

Response to the Appendix titled “A Review of the Populations, Behavioural Ecology and Life History of Australian Pied Oystercatchers and Migratory Shorebirds common to the Derwent Estuary - Pitt Water Area South-east Tasmania” by Iain Woxvold.

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Summary

The review provides a comprehensive account of the literature on the Australian Pied Oystercatcher in south-east Tasmania. This information in conjunction with the results of overseas studies of closely related oystercatcher species is used to draw conclusions concerning the impact of the proposed marina development at Lauderdale on the local Australian Pied Oystercatcher population.

The response in this document provides the background to the south-east Tasmanian investigations of the life history and population dynamics of the Australian Pied Oystercatcher and correct some conclusions reached in the review. In particular it is pointed out that contrary to the impression given in the review the sample sizes in the published local studies are substantial relative to the size of the local population and have the advantage of longevity (15 years of comprehensive monitoring and >30 years intermittent study) and key parameters like breeding productivity are accurate. In contrast recent breeding studies conducted by Aquenal on behalf of the developer are short term (2 years; only one intensive) and productivity measurements have large error ranges.

Over the last 40 years Australian Pied Oystercatcher numbers at Lauderdale have increased and Ralphs Bay now supports a population that is of national and international significance to the species throughout the year. Historically oystercatcher numbers peaked in winter but this has changed demonstrating that significant changes have occurred in the ecology of the area to which the oystercatchers have progressively adapted.

The attached notes provide possible explanations for the increased numbers of oystercatchers at Lauderdale that has become the key feeding habitat for the south-east Tasmanian population. Central to the proposed explanation is the proposition that the bay at Lauderdale provides the best combination of feeding and roosting opportunity available in the region. In part this may be a consequence of increased food resources at Lauderdale reflecting improved environmental quality of the mudflat. However it probably also reflects increased roosting difficulties at areas like South Arm Neck and Pipeclay Lagoon associated with rising sea levels and increased development.

Coupled with the increased bird numbers at Lauderdale, there is evidence that Australian Pied Oystercatchers are now exploiting new types of nest sites on higher ground. The net increase in breeding territories provided by exploiting these new types of nest site may be off-setting the lower breeding productivity/territorial pair associated with the use of nest sites which are not immediately adjacent to the area used for feeding unfledged young.

Studies by the British Trust for Ornithology commissioned by the marina development proponent, suggest that it will not be possible to mitigate at Lauderdale for the loss of habitat associated with the marina development. Furthermore any creation of new feeding habitat would require long lead times (e.g. 5 years) and would need to be in place and demonstrated to be successful before the development commenced.

In the event that the development proceeds without mitigation in terms of the provision of both new roosting and feeding habitat, it appears inevitable that large numbers of oystercatchers will be displaced from their preferred habitat at Lauderdale. It is a reasonable expectation that many of these birds experience premature mortality with a decrease in the size of the south-east Tasmanian population. New comprehensive long term studies would be required in order to predict the impact of oystercatcher displacement by the proposed development on the south-east Tasmanian Australian Pied Oystercatcher population. In the absence of this information, the precautionary principle should apply and the development should not be approved.

Background to Australian Pied Oystercatcher Studies in the Lauderdale Area

Alan Fletcher was the first person to make systematic records of Australian Pied Oystercatchers at Gorringes Beach, Mortimer Bay by collecting data for the Royal Australasian Ornithologists' Union (RAOU) Nest Record Scheme (NRS). The objectives of the NRS were to collect data on breeding events, particularly timing of the breeding season, nest site locations, nest construction, clutch size, hatching success, fledging period and fledging success.

The initial motivation for Mike Newman's Australian Pied Oystercatcher investigation was to demonstrate that the species was successfully breeding in the Derwent Estuary following suggestions by the late Professor Bloom that the area was an ecological disaster as a consequence of heavy metal pollution. Gorringes Beach in Mortimer Bay was selected as a focus for this study because it was adjacent to areas of mudflat known to be contaminated and also known to support a small breeding population of oystercatchers. In addition to conducting multiple visits to Gorringes Beach throughout the season to identify all breeding pairs and their fledging success, colour banding of adult breeding birds (by trapping on the nest) and fledged young (by capture as runners) was initiated.

