

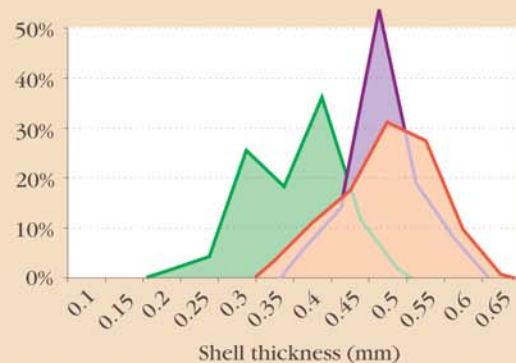
Stress causing eggshell thinning: Northern royal albatross



Territorial aggression. The Little Sister, November 1973

The northern royal albatross, *Diomedea sanfordi* breeds at four locations (The Sisters and The Forty Fours with 5200 pairs in the Chatham Is., and at a small mainland colony of 25 pairs on Taiaroa Head, New Zealand). These albatross lay a single egg and are normally biennial breeders if a chick is reared. If the egg fails, breeding is attempted annually. The female is normally present at the nest for three days before egg laying. It is presumed that final shell deposition occurs during this period.

Egg shell thinning and egg mortality are usually interpreted as a syndrome of contaminants in the food chain, especially DDT / DDE and PCBs. In these albatrosses no difference in shell thickness has been found between eggs which hatch and those which fail. Mean shell thickness has been constant at Taiaroa Head from 1970-1997 and is similar to the shell thickness at the Chathams in the 1970s. However, between the 1970s and the 1990s the mean shell thickness in the Chathams populations declined by over 24%.

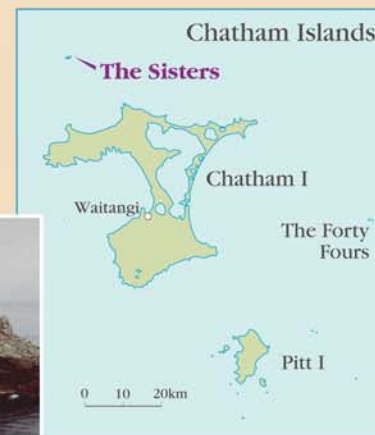


■ Taiaroa Head 1970-97 ($\bar{x} = 0.504\text{mm}$)
 ■ Chathams 1973/74 ($\bar{x} = 0.499\text{mm}$)
 ■ Chathams 1993-97 ($\bar{x} = 0.376\text{mm}$)



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The Little Sister



Nesting density and quality of habitat

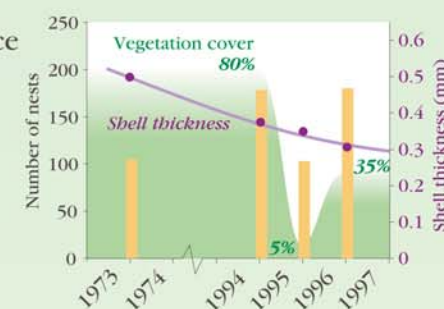
Since the early 1970s, an increasing soil moisture deficit has affected seasonal plant growth at the Chathams. In July 1985 a hurricane severely modified the northern royal albatross breeding islands by removing up to 80% of available soil and much of the vegetation. The resulting rocky and desert-like landscape has poor water retention, variably affecting seasonal vegetation



cover with which to build suitable nests. Subsequently, hatching success has been poor, with up to 95% of the breeding population attempting to nest in some years, instead of a more normal 60%.

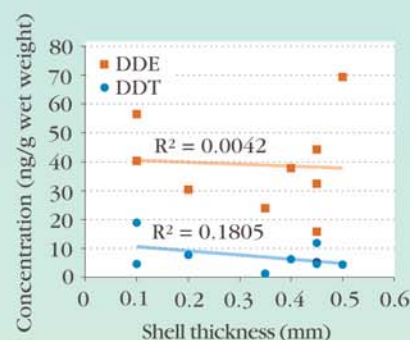
There is a direct relationship between shell thickness and nesting density which is compounded when vegetation is sparse or not present. In years of comparable population size there is an inter-seasonal difference in shell thickness directly correlated with vegetation cover during egg laying.

