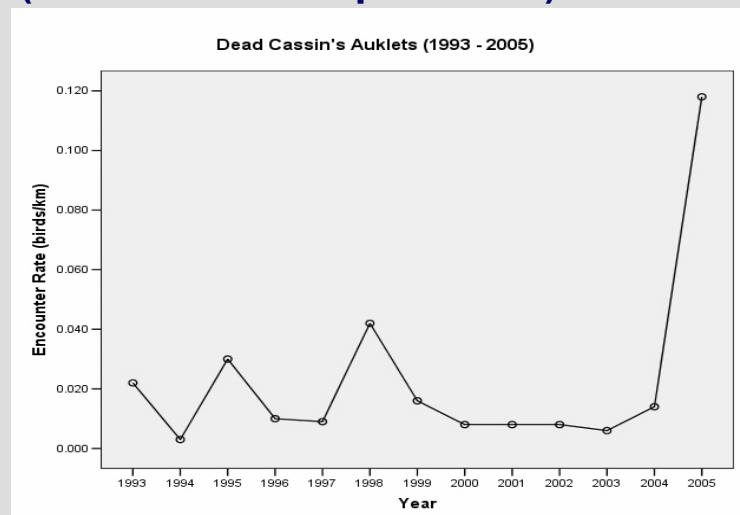
# Oceanographic conditions in northern California Current System

- Biological responses to 2005, 2006 oceanographic conditions:
  - Low spring primary productivity, low spring and summer krill abundance, very low rockfish recruitment
  - Cassin's Auklet – breeding failure, increased adult mortality?, increased emigration?

## CAAU, SE Farallon I. (Sydeman et al. 2006)



## CAAU, Central CA beaches (BeachWatch Report 2005)



- Expect differences in response of seabird predators based on life history and foraging strategies



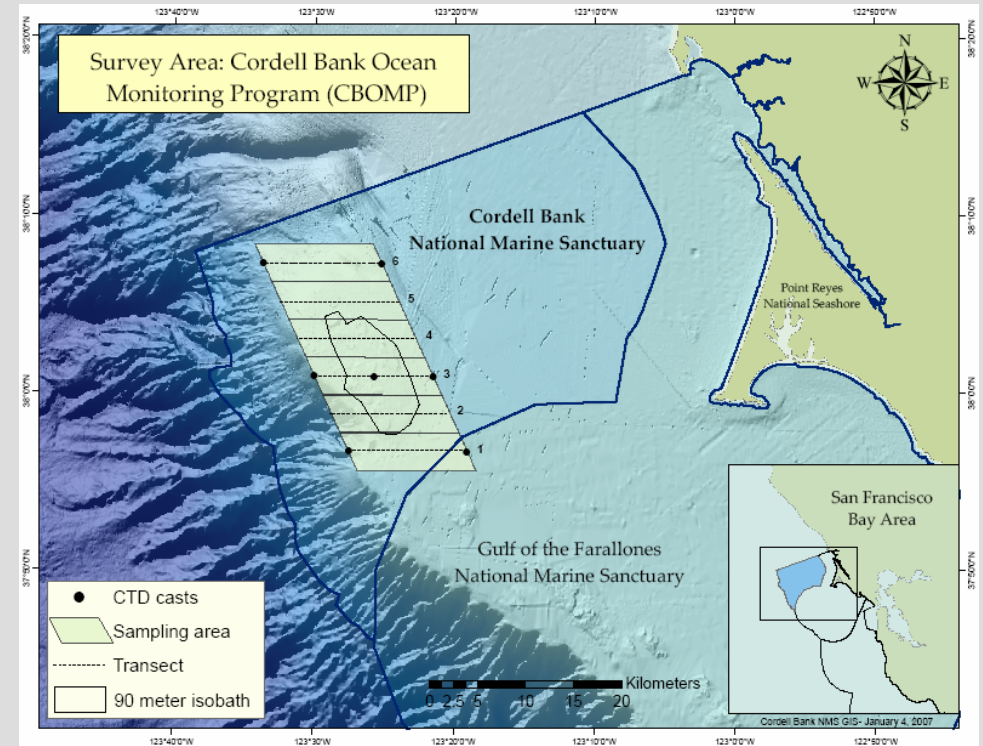
## Objectives

- Determine abundance patterns of seabirds with different life history and foraging strategies at Cordell Bank during years 2004-2006
- Assess whether local biological patterns at Cordell Bank are congruent with regional unique conditions detected in northern California Current System during 2005-2006

