

Interactions between Silver Gulls (*Larus novaehollandiae*) and Southern Bluefin Tuna (*Thunnus maccoyii*) aquaculture in the Port Lincoln area

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A thesis submitted in fulfilment for the degree of
Doctor of Philosophy

Flinders University of South Australia
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1st October 2009

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Abstract

The interaction between seabirds, particularly the Silver Gull (*Larus novaehollandiae*) and the Southern Bluefin Tuna (SBT, *Thunnus maccoyii*) aquaculture industry was studied to determine how much tuna feed is scavenged and the impacts of this food source on the local Silver Gull population. Previous research indicated Silver Gulls scavenged approximately 2.3% of the feed used by one tuna farming company and this is likely to be the reason the gull population increased rapidly due to an enhanced reproductive output compared to a reference population without access to tuna feed.

The aims of the research described in this thesis were:

- To quantify tuna feed loss to seabirds from a broader cross-section of the tuna farming industry.
- To determine the reliance of the Port Lincoln Silver Gull population on tuna feed compared to gulls at two reference sites with no access to tuna feed.
- To determine whether the reproductive output (and thereby, population growth) of the Port Lincoln Silver Gulls was enhanced by tuna feed compared to the reference site gulls.
- To trial practical measures to decrease tuna feed loss to Silver Gulls and to control the Silver Gull population by preventing eggs from hatching and adult birds from re-laying.

Sixty thousand tonnes of baitfish were fed out to the SBT per annum across the 13 companies' pontoons (total ~130 pontoons). Extrapolation of observations of feed loss suggested about 1.3% or 790 tonnes of feed was scavenged by seabirds annually, of which ~570 tonnes (72%) was consumed by Silver Gulls, with around 37,000

Silver Gulls present across the total tuna lease area each day. The proportion of the Port Lincoln area Silver Gull population that is reliant on this tuna feed depends on the method used to estimate dietary intake and varies between 28% (based on pellet/prey collection and stomach flushing) and 72% (tuna farm feed loss estimations). The availability of tuna feed has profound effects on the population of gulls around Port Lincoln. Firstly, the breeding season has been considerably protracted so it now mimics the tuna farming season (January to September/October) with around three peaks in nesting activity per season, compared to reference populations that initiate breeding months later and usually have one, or possibly two, nesting peaks. Secondly, the reproductive output (average number of fledging chicks per nest) of Port Lincoln gulls was 25-50% greater than that of the reference gulls, which coupled with the protracted breeding season further enhances reproductive output. These changes in breeding have, at least partly led to an exponential increase in breeding gulls from 3,300 pairs in 1999 to as high as 27,800 pairs in 2005. However, a proportion of this over abundant population may be caused by gulls migrating to Port Lincoln to exploit the relatively new food source provided by the tuna (and potentially other seafood) industry. This large population causes social and nuisance problems, particularly at the end of the tuna farming season when the gulls migrate into the urban areas of Port Lincoln in search of food, which unfortunately coincides with the busy summer tourist season.

The problems associated with this inflated gull population can be significantly reduced by a number of control measures. Feeding the tuna with frozen blocks of baitfish feed in enclosed cages within the pontoon reduced feed losses to 1.08% compared to a 2.38% loss from shovelling chilled or thawed baitfish. Farms that

prefer to continue shovel feeding could significantly reduce baitfish losses to gulls by using a scaring device, particularly the float on a rope method, which reduced losses by 87%. Another approach is to control the reproductive output of gulls. Spraying eggs with vegetable oil reduced the hatching rate to 0%. The outstanding success of this trial in 2006 led to the Australian Southern Bluefin Tuna Industry Association (formerly Tuna Boat Owners of South Australia) and the Department for Environment and Heritage implementing an egg oiling program in 2008 to manage the gull population.

This project has shown that although the feeding practices of the SBT industry contributed to the exponential increase in the Silver Gull population at Port Lincoln, the industry can (and in some cases has) introduced measures to reduce the feed losses that underpinned the local success of this wonderfully adaptable scavenger species. At an industry-wide level, the Australian Southern Bluefin Tuna Industry Association has played a significant role (with the Department for Environment and Heritage) in the 2006 and 2008 egg oiling programs. This project has been an effective example of scientists working together with industry and regulators to describe, quantify and overcome economic, biological and social issues that threatened to put an important regional industry in conflict with a South Australian native species that is often overlooked.

