Review of Report Prepared by Aquenal Pty. Ltd.

Surveys of nest locations and breeding success of Pied Oystercatchers and Red-capped Plovers in and around Lauderdale.

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Summary

Aquenal estimate the breeding success rate for Pied Oystercatchers in the extended Lauderdale area to be in the range 0.55 to 0.83 chicks/breeding pair for the 2007/08 season. This range is substantially overstated and it is argued that when realistic assumptions are made the breeding success rate is much lower; possibly near the minimum rate of 0.25 chicks/breeding pair calculated by Aquenal based on the number of chicks they actually proved to have fledged.

The upper level of the Aquenal estimate assumes the survival of chicks as young as one week through to fledging at seven weeks (ie no mortality). The literature and prior studies near Lauderdale demonstrate high rates of chick mortality, as do all studies for Pied Oystercatchers breeding in coastal areas reported in the literature.

It is also suggested that the Aquenal calculations are based on an under estimated number of breeding territorial pairs, which also contributes to the overstatement of the breeding success rate.

The field studies conducted to generate the data for the Aquenal studies relied on three surveys. This is inadequate to determine the key parameters required for a reliable measurement of breeding success. For instance the nests of some pairs may have been missed and a number of young had not fledged when the final survey was made. As a consequence it was necessary to make assumptions, some of which as indicated above are unrealistic, and all their results are subject to large error ranges.

No meaningful conclusions could be drawn concerning the differences in breeding success between different sub-areas of the study because of the small sample sizes and the high error ranges of the estimated parameters. This is an unfortunate and was exacerbated by the inadequate design and timing of the surveys. For instance although no impact of disturbance was demonstrated it does not negate the possibility that it is detrimental to Pied Oystercatcher breeding success.

General Comments

The review of the literature contained in this report is comprehensive and provides a balanced overview of past studies in the Lauderdale area.

The design of the field work studies is inadequate both in the number and in the timing of the surveys.

The field work is thorough and provides an extremely valuable update and extension to the knowledge of the breeding biology of the Pied Oystercatcher and Red-capped Plover in the Lauderdale area.

The interpretation of the results suffers from limitations in the experimental design. As a consequence, in calculating the results it was necessary to make assumptions and these demonstrate a lack of knowledge of some aspects of Pied Oystercatcher breeding behaviour. Consequently as will be discussed the derived breeding success rates have been over-stated.

Breeding Success Rate

This is an extremely important parameter because it can be compared across studies both in the Lauderdale area and with other populations of Pied Oystercatchers. To calculate the Breeding Success Rate expressed as the number of fledged chicks/breeding pair it is necessary to measure two parameters:

1. The number of fledged chicks (ie able to fly).
2. The number of breeding (ie territorial) pairs.

In the following sections it will be demonstrated that because of limitations in the design of the surveys neither of these parameters is known absolutely and hence assumptions are required to calculate the results, generating an estimated range rather than a value for the breeding success rate. As argued in detail below the range is unreliable and over-states the breeding success rate, probably substantially.

In my personal studies conducted with the help of Priscilla Park at Mortimer Bay, an absolute value of breeding success rate was obtained.

Aquenal quote a minimum breeding success rate of 0.25 fledged chicks/nesting pair based on the number chicks known to have fledged. They generate a higher number of 0.55 fledged chicks/nesting pair based on the assumptions that chicks seen at five weeks will successfully fledge. Their upper range estimate of 0.83 fledged birds/breeding pair assumes that chicks last seen as young as one week fledge. In the next two sections, we will argue that some breeding pairs may have been missed during the surveys and that the estimates of the number of fledged birds does not adequately account for the known mortality of runners between hatching and fledging. Both of these factors lower the breeding success rate.

Aquenal claim that the average known number of fledging chicks/pair (0.25) is an underestimate because there were a number of chicks which had not fledged at the time of the final survey. This assumption is valid, provided that the error in the denominator (the number of undetected breeding pairs) is less than error in the nominator (the number of additional chicks fledged after the last survey).

In the following sections reasons are provided that for suggesting that 0.55, the lowest estimated number of fledged young/ breeding pair, has been calculated based on unsound assumptions.

It is pointed out that the estimated maximum breeding rate (0.83) is 3.3 times the minimum known fledging rate (0.25). The magnitude of this discrepancy highlights the inadequate nature of the results.

Aquenal conclude that the average breeding success rate is in the range 0.55 to 0.83 (midpoint 0.69) fledged young/breeding pair for 77 pairs. Our analysis in a subsequent section suggests that breeding success rate may be even lower, at 0.31, in which case the mid point of the Aquenal range overstates the breeding success rate by 2.2 times.