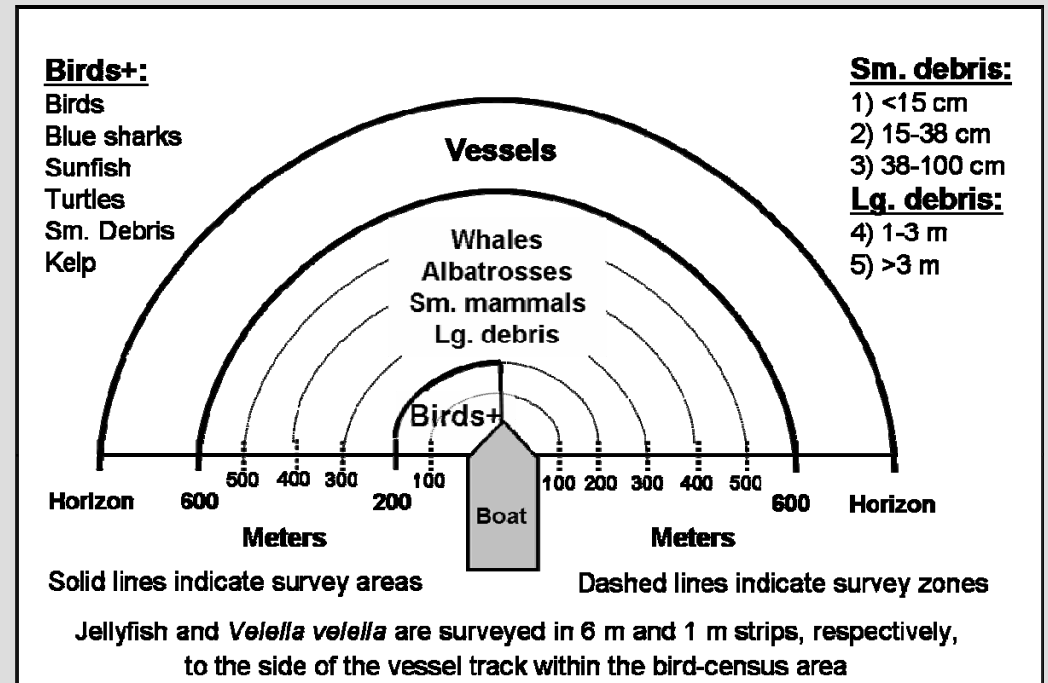


# Cordell Bank Ocean Monitoring Program

- Monthly program to characterize and monitor the pelagic ecosystem in Cordell Bank region
- 2004-present
- 6 transects (13km each)
- Observation data
  - birds and mammals
  - sharks, turtles, jellyfish, ocean sunfish, kelp, marine debris, boats
- CTD data (7 locations)
- TSG data
- Hydroacoustic data (120 kHz)