Declaration

I certify that this thesis does not incorporate, without acknowledgement, any material previously submitted for a degree or diploma in any university; and that to the best of my knowledge and belief it does not contain any material previously published or written by another person except where due reference is made in the text.

This research was carried out under the following permits:

- Flinders University Animal Ethics Permit (permit no. E214),
- Department for Environment and Heritage Research Permit (permit no. C24685-2).

Shelley Jane Harrison

1st October 2009

Acknowledgements

This thesis is dedicated to my husband and best friend Shane. The kindest, most supportive man I have ever met. Your faith and love have got me this far. I only hope I can repay at least some of what you have given me.

A big thankyou to my supervisors John Carragher and Jeremy Robertson. John, you have been my mentor and I truly appreciate all the time and effort you have put into helping me do this PhD. Jeremy, the input you have had is also greatly appreciated. At times it has been pretty hard being separated by distance and being supervised by two very busy people. However, this thesis shows what we have all achieved together.

Thanks to my family (Paul, Cate, Jess and Sarah) for assistance with field work and general encouragement for the duration of my PhD. A big thankyou to my Dad who assisted me with a large amount of island field work. Your knowledge, time and help is greatly appreciated.

Thankyou to my industry mentor, David Ellis, who made my tuna farm field work possible but who also provided me with guidance, knowledge and direction.

Thankyou to everybody at the Lincoln Marine Science Centre for support, encouragement and interest in my work. Thanks to Bob Delaine for skippering the *Tolero*. We had some adventures, but I think you had as much fun as I did. Thanks to Ib Svane for skippering the boat when Bob couldn't and for acting as a co-supervisor for the majority of my PhD. Thanks to Lana Roediger and Jenna Bowyer for last minute thesis help and to Toby Bolton and Phil Thomas (formerly LMSC) for providing guidance and direction beyond the call of duty.

Thanks to Danielle Foote (TBOASA) who ably assisted me with many facets of my project, and who carried on with seabird research when I finished field work. Thanks also to Teua Tenamau who assisted me through TBOASA for a period of time.

Thankyou to AJKA, Blaslovs, DI Fishing, Sarin Marine Farm, Sekol, Stehr Group, Stolt Sea Farm and Tony's Tuna for allowing me on your boats and farms to undertake research and providing many fun times and hot breakfasts.

Thankyou to Steve and the crew from Collex Pty Ltd. for allowing me access to the Port Lincoln dump.

Thankyou to Glenn Shimmin (DEH Adelaide) and staff at DEH Port Lincoln/Eyre Peninsula for help and funding with the egg oiling trial and to TBOASA and Chris Pitney for help with the field work for that part of my study.

Thanks to David Armstrong and Leigh Amey from DEH Venus Bay for providing me with their time and resources.

Thanks to Brad Page who is an otolith wiz! Your help with the diet identification, statistical analysis and general direction is greatly appreciated. I only hope some of

your greatness has rubbed off on me!

Thanks to Kylie Lange (Flinders University) for significant ($p < 0.001$) help with statistics.

Thanks to everyone at Aquafin CRC, in particular Peter Montague and Emily Downes for helping me through the constant media attention. Lucky you guys are pretty tolerant. I got myself in trouble a few times!

Thanks to the crew from SARDI Aquatic Sciences including Annelise Wiebkin, Lachie McLeay, Derek Hamer *et al.*, for interest, information, chats and guidance.

A big thanks to Associate Professor Corey Bradshaw from Adelaide University for your help with the Program MARK. I really appreciate the time you have taken to provide advice and support. Enjoy the beer and wine!

Thankyou to the examiners and external arbitrator for providing feedback which has undoubtedly improved the quality of the final version of this thesis.

Thankyou to Flinders University and Aquafin CRC for funding throughout the project as part of the Aquafin CRC Environment Project 4.3.3. Thanks also to Aquafin CRC and Flinders University for funding my trip to give an oral presentation at the 2007 European Aquaculture Society Conference in Istanbul, Turkey, and to visit Northern Bluefin Tuna farms in Astakos, Greece.