Number of Breeding Pairs

The Aquenal report indicates that 116 nests were located in October 2006 compared with only 79 in the period October 2007 to January 2008.

It is extremely surprising that 31.8% fewer nests were located in the second year of surveys as breeding Pied Oystercatchers are extremely faithful to their territories and adult birds have a low mortality rate. (Newman 1992 and Newman 2008). One explanation is that a number that the nests of a number of territorial breeding pairs were missed during the 2007/08 surveys.

The Aquenal approach was based on finding nests during what appears to have been a single site visit during October, including nests without eggs. However in Table 8 between 1 and 3 eggs were recorded for all 78 of the nests where the contents were known. Hence no nests without eggs were considered in the analysis of results from which the breeding success rate was determined. This suggests that the number of breeding pairs has been understated, probably to a considerable extent, causing overestimation of the breeding success rate.

At this point it is pointed out that breeding success rate should be calculated based on the number of territorial pairs not on the number of nests found. There are a number of ways that nests can be missed unless frequent repeat surveys are made:

- Aquenal made their incubation period surveys in late October – early November which is at the height of the incubation period. However many clutches are complete by mid October and may suffer predation or loss due to inundation by high tides at any time, including immediately after the laying. Hence Aquenal could have missed first clutch attempts during their incubation period survey. Approximately 18 days is taken to produce a repeat clutch (Newman 1993). Hence repeat surveys ideally at weekly or less frequency are necessary if all breeding territories and nests are to be found.
- Some very old birds continue to occupy territories and may even prepare nest scrapes, but appear to be infertile and no eggs are laid. (Newman 1993). It is important that these birds are considered in the calculation of breeding success rate because they are holding breeding territories. Non-breeding birds, well in excess of the minimum breeding age are queuing to obtain territories which are of limited supply. Hence the impact of infertile birds on the number of productive territories and must be taken into account in determining the overall breeding productivity of an area.
- Pied Oystercatchers may make a number of nest scrapes prior to laying in the preferred scrape. These test scrapes can be located at the extremities of a territory often at points where breeding has occurred in previous seasons. It is thought that the oystercatchers monitor these alternative nest sites and assess the threats like inundation before selecting a preferred option in which the eggs are laid. It is possible that in 2006 Aquenal overestimated the number of nest sites by attributing more than one trial nest scrape to a single pair.

Examination of Figure 2 indicates that no Pied Oystercatchers bred along the sandy beach at Mortimer Bay. This is an extremely disturbed area which has been monitored every year since 1977. A male bird banded

in 1987 has maintained a territory in the centre of the beach every year since that time, comprising 2006/07, 2007/08 and 2008/09. This bird has developed advanced strategies for coping with disturbance including hiding chicks in hollowed out fence posts while feeding at low tide and well back in a creek bed at high tide. This pair was missed by Aquenal in both years. Other pairs including banded birds also attempted to breed on that beach area during the past three years and were also missed.

The above example demonstrates the extreme fidelity to nest site territories of established breeding pairs. Non-breeding flocks contain many individuals capable of breeding which seek opportunities to breed as indicated earlier. This will usually occur by replacing a deceased adult. But some pairs may attempt to share an established territory. It is possible that due to the persistent aggravation from established birds these attempts will be once off attempts. This could contribute to a small loss in pairs between seasons but not of sufficient magnitude to explain the 31.8% decrease between 2006 and 2007/08 reported by Aquenal.

The above discussion supports the conclusion that the number of breeding pairs was underestimated during the 2007/08 season. It is suggested that a conservative estimate of the number of territorial pairs should be 98 the mid point between the numbers found in 2006 (116) and 2007/08 (79).

Estimated Number of Fledged Birds

In calculating the fledging success rate assumptions have been made concerning the survival of chicks as below:

- Lowest estimated – chicks last seen within one or two weeks of fledging are assumed to have survived = 42 including 23 chicks fall in this category compared with 19 which were actually seen to have fledged.
- Highest estimated – includes chicks of all ages from 1 week to 6 weeks = 64 including 45 chicks which had not fledged compared to 19 which fledged.

It is suggested that the mortality of chicks cannot be excluded from the estimate and that the assumptions in the highest estimated fledging rate are not credible.

Below are presented some mortality rates for Pied Oystercatcher chicks between hatching and fledging in which the results for results for Mortimer Bay are compared with other populations.