# Observation sampling methods



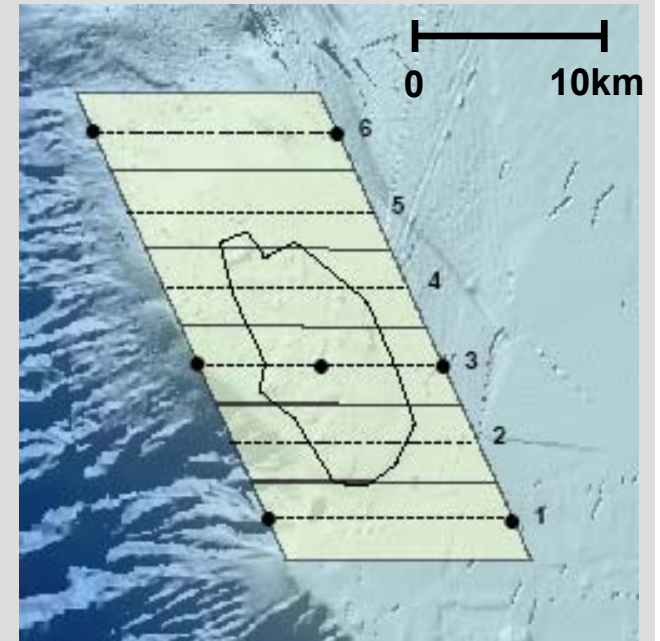
- Strip transect method – continuous data collection
- Observation strip width of 200m (1/4 circle) for most birds, 600m (1/2 circle) for albatrosses
- Zones within strip width recorded (by 100m)
- Quality of visibility scores recorded per transect



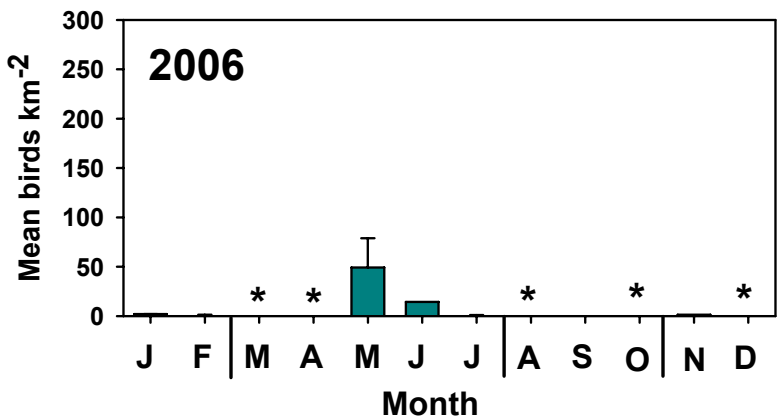
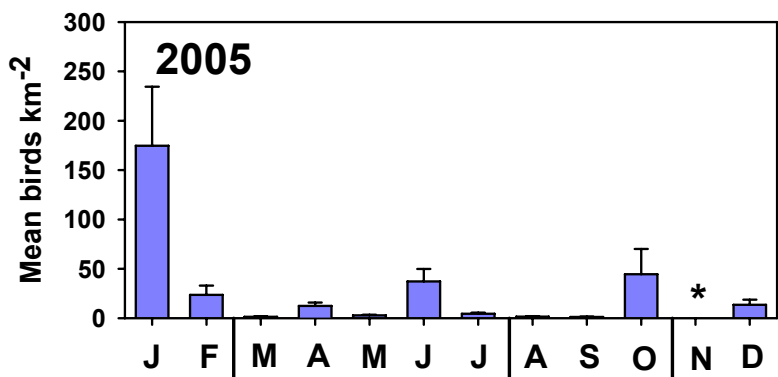
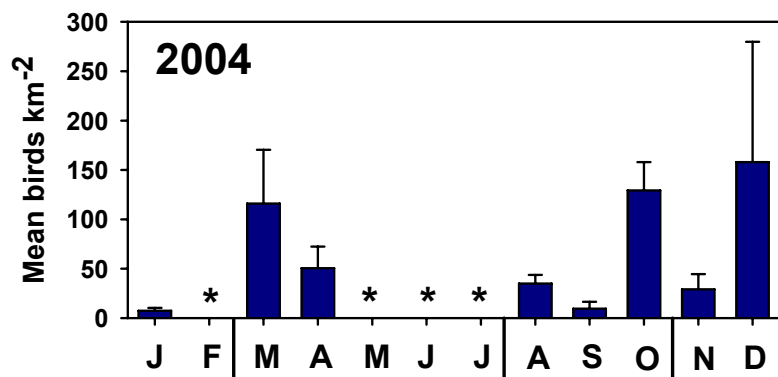