Intra-seasonal differences are eliminated in poor vegetation years when laying females are exposed to behavioural and physical disturbance from surrounding birds. This affects shell deposition before laying.



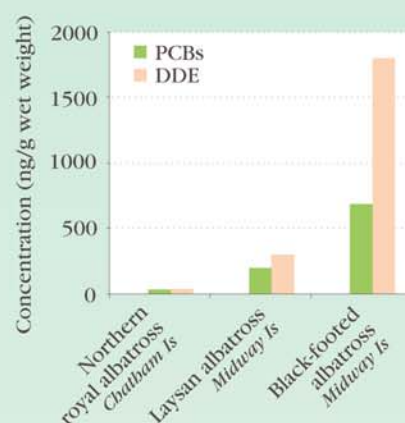
Contaminant analysis

In 1996, samples of fresh royal albatross eggs from The Little Sister were tested for a comprehensive range of known contaminants. Mean wet weight contaminant levels were very low. There was no relationship between shell thickness and the concentration of DDT or DDE which were many times less than levels for other albatross.



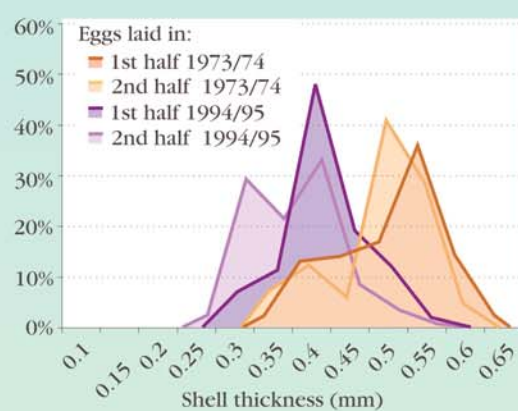
Comparable contaminant levels in laysan, black-footed and northern royal albatross showed significantly lower levels for the royal, which has had extensive shell thinning in the Chathams, compared with no thinning for the other two species at Midway. Only the black-footed albatross has demonstrated PCB induced death during chick development in the egg.

Therefore, significant shell thinning in the northern royal albatross is not caused by contaminants.



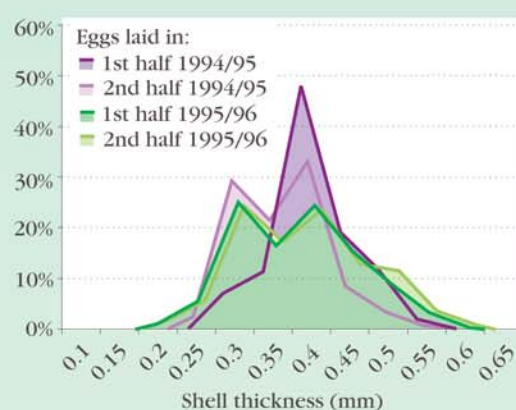
Inter- and intra-seasonal differences in shell thickness

Inter-seasonal differences suggest that nesting density combined with seasonal, climatic or habitat conditions are significant contributors to shell thickness reduction in the Chathams, as no change has occurred at Taiaroa Head.



At The Little Sister in 1973/4 and 1994/5, there was a significant intra-seasonal difference in mean shell thickness between eggs laid in the first half of egg laying, compared with the second half of laying.

However, there was no discernible difference between different parts of the laying season in 1995/6 (or 1996/7).



Conclusions

Contaminants are not a primary cause of egg shell thinning for the northern royal albatross in the Chatham Islands.

- Increasing nesting density can result in significant shell thinning.
- Degraded habitat and lack of nesting material also produces significant shell thinning.
- Behavioural stress at the time of shell deposition, immediately prior to egg laying, causes shell thinning.