In the 1977/78 season, it was demonstrated that the oystercatchers were breeding successfully and it was decided to both continue and extend the study with the added objective of following the survival of fledged birds through to adult breeding status. Consequently in subsequent seasons nests were monitored and runners banded in as many areas as possible in south-east Tasmania. However Gorringes Beach, Mortimer Bay remained the area of primary focus with sufficient visits each season to ensure every breeding territory was identified, every fledged bird was recorded, almost every nest was found and most runners were banded. In addition through a combination of ongoing trapping on the nest and cannon netting of birds at high tide roosts eventually every adult oystercatcher breeding at Gorringes Beach was colour banded. The comprehensive monitoring of Gorringes Beach, Mortimer Bay was continued for 15 successive years until Newman relocated to NSW for work reasons. Newman continues to visit Tasmania regularly and every year makes strategic visits to Gorringes Beach to monitor the survival of breeding adults and their breeding success in terms of the number of fledged young. Lauderdale breeding territories were also regularly monitored because they were easily visited on the way to Gorringes Beach.

Comprehensive records of breeding information were archived through the NRS and returns of banding information sent to the national Bird and Bat Banding Schemes in Canberra.

Colour marking of birds captured by cannon netting at roost sites, trapping on the nest and capture of runners allowed the movements of all age classes of birds to be followed in the area by monitoring the presence marked birds in roosting flocks, foraging groups and breeding pairs. This allowed conclusions to be drawn concerning the rate of disappearance of fledged birds (assumed mortality), age of first breeding and the location where fledged birds eventually obtained breeding territories. Adult mortality and site fidelity was also monitored by checking on annual survival rates of colour banded adults.

Throughout the study at Gorringes Beach, the area became progressively developed which impacted on the breeding strategies adopted by the birds. The potential for this anthropogenic disturbance to impact on the breeding success of the population was obvious. However it was not practical to monitor other areas with similar intensity to the effort at Gorringes Beach. Consequently protocols were set up to determine breeding success involving less intense survey effort as exemplified by the published study of oystercatcher breeding on the Tasman Peninsula (Newman 1985; Tasmanian Bird Report 14, 9-11) where the numbers territorial pairs and fledged young was determined at the end of the breeding season. This type of survey was extended to a number of other breeding areas.

The ultimate goal of the Newman's work became to understand the population balance for the Australian Pied Oystercatchers living in south-east Tasmania. Towards the end of the first 15 years of the study sufficient data on breeding productivity and mortality of various oystercatcher age groups was available to establish an equilibrium (i.e. static) population balance. However ongoing monitoring has demonstrated that the balance is dynamic rather than static requiring ongoing study to determine changes in the rate determining factors.

Sample Sizes, Accuracy and Publication of Results

The review prepared by Woxvold frequently comments on the small sample sizes, implies a lack of quantitative data and draws attention to the small numbers of colour banded birds in the Australian Pied Oystercatchers studies conducted by Newman and others in south-east Tasmania. These comments

misrepresent several aspects of the work as explained below.

i. Sample Sizes

In south-east Tasmania, Australian Pied Oystercatchers breed along a number of short beaches, small bays and tidal lagoons. Each of these locations provide a set of territories, often less than 10 and seldom greater than 15, which have unique features with respect to factors such as their topography and aspect (i.e. availability of nest sites and exposure during storms), ecological attributes (e.g. foraging opportunities) and disturbance (e.g. recreational). Small sample sizes are an inevitable outcome of any attempt to compare oystercatcher breeding between sub-areas (e.g. Gorringes Beach, Lauderdale and South Arm Neck). As explained earlier intensive effort was focused on one area, Gorringes Beach where over a 15 year period the productivity of on average seven pairs were monitored giving a sample size of 105 for which every outcome in terms of fledged young was known. It is contended that this is not a small sample and typically required 15 or more surveys each season or a total of 225 surveys over 15 years. The Gorringes Beach study has the advantage of measuring the breeding success of pairs averaged over a number of years thus generating a value which takes into account the impact of variations in the adult maturity, experience and environmental factors like changes in sea level and disturbance. As indicated earlier other less intensive survey methods were developed which provided larger samples of territories to be sampled allowing comparisons of breeding success at a number of locations.