# Statistical analyses

- Broad-scale patterns over Cordell Bank region
- Densities per transect, means across sampling area
- ANCOVA models –
  - bird densities by species
  - examined factors of year and oceanographic seasons
  - included quality of visibility as covariate
- Oceanographic seasons:
  - Winter: November - February
  - Upwelling: March - July
  - Relaxation: August - October



## Cassin's Auklet



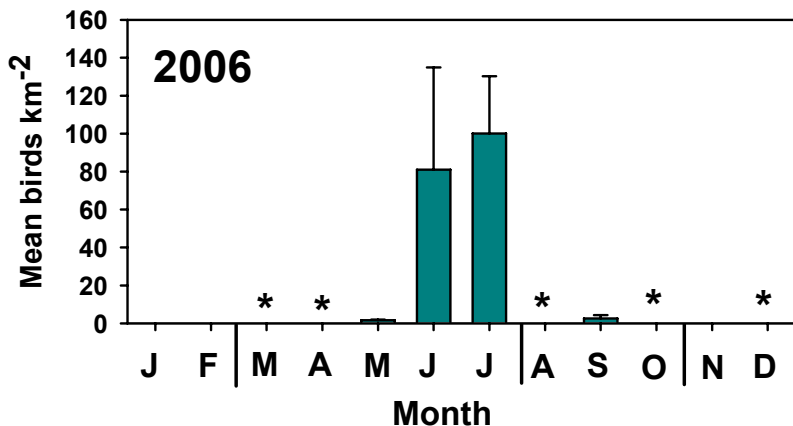
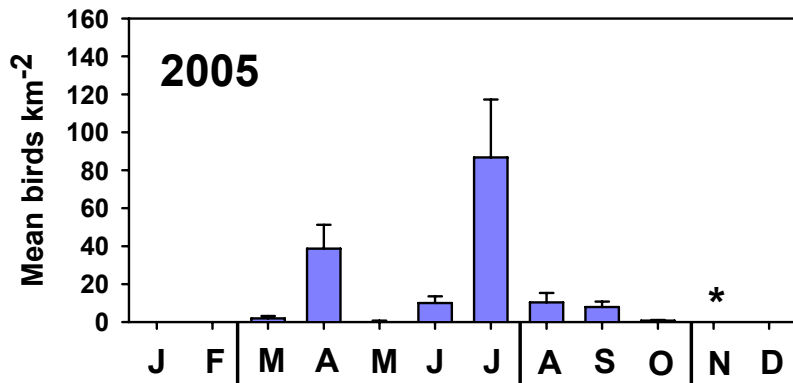
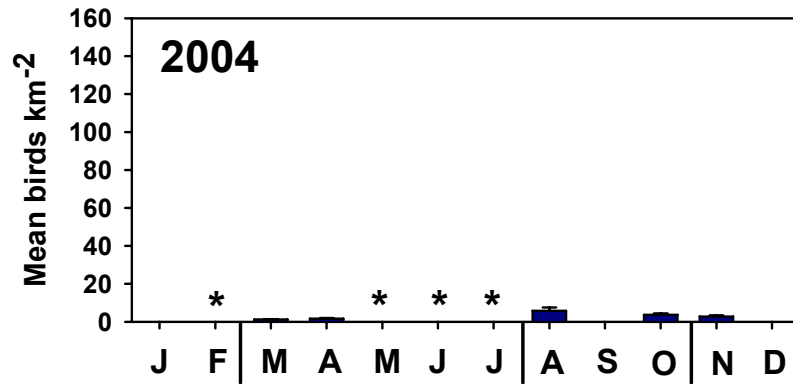
[pbase.com/gtepke](http://pbase.com/gtepke)

- CAAU - most abundant species observed (45% observations)
- ANCOVA model:  $R^2=0.38$
- No difference among ocean seasons
- Significant difference among years
- Lower abundance in 2005 and 2006