Glossary

- ABARE:** Australian Bureau of Agricultural and Resource Economics.
- ABBBS:** Australian Bird and Bat Banding Scheme.
- anthropogenic:** of human origin.
- APHIS:** Animal & Plant Health Inspection Service.
- Aquafin CRC:** Aquafin Cooperative Research Centre (CRC for the Sustainable Aquaculture of Finfish).
- Arcsin transformation:** transformation that assists with normalising percentage data.
- ASBTIA:** Australian Southern Bluefin Tuna Industry Association.
- ATSB:** Australian Transport Safety Bureau.
- B:** breadth (cm).
- Bonferonni adjustment:** dividing the acceptable p value by the number of comparisons being made to reduce the probability of accepting a hypothesis that is not supported by the data (type 1 error).
- broodstock:** stock kept specifically for breeding purposes.
- CDC:** Centers for Disease Control and Prevention.
- cm:** centimetre.
- clutch size:** Number of eggs laid per nest.
- DAFF:** Australian Government Department of Agriculture, Fisheries and Forestry.
- DEH:** South Australian Department for Environment and Heritage.
- DEWHA:** Australian Department of the Environment, Water, Heritage and the Arts.
- DPIWE:** Tasmanian Department of Tourism, Parks, Heritage and the Arts.
- egg volume:** volume of egg in millilitres or cm³. Calculated using $0.496LB^2$ (Wooller & Dunlop, 1979).
- EHD:** estimated hatching date or date at which eggs should hatch after laying
Approximately 24 days for Silver Gulls.
- EIFAC:** European Inland Fisheries Advisory Commission.
- ERM:** Enteric Redmouth Disease.
- FAD:** fish aggregating device.
- FAO:** Food and Agriculture Organization of the United Nations.
- fledgling:** chick has gained flight feathers and can successfully fly.
- Frequency of Occurrence (FOO):** The frequency of occurrence of a prey species is an expression of presence or absence. In any given data set, FOO % of any prey taxon defines the proportion of samples in that data set that contained a minimum of one individual of that prey taxon.
- GPS:** Global Positioning System.
- GRAS (chemicals):** generally recognised as safe.
- Ha or ha:** hectare.
- hatched:** chick has emerged successfully from the egg.
- hatching success:** eggs successfully hatching chicks. Expressed as a % of total eggs per nest for statistical purposes.
- Hiab:** hydraulic crane on boat.
- human refuse:** garbage usually sourced at disposal sites.
- IPN:** Infectious Pancreatic Necrosis.
- km:** kilometre.
- L:** length (cm).
- lease:** marked area in which an aquaculture company has permission to farm.
- m:** metre.

MDS: Multi-dimensional scale plot.
mm: millimetre.
mortality rate: number of dead chicks found per nest. Expressed as a % of clutch size.
NE: northeast.
nesting: birds are breeding. Demonstrated by presence of newly formed nests, eggs or chicks.
NNE: north northeast.
NNW: north northwest.
NSW: New South Wales.
Numerical Abundance (NA): Numerical prey abundance describes, for each prey taxon identified in all the samples, the proportion of the total number of prey items that is made up by that prey taxon.
NW: northwest.
Estimate of overall reproductive output: average number of chicks successfully produced per nest.
pipping: chick has just broken through the shell to start hatching.
PIRSA: Primary Industries and Resources South Australia.
pontoon: seacage in which fish are farmed.
PVC: polyvinyl chloride-plastic.
roosting: birds congregate to rest or sleep.
SA: South Australia.
SARDI: South Australian Research and Development Institute.
SBT: Southern Bluefin Tuna (*Thunnus maccoyii*).
seacage: pontoon in which fish are farmed.
SPSS: statistical analysis program (Statistical Package for the Social Sciences).
SVC: Spring Viraemia of Carp.
T1: treatment 1 nests (all eggs in the nest treated once with vegetable oil).
T2: treatment 2 nests (all eggs in the nest treated twice with vegetable oil on 2 visits a week apart).
t: tonne (1000kg).
TBOASA: Tuna Boat Owners Association of South Australia. Has since changed to ASBTIA.
UK: United Kingdom.
USA or US: United States of America.
USDA: United States Department for Agriculture.
VHS: Viral Haemorrhagic Septicaemia.
Vic: Victoria.
WA: Western Australia.
§: Refer to.

Species names are given capitals, eg, Silver Gull, while groups of birds are given in lower case, eg gulls.