ii. Accuracy

As discussed above, the breeding productivity data measured as fledged young/territorial pair over a 15 year period at Gorringes Beach is an absolute value (i.e. all pairs located and all fledged young found). In contrast the recent studies by Aquenal which are based on three visits in one breeding season over an extended area have large error ranges. This inaccuracy stems from failure to make sufficient visits with appropriate timing to find all fledged young, thus necessitating the use of assumptions concerning runner mortality rates as discussed in the detailed comment provided separately on the Aquenal report.

Newman and co-workers carefully timed their end of season surveys when making measurements of breeding success over extended areas in order to minimize difficulties associated with runner mortality and hence while their values in this type of survey are not absolute as is claimed for Gorringes Beach, they are considered to be accurate (i.e. >90%) based on the observer's long term knowledge of the location of breeding territories and oystercatcher breeding behaviour when they have young.

The mortality rates of breeding adult oystercatchers measured at Gorringes Beach are also considered to be extremely accurate values based on the survival of colour banded birds between seasons where all pairs were found each year. For instance annual survival rates of greater than 90% were typically observed indicating maximum mortality rates of less than 10% annually. As oystercatchers are extremely faithful to the breeding locations even when they have lost partners, become injured and divorced (see Newman's published papers; Newman 1992a, Emu 92, 87-92. and Newman 2008) the probability of the mortality rate being overestimated because some breeding adults have relocated to other areas is extremely low. However it is possible that the Gorringes Beach adult breeding population had an abnormally high survival rate (i.e. low mortality rate) during the 15 year study because low risk nest sites were used. For instance at Lauderdale and South Arm Neck, breeding adults are nesting, caring for young and roosting in close proximity to moving traffic and hence suffer enhanced mortality rates as evidenced by dead bird returns to the national bird banding scheme involving birds killed by traffic.

The other parameter determined by Newman which is central to constructing an oystercatcher population balance, is the survival of immature oystercatchers through to minimum breeding age. In this case the values measured are minimum values because of the possibility of birds banded as runners surviving outside the locations searched. However this error is not considered to be high because very few birds were seen following extended periods (i.e. greater than 1 year) of absence and few birds were reported away from south-east Tasmania.

iii. Colour banding

In his review Woxvold repeatedly comments that few colour banded birds were involved in the study. This statement is incorrect. In addition to the colour banding of the entire set of breeding adults at Gorringes Beach many additional breeding adults were colour banded at Lauderdale, Pipeclay Lagoon, South Arm Neck, Seven and Five Mile Beaches and the Tasman Peninsula allowing a comprehensive

view to be formed of breeding behaviour throughout the area. In addition over a number of years large sets of runners were banded at all of the above locations and their survival rates were monitored through to breeding age, including locating where and when they established breeding territories. At the height of this campaign winter flocks at locations like Lauderdale, Pipeclay Lagoon and South Arm Neck typically contained 10% or more colour banded birds.

iv. Publication

In addition to the numerous papers published on the study, a significant amount of data remains to be published. This additional information includes a number of draft manuscripts and raw data requiring analysis. Priority for analysis and publication was given to the comprehensive data sets for Gorringes Beach. In addition key information was extracted for inclusion in the section on the Australian Pied Oystercatcher in the Handbook of Australian New Zealand and Antarctic Birds HANZAB (Volume 2 pages 716 - 726). The time scale required for this information (e.g. minimum breeding age) precluded prior publication. Newman has recently retired and is currently involved in the analysis and publication of the archived material.

v. Archived data

As indicated previously significant amounts of archived material exist. This is unpublished and could be used to support the concepts proposed in this document. For instance Newman and Fletcher submitted 284 and 29 NRS reports respectively which are in the Birds Australia data base. These represent a substantial proportion of the available data on the Australian Pied Oystercatcher for which 667 breeding events are documented in the NRS. Newman has a number of additional records that were not submitted. These reports contain valuable information on the types of nest site used in the 1970 and 1980s. These numbers further illustrate that the knowledge of the south-east Tasmanian oystercatcher population is not based on small samples.