→  
2006    2005    2004



## Sooty Shearwater



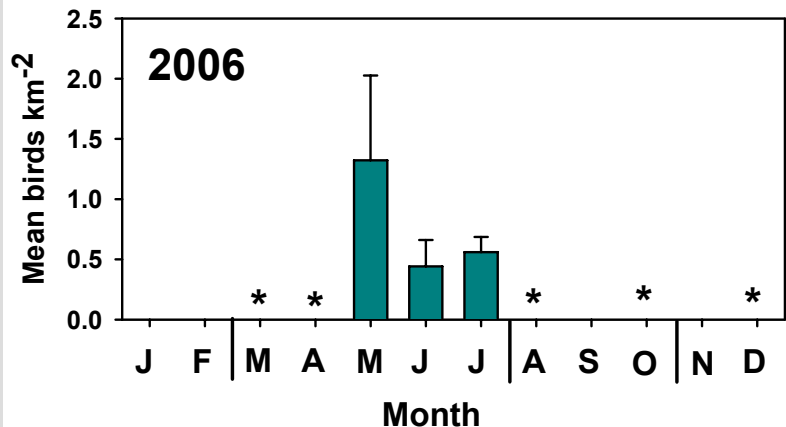
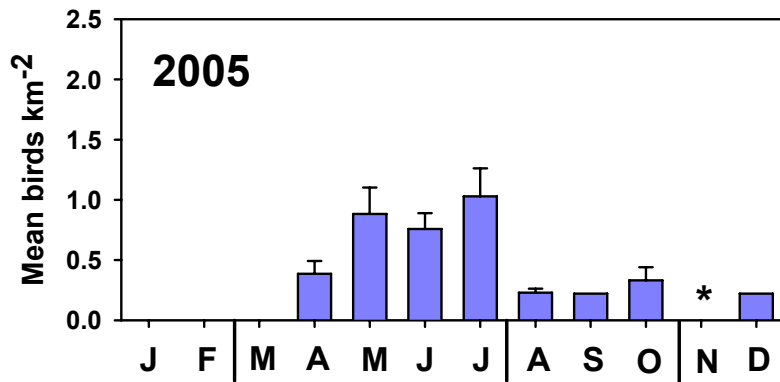
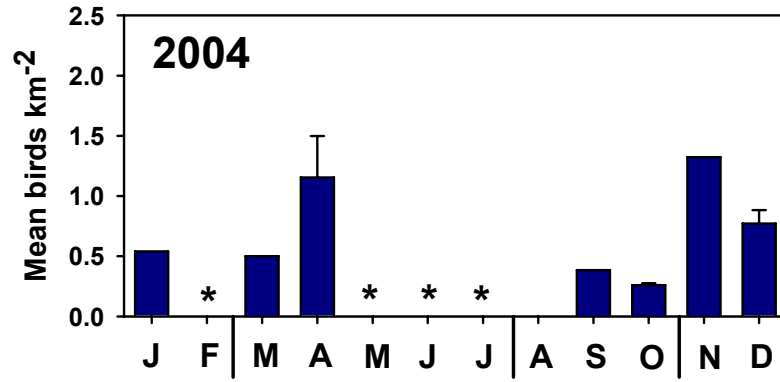
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- SOSH - 2<sup>nd</sup> most abundant species observed (18% observations)
- ANCOVA model:  $R^2=0.47$ 
  - No difference among years (not enough data?)
  - Significant difference among ocean seasons
  - Highest abundance during upwelling season

Winter Relaxation Upwelling →



## Black-footed Albatross



[pbase.com/gtepke](http://pbase.com/gtepke)