Mortimer Bay (Newman 1983) – 77%
Coastal Holland (Ens et al. 1996) – 78%
Combined Oystercatchers (Ens et al. 1996) – 67.6%
Finland (Nethersole-Thompson 1986) – 22%

From the above data, it is apparent that chick high mortality rates are normal for coastal population of oystercatchers and that the figure for Mortimer Bay is realistic despite the relatively small sample size. The populations showing high survival rates likeFinland are acknowledged to be special cases free from disturbance. Based on the above information, it is assumed in the following analysis that the mortality rate of chicks in the Lauderdale area is 67.7% (ie two in every three chicks hatched die and only one fledges). The assumed mortality is comparable to the average for combined Pied Oystercatcher populations (67.6%) and lower than the mortalities for coastal breeding populations at Mortimer Bay (77%) and Holland (78%), and hence is conservative.

Table 5 in the Appendix to the Aquenal report provides the following breakdown of the data used to calculate the fledging rates:

Number of chicks hatched = 72
Number of fledging chicks (low –high estimates) = 42 to 64

These data indicate chick survival rates (low–high estimates) = 58 to 91%
Expressed as chick mortality rates the range (low-high estimates) = 42 to 11%

Applying the relatively conservative mortality rate of 67.7% to 72 hatched chicks and 77 nests for which the number of chicks hatched was calculated:

Estimated number of fledged chicks = 72 * 0.33 = 23.8
Estimated fledging rate / pair = 23.8/77 = 0.31

However if it is assumed that a number of pairs were missed and that the actual number of territorial pairs was 98 as proposed in the previous section the fledging is revised to an even lower value.

Revised estimated fledging rate/pair = 23.8/98 = 0.24

Differences in Survey Approach

The Aquenal report suggests that the published work of Priscilla Park and myself was based on surveys conducted by walking beaches. This is correct but there were other important differences:

- Frequent visits (at least weekly) at key areas like Mortimer Bay to ensure all the key breeding parameters like clutch size, hatching success rate, fledging success rate were collected allowing absolute values of breeding success/territorial pair to be calculated.
- Emphasis on identifying every breeding pair and every fledged young in the area.
- Banding of adults and runners so that at one stage every individual bird was marked and every nest and chick could be related to a known pair.
- Ability to follow any changes between territory limits and nest site position between years.
- Other surveys were conducted at a number of other areas primarily to band runners and to determine where and when birds banded as runners entered the breeding population. Often these studies particularly at Lauderdale generated very detailed breeding data and knowledge of all breeding territories.

Basically, the difference between the Aquenal and my studies is one of quantity of nesting territories monitored and the intensity with which a smaller sample of territories were surveyed. Both approaches have their merit.

Aquenal's studies cover more territories, in part because they used a boat and hence they have identified territories which were previously unknown. However, because they rely on just three surveys in one year they have had to make assumptions and extrapolate their data to determine key parameters like fledging rates/pair. The error ranges on their parameters are very large and this has undermined their objectives to statistically test differences in breeding quality of sub-areas of the study areas and to relate variations inbreeding success to the environmental quality of different nest sites. Given that fledging rate/territorial pair is arguably the most important parameter defining the productivity of a breeding population, at a minimum an additional survey should have been made in early February to ensure that the number fledged young were measured rather than estimated. It could be argued that the mortality of chicks will decrease with chick age and hence that all chicks within one or two weeks of fledging will survive. However this view does not take into account the additional risks for chicks close to fledging in that they are much larger and require a higher food intake. Hence they are both more visible and more active following their parents around while feeding over longer period increasing their risk of predation. In addition their response to predators often involves running to cover above the high tide mark as opposed to remaining hidden on the beach. We also suggest that it is important to identify all territorial pairs because nest may be missed when a limited number of surveys are conducted.

The studies at Mortimer Bay were very intense, continued over a number of seasons, and generated precise data. However the sample size in terms of the number of territorial pairs is small and similar quality data is not available for other areas.

Quality of Territories and Nest Sites

The Aquenal analysis failed to find any evidence that breeding was less successful at disturbed sites due to the small sample size (and also as a consequence of the lack of precision of their measurements for sub-samples). Their discussion highlights the complexity of the issues associated with understanding the impact of disturbance, and raises the possibility that birds may become habituated to it. A few insights into this possibility are provided below.

Observation of a number of breeding pairs of oystercatchers over successive seasons (up to 20 in one case) indicate that the birds strategically adapted their nest site selection to perceived threats such as the risk of inundation by high tides. Selection of more elevated nest sites such as among trees and in paddocks behind the fore-dune increases the risk of predation not only of the nest contents but also more seriously of the incubating adult. I have seen instances of this adaptation occurring at Mortimer Bay as consequence of rising sea levels and beach erosion. These sub-optimal sites are almost often less prone to disturbance but as indicated such sites are of quality poor and are not necessarily superior to a disturbed site on a beach front which is sufficiently high to prevent being washed out.