In addition as previously discussed there are banding recoveries of dead and recaptured birds in the national bird banding scheme records and numerous records of field sightings of colour banded birds in Newman's possession.

Given the very limited time allowed for response to the proponent's documentation it is not possible to analyse this data to support the concepts proposed in this document.

Trends in Oystercatcher Utilisation of the Derwent Estuary and surrounding Areas

There have been changes in the distribution and size of foraging and roosting flocks of non-breeding flocks of Australian Pied Oystercatchers. Woxvold's review highlights the discrepancy between the published results of Thomas and Newman, which show an increase in oystercatcher numbers at Lauderdale, and more recent results where the annual summer and winter counts are of similar magnitude. It is suggested that this is a real result as will be explained later. Some additional examples of trends in the use of the Estuary by non-breeding birds follow:

- Rising sea levels have diminished the viability of high tide roosts at South Arm Neck and Pipeclay Lagoon.
- At South Arm Neck birds are regularly forced onto the road and are frequently killed as demonstrated by recoveries of dead banded birds.
- Numbers of non breeding Australian Pied Oystercatchers foraging at Gorringes Beach during the breeding season have increased.
- Australian Pied Oystercatchers have ceased to roost regularly on the dunes at the end of Seven Mile Beach.
- Up to 100 Pied Oystercatchers now roost and forage at locations on the Derwent River above the Tasman Bridge where they were historically absent.
- Both Australian Pied Oystercatchers and Sooty Oystercatchers now forage on the rocky areas between Tranmere and the Tasman Bridge, habitat seldom exploited in the 1970s and 1980s.

Collectively these observations demonstrate significant changes in the breeding, foraging and roosting behaviour of Australian Pied Oystercatchers in the Derwent Estuary and surrounding areas. These changes were unexpected and consequently no comprehensive quantitative base line studies were made. The summer and winter shorebird counts conducted by Birds Tasmania primarily target migratory species and hence do not cover many of the areas important to Australian Pied Oystercatchers.

Dynamic Features potentially affecting the Derwent Estuary as Oystercatcher Habitat

Over the last 40 years a number of factors outlined below have impacted on the ecology of the Derwent Estuary and surrounding areas which have the potential to influence the use of the area by Australian Pied Oystercatchers. Some key effects are summarized below:

- Rising sea levels have restructured the shoreline rendering important roost and breeding sites unsuitable.
- Roads immediately adjacent to the foreshore at Lauderdale and the South Arm Neck prevent the natural restructuring of the foreshore to create new roosts and nest sites in response to rising sea levels.
- Massively increased residential development within the area has caused increased disturbance on the beaches where the oystercatchers historically nested and roosted.
- Residential development adjacent to the beaches has created areas of short grass, both lightly grazed and mowed, which can be used for nest sites. Even though these types of nest sites are sub-optimal, because they are not immediately adjacent to foraging areas, they can be advantageous when rising sea levels inundate foreshore sites. These sites have some similarity to the Dutch “leapfrog sites” which have been demonstrated to have low breeding productivity.
- Increasing environmental quality of the Derwent Estuary following a number of initiatives progressively implemented between 1975 and 1995. These include changes in zinc processing at the Nyrstar zinc refinery at Risdon to prevent the discharge of iron rich residues containing heavy metals to the Estuary and the implementation of effluent treatment at numerous industrial and municipal operations discharging effluents. Contaminated sediments in the estuary have become covered with clean silt layers.
- At Lauderdale, the municipal tip located immediately adjacent to the bay was closed. Leachates from this tip, which would be expected to be heavily contaminated, progressively ceased to drain into the bay.
- The extensive development of the oyster industry resulted in disturbance to foreshore areas used for breeding and roosting as well as potentially impacting adversely on mud flats historically used by oystercatchers for foraging.
- The impact of sewage discharged into the bay at Lauderdale

