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Report on Marin County Heronry Study for 1974 and 1975

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There are currently six known major active colonies of members of the heron family in Marin County. One is on the east side of Tomales Bay south of Lawson's Landing on the Brazil ranch; one is opposite Nick's Cove near Marshall; one is on Schooner Bay at the Johnson Oyster Farm; one is on an island in Stafford Lake; one is on West Marin Island off San Rafael; and one is at Audubon Canyon Ranch on Bolinas Lagoon. In addition I found two Great Blue Heron (Ardea herodias) and two Great Egret (Casmerodius albus) nests in 1975 in a Douglas Fir (Pseudotsuga menziesii) growing adjacent to Sir Francis Drake Boulevard near Inverness Park. There could well be other undiscovered locations with small numbers of nests.

Of these colonies, it was possible to study those at Audubon Canyon Ranch, Stafford Lake, Nick's Cove, and Schooner Bay in some detail for the 1974 and 1975 seasons. This report summarizes the results. Great Blue Herons nested in all four colonies. Great Egrets nested at Audubon Canyon Ranch and Nick's Cove.

The colonies and methods have been described previously (Pratt 1975). In 1975 in addition to regular visits to the heronries, we held night watches at Audubon Canyon Ranch on 20 and 21 June from 20:00 to 24:00 to identify the predator or predators responsible for heavy predation evident there.

Great Blue Heron

One of the more interesting and puzzling findings was that the Great Blue Herons arrived at different times at different colonies. At Audubon Canyon Ranch and Stafford Lake the herons arrived at about the same time early in February and started their clutches in the last week of that

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month or during the first two weeks in March in both years. The populations gradually increased as more birds arrived and reached maximum levels about mid-April. At Nick's Cove the herons did not arrive until after 26 February in 1975 and it was after 10 March when laying commenced. Maximum occupancy there was not until sometime during the first two weeks of May. We lack arrival dates at this heronry for 1974. At Schooner Bay it was after 4 April when the herons occupied nests in 1975 and except for two pairs, all were on nests by 11 April. They were equally late in arriving in 1974. Thus there was a spread of about two months in occupancy dates between the earliest and latest colony. Maximum occupancy varied less widely being within about a month's time at all colonies.

Population levels of herons at the different colonies did not change much from 1974 to 1975 except at Stafford Lake where the number of breeding pairs increased from 14 in 1974 to 21 in 1975 (Table 1). At each colony some nests were hidden from the view of observers and the small changes recorded at the other colonies may in part reflect difficulties in locating nests. The total number of estimated breeding pairs of herons at all the heronries was close to 100 in both years.

Nesting success as measured by the number of young herons raised per successful nest increased at Audubon Canyon Ranch and at Schooner Bay in 1975, remained the same at Nick's Cove and declined at Stafford Lake (Table 2). Hatching success in successful nests at Audubon Canyon Ranch was the

same in both years (94% in 1974 and 95% in 1975) and mean clutch size was 3.3 in both years. The increase in number raised per successful nest resulted from greater survival within broods as evidenced by an increase in successful nests raising three young (Table 3) and may indicate that the parents were able to bring more food to the nests in 1975. It was impossible to determine clutch size and hatching success at Schooner Bay but the increased success there could also be the result of a larger quantity of food brought to the chicks. The data from Stafford Lake are not detailed enough to indicate why the herons were less successful there in 1975. Since this is a difficult colony to study, part of the apparent decline may simply be because young on hidden nests were hard to count.

Nesting success as measured by the number of young raised per breeding pair fluctuated in parallel with success per successful nest except at Audubon Canyon Ranch (Table 2). Here the percent of successful nests dropped from 81 in 1974 to 40 in 1975 and percents of nests losing eggs and young both showed drastic increases (Table 3). Predation (also responsible for loss of egret nests, see below) was clearly a large factor in nestling loss and perhaps also in egg loss. In June when it was too late for renesting five heron nests with chicks were known to be destroyed by a predator and four others may have been. As a consequence the number raised per breeding pair declined in 1975 to 1.2 from 1.8 in 1974 even though the number raised per successful nest increased.

Great Egret

The estimated number of breeding pairs of egrets at Audubon Canyon Ranch declined from 96 in 1974 to 85 in 1975. At Nick's Cove, the egret population increased from 6 pairs in 1974 to 15 in 1975. Overall the number of breeding pairs of Great Egrets in west Marin County was about the same in both years. Of the 15 nests at Nick's Cove in 1975, 10 were successful. They raised 21 chicks or 2.1 per successful nest. In addition 13 pairs of egrets came to Nick's Cove in late June or early July after extensive predatory losses at Audubon Canyon Ranch. Some apparently started clutches but it was too late for any to raise young.