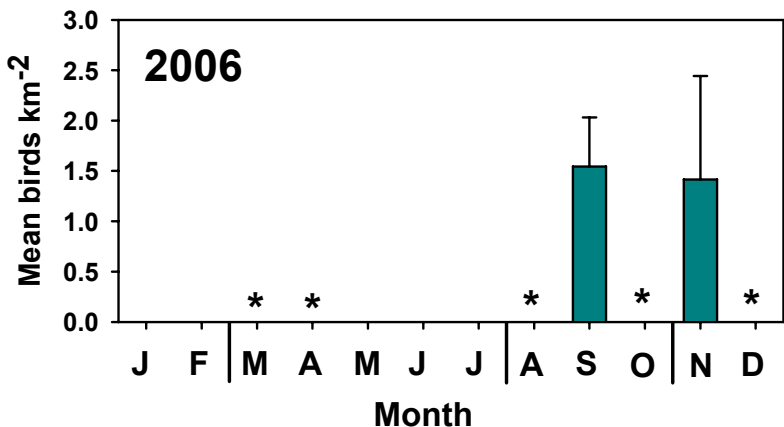
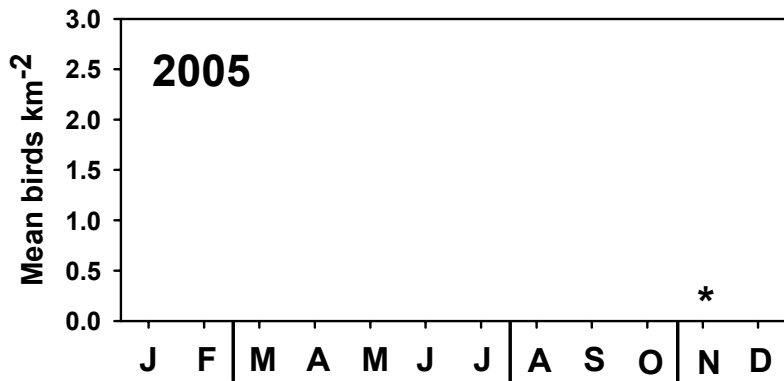
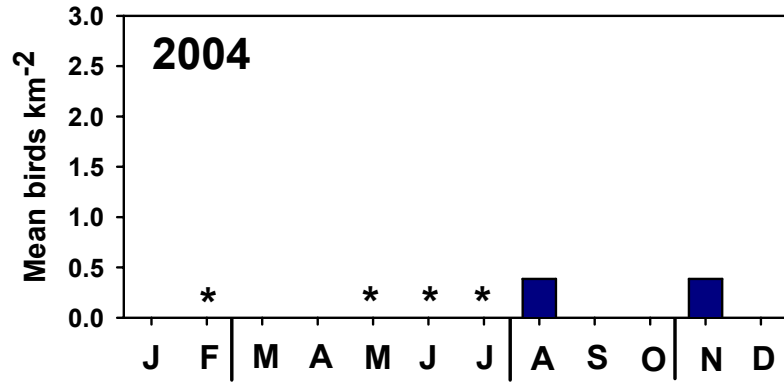
ANCOVA model:  $R^2=0.34$

- No difference among years
- Significant difference among ocean seasons
- Seasonal increase from relaxation to winter to upwelling