It will be noted that these effects are expected to have a range of impacts, some negative and others positive. It is therefore not surprising that there have been significant changes in the manner in which Australian Pied Oystercatchers exploit the Derwent Estuary during the last 40 years. Some possible outcomes are discussed in the next section and their validity tested against trends in oystercatcher numbers and distribution discussed earlier.

Has the seasonal use of Lauderdale by Australian Pied Oystercatchers changed?

Woxvold refers to the discrepancy between the published results of Thomas and Newman that show a build up of oystercatcher numbers at Lauderdale in winter and the more recent correspondence between numbers in the annual summer and winter counts. These observations involve different periods in time and follow a very large increase in the numbers of oystercatchers feeding and roosting at Lauderdale. It is proposed that both sets of data are correct and it is necessary to seek reasons for the change involving the increased utilization of Lauderdale during the last two decades. One possibility is that the food resource at Lauderdale available to oystercatchers has improved dramatically as a consequence of the implementation of the suite of pollution abatement measures discussed in the previous section. Consequently Lauderdale is now capable of supporting greater numbers of oystercatchers both in winter when it was a preferred location historically because of its roost options at high tide and now throughout the year because of its foraging attributes. We point out that the proportion of non-breeding birds will have increased relative to breeding birds as the total number of birds increased and only a few pairs breed at Lauderdale.

Why have Australian Pied Oystercatcher numbers increased at Lauderdale and does this reflect an increase in the south-east Tasmanian population?

Several reasons can be hypothesised for the increased number of oystercatchers at Lauderdale and a possible increase throughout the area noting that the twice-yearly counts only sample part of the Australian Pied Oystercatcher population in south east Tasmania. It should be stated that while the south-east Tasmanian population appears to be largely closed (ie small rates of immigration and emigration under normal circumstances) the population is not necessarily in balance. Several alternative hypotheses for increased numbers at Lauderdale are listed below.

- Increased disturbance both anthropogenic and natural (eg rising sea levels) have made alternative feeding and roosting areas like South Arm Neck and Pipeclay Lagoon less suitable habitat resulting in a redistribution of numbers in favour of Lauderdale which has superior roost options.
- Improvement in the environmental quality of the mudflats at Lauderdale as discussed above have increased food resources in the bay and hence the holding capacity for Australian Pied Oystercatchers.
- Australian Pied Oystercatchers have progressively expanded into a new range of breeding territories increasing the net breeding productivity for the area (this hypothesis is discussed further in the next section).
- A significant immigration of Australian Pied Oystercatchers displaced from the east coast of Tasmania into south-east Tasmania as a consequence of a depletion of their food resources caused by clam harvesting.

A combination of these factors is probably involved.

Implications for the Australian Pied Oystercatcher Population Balance.

In 1992, a crash in Australian Pied Oystercatcher numbers was predicted (Newman 1991 Tasmanian Bird Report 20, 21-24) based on the falling breeding productivity measured at that time, the ongoing residential development of the coastal area and the increased use of the beach areas for recreational and commercial (eg oyster farming) purposes. This prediction was made on the assumption that the rate-controlling factor was the availability of breeding territories. This was a reasonable assumption based on studies of colour banded birds which demonstrated large numbers of mature birds in the non-breeding population queuing for a breeding territory (ie that is birds older than 4 years which is the minimum age oystercatchers normally breed in south-east Tasmania). In addition, the traditional breeding sites were becoming increasingly competed for (i.e. intruding pairs nesting close to established pairs) and traditional nest sites were becoming unviable due to disturbance and natural events like rising sea levels.

