

Environmental influences on inshore habitat use, absence and presence of *Carcharodon carcharias* in Gansbaai, South Africa.



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INTRODUCTION

South Africa's rich Western Cape oceans are subject to dramatic variability in environmental factors such as temperature, currents, salinity, oxygen and turbidity. These processes can constrain aquatic organisms at various levels, from direct effect upon tissues, to effects upon organismal performance and behaviour (Domenici et al, 2007). This study aims to investigate the relationships between environmental factors and their influence on great white sharks presence in Gansbaai, particularly in correlation with the sharks unexplained 'summer' inshore habitat use.

Kleinbaai is a relatively exposed bay system located 95km South west of Cape Town. Dyer Island is located 9km offshore. It is a popular resort for white shark cage diving and eco tourism.

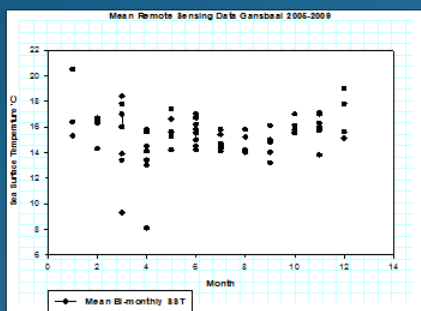


Fig 2 Remote sensing SST trends Gbaai 2005-2009

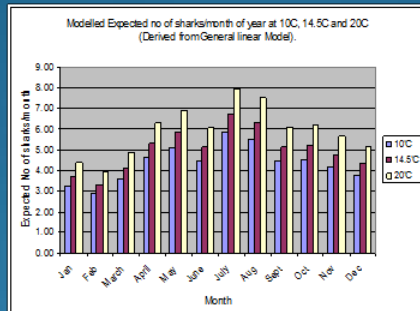


Fig 3: Modelled magnitude of SST on no of sharks 2007-2010

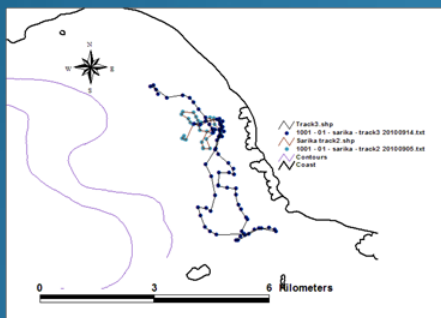


Fig 4: Example of acoustic track of inshore shark.

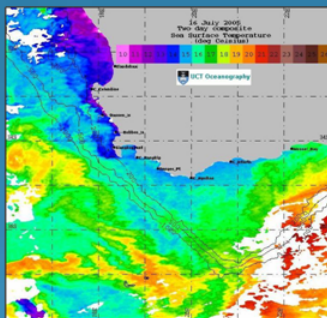


Fig 1: Remote Sensing SST Map 16 July 2005

Thanks to Wilfred Chivell, The Dyer Island Conservation Trust, Fastrax Marine, Chris Fallows for photos, Dr. Malcolm Smale and Prof Les Underhill



METHODS

Remote sensing data covering the western cape coastline of sea surface temperature and chlorophyll concentration was analysed temporally to assess trends over a five year period 2005-2006. Daily logs were taken over a four year time period 2007-2010 from a cage diving vessel.

A generalized linear model with Poisson distribution and logarithmic link function was linked to the number of sharks seen on each trip. Water depth was used along with, sea surface temperature, cloud cover, wind speed and wind direction as explanatory variables. We also tested for a trend through time over the period of study.

Acoustic telemetry using v16 Vemco transmitters (with temperature and depth loggers) was later utilised to track the fine scale movements of n=3 animals during early summer 2010. The study is in progress and shall continue throughout the course of 2011 for a second comparative summer season.

Salinity, temperature and turbidity were sampled via regular CTD deployments at known offshore and inshore sites. Dissolved Oxygen concentration was sampled via the deployment of a niskin bottle and measured by using the Winkler titration.

PRELIMINARY RESULTS & CONCLUSIONS

Remote sensing data indicates significant and drastic variability in SST both in and between months and years in the area of Gansbaai. (See Fig 1 and 2)

The regression coefficient for SST, when transformed from the logarithmic scale to an arithmetic scale, suggests that for each one degree increase in SST, the number of sharks increases by 3.14%. For example, in July, the month with the largest numbers of sharks per trip, the expected number of sharks is 5.84 at the coldest observed SST of 10C, 6.71 at the average SST of 14.5C, and 7.94 at the maximum observed SST of 20C.

The modelled magnitude of the impact of SST on great white shark numbers is shown in Fig 3.

Early acoustic tracking data of 3 female white sharks (in progress) indicates individual sharks utilising and returning to key inshore niches. Interestingly not one shark frequented the seal colony at Dyer island during the summer time tracking hours, longer continuous tracking shifts would have better confirmed this however. (Fig4) CTD profiles of inshore vs. offshore spots have shown signs of occasional dramatic fresh water influx in shallow inshore areas and rapid drops in water temperature throughout the water column, in less than 10m depth. See fig6 Dissolved oxygen varies from 4mg-l (almost hypoxic conditions) to 8.5 mg-1.

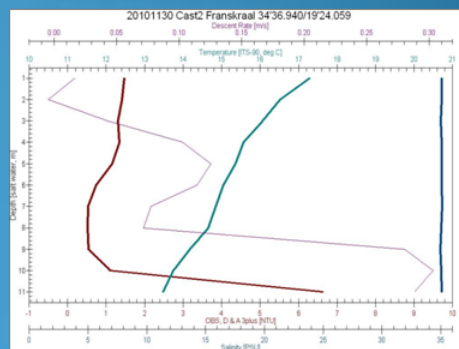


Fig 6: CTD profile