→  
Relaxation   Winter   Upwelling



## Brown Pelican

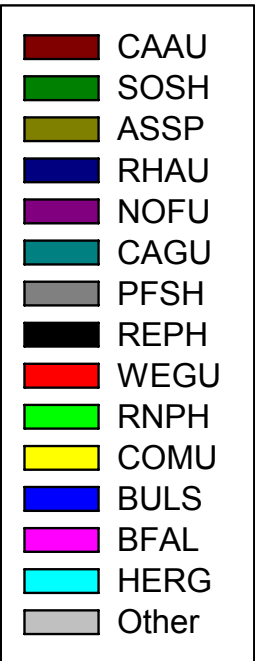
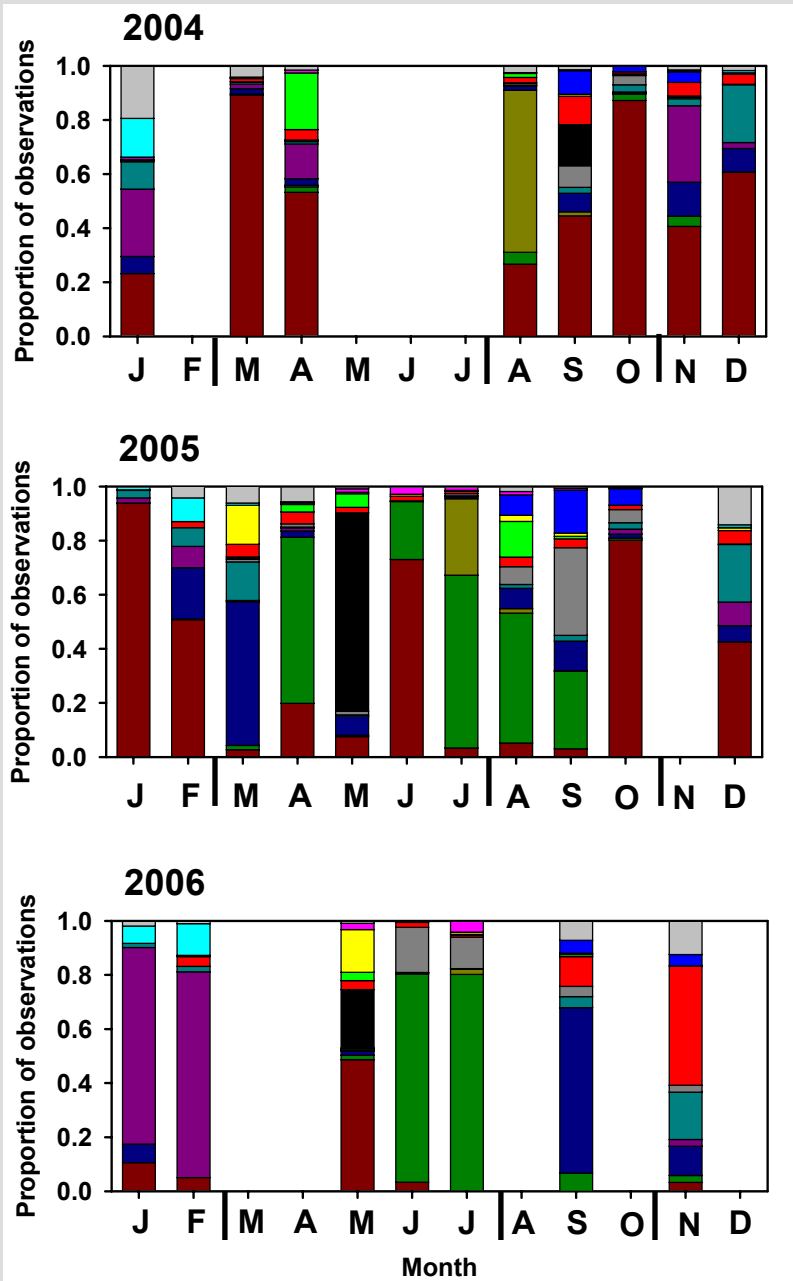


[pbase.com/gtepkc](http://pbase.com/gtepkc)

ANCOVA model:  $R^2=0.59$   
 -Significant year x ocean season effect  
 -During relaxation,  
 2006 > 2004 and 2005

U: 2004    2005    2006  
 W: 2004    2005    2006  
 R: 2004    2005    2006

# Species composition



## Conclusions

- Difficulties in conducting a monthly monitoring program in offshore environment – missing data
- 2005, 2006 – lower abundance of dominant species and change in community composition
- Abundances of planktivorous specialists were lower in 2005 and 2006 (CAAU, blue whale)
- Abundances of foraging generalists (SOSH, BFAL) did not change across 2004-2006, vary by season
- Distribution of Brown Pelican shifting to offshore foraging habitats. Sardines?
- Utility of monitoring program in detecting changes in local biological patterns that could represent changes in regional oceanographic conditions



## Future work

- Examine local bird patterns on finer spatial and temporal scale and assess mechanisms driving change
  - influence of bathymetric features (Cordell Bank, shelf-break, Bodega Canyon)
  - influence of small and large-scale oceanographic conditions, chlorophyll-a, krill
- Analyze the ability of this sampling program to detect changes in representative species –
  - modify program to meet the needs of site characterization and monitoring
- Integrate Cordell Bank Ocean Monitoring Program results with other at-sea monitoring programs in the region (e.g, H.T. Harvey, SWFSC, PRBO, GFNMS, UCSC)





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Photo: Steve Howell