The predicted population crash did not occur and with hindsight it is apparent that a simple equilibrium balance approach was inadequate. In the previous sections various dynamic factors have been discussed which provide a possible explanation of the increased numbers of Australian Pied Oystercatchers at Lauderdale and the surrounding areas. Central to these possibilities is the core concept that the oystercatchers have adapted to a combination of local circumstances involving large numbers of birds capable of breeding but unable to acquire a breeding territory because of the limited availability of premium nest sites of the type used historically. By progressively exploiting a range of new territories involving inferior nest sites (eg away from the beach front and among vegetation) which involve a trade off between increased security (ie less disturbance and risk of inundation) off-set by greater risk of predation and difficulty in feeding young more birds have been able to enter the breeding population. It is suggested that this adaptation has been a gradual process with non-breeding birds watching the behaviour of experienced birds and seeking to replicate their experience (i.e. once experienced birds demonstrate the successful use of new types of nest sites and territories other new pairs are formed and follow suite). Hence at least in the short term oystercatcher numbers may be bolstered by more territorial pairs producing young but at a lower productivity per pair. It has also been suggested that the catalyst for this dynamic change may have involved an improvement in the environmental quality of the mudflats and hence an increase in food availability and the survival of non-breeding birds. In addition the possible immigration of birds from outside the south-east Tasmanian area following displacement from their historical feeding grounds by clam harvesting must be considered.

The above concepts could be evaluated using a population balance model but validation would require extensive long term field studies in view of the dynamic nature of the situation and the fact that key parameters like the age structure of non-breeding birds and the average age of first breeding may have changed. Field studies of at least seven years are required to establish these parameters.

Is the population of Australian Pied Oystercatchers in the Lauderdale Area Sustainable?

This question posed by the Woxvold review cannot be definitively answered because of the dynamic nature of the factors influencing the Australian Pied Oystercatcher population in the Lauderdale area. However it is obvious that Lauderdale has become increasingly favoured by oystercatchers during the last 20 years. One hypothesis for this trend is that oystercatchers are increasingly finding other areas less secure, particularly during the extended non breeding period of their lives. This suggests that Lauderdale is essential to the ongoing health of the Australian Pied Oystercatcher population in south east Tasmania.

The analysis by Atkinson of the British Trust for Ornithology (Atkinson 2004 BTO Research Report No. 370) indicates that it will not be possible to mitigate within the bay at Lauderdale for habitat loss caused by the proposed development. Assuming as argued above that Lauderdale is a very important, probably essential to the oystercatcher local population, it would be a rash assumption that they can be excluded from Lauderdale without substantial mortality. There is no basis for estimating the extent of such mortality and its ultimate impact on the size of the breeding and non-breeding populations in south-east Tasmania. In the absence of such evidence the precautionary principle should apply and the development should not proceed.

As stated previously long term (at least five, ideally seven years) comprehensive studies of the south-east Tasmanian Australian Pied Oystercatcher population would be required to gain the additional insight necessary to predict the impact of the development proceeding. Also as indicated by Atkinson any attempts to create new feeding grounds in compensation for areas lost to the development would also have a similarly long lead time in addition to the associated risk of failure. Mitigation measures must be in place and demonstrated to be successful **before** development commences and removes existing mudflat habitat. If it is planned to use the existing sediments from the development site to seed newly created mudflats as suggested by Atkinson this may also result in short term loss of foraging habitat.

Providing mitigation for the development outside the Lauderdale Bay poses other difficulties. In this case mitigation measures include the need for establishing secure roost options and possibly improved adjacent feeding areas. How do you demonstrate the success of the mitigated areas before the oystercatchers are excluded from Lauderdale by the commencement of the development?

References

Woxvold's review with one exception cited below identifies all the published information on which the above discussion is based. Key references are identified in the above text with sufficient detail provided for the source article to be identified in the references cited in Woxvold's review.

Newman M (2008) Australian Pied Oystercatchers Breeding at Mortimer Bay, Tasmania, Australia 1977-2000. *Stilt* 54, 51-53.