The 1975 season for the Great Egrets at Audubon Canyon Ranch was disastrous. Only 3 nests were successful compared to 59 in 1974 (Table 4). It became obvious during the second week in June that the egrets were losing more nests than usual. In many that had contained chicks, bloody remains gave clear evidence of predation. By the time we identified a raccoon (Procyon lotor) as a predator on the night watch of 20 June the egrets had sustained almost total reproductive failure. The three successful pairs fledged five chicks, whereas a conservative expectation for young raised by 85 pairs based on results from previous years would be 100 to 120 fledglings. The raids may have started as early as the first week of June when four nests with chicks and one with eggs were lost. Most losses were between 8 and 20 June. During that time the egrets lost 26 nests with eggs and 35 with chicks. It is not possible to be sure that the

raccoon that we saw destroyed all of them. Some may have been lost for other reasons or to other predators. We know that at least 14 egret nests with chicks were raided by predators and we suspect that most of the others were also. After the losses, between 22 June and 3 July, there were 29 new nesting starts but all were deserted by early August.

Discussion

Some of the advantages suggested for colonial nesting are that it offers greater protection against predation by providing a more effective warning system, it may enable group defense, and it increases protection to most individuals through a swamping effect on predators. In our observations on the night of 20 June the egrets demonstrated an effective warning system but ineffective defense. When the raccoon climbed into the trees and approached the nests, the adults gave an alarm call and egrets that had been finding perches for the night in trees surrounding the nesting area flew to the spot and circled around the disturbance. If it had been an avian predator, the egrets might have been able to drive it away by mobbing. Mobbing has been reported by Great Blue Herons against a Golden Eagle (Aquila chrysaetos) (Wilburn 1970). They had no defense against the raccoon however. In this instance, having the nests clustered close together was disadvantageous to the egrets since once the raccoon had climbed into the redwood canopy it was able to travel from nest to nest through the branches relatively easily without descending to the ground.

Reproductive failure largely due to predation has also been reported in heron colonies in Texas (Taylor and Michael 1971) and Alabama (Dusi and Dusi 1968). So far as I know, this is the first time since Audubon Canyon Ranch was established as a sanctuary in 1961 that predation has been a serious threat to nesting success. Perhaps incidents of this sort are of such low frequency that the advantages of colonial nesting outweigh the possibility of catastrophic losses to predators.

I am not able to explain why predation at Audubon Canyon Ranch was so extensive in 1975 and not in other years. Nestling loss was rather high in 1974 and I speculated then that predation might have increased somewhat (Pratt 1975). Perhaps the raccoon population had increased in 1974 increasing pressure on food resources and this trend accelerated in 1975. Or perhaps a young raccoon learned how to exploit the heronry and preferred to feed there rather than utilizing other food sources. Although more than one raccoon might have been responsible, analysis of the losses suggests that one animal visiting the heronry each night could have raided all the lost nests alone. It is possible also that Great Horned Owls (Bubo virginianus) may have destroyed a few nests with young. They have often been heard calling in the canyon and are apparently resident in the area.

Feeling that control of the raccoon population was necessary to protect the heronry, Skip Schwartz, Audubon Canyon Ranch manager, trapped five raccoons that were then released at other locations in Marin County.

In both 1974 and 1975 we found remains of six dead adult Great Egrets on the floor of the heronry at Audubon Canyon Ranch. In 1974 one of them had died after several hours of convulsive seizures (Pratt 1975). Egrets that died in this way in 1970 had lethal concentrations of Dieldrin in the brain (Faber et al. 1970). In 1975 only fragments of the bodies were found and it was impossible to determine how many died. I had speculated in 1974 (Pratt 1975) that after the ban on Dieldrin and Aldrin fewer adult Great Egrets might die at Audubon Canyon Ranch during the nesting season. Events in 1975 did not support this speculation but since it was impossible to determine the cause of death of the egrets that died in 1975, no interpretation can be made.

The increase in 1975 in number of breeding pairs of egrets at Nick' Cove and timing of arrival may indicate that they are building a new colony. Although herons were reported nesting there since at least 1970 (E. Strauss, pers. com.) there were no reports of egret nests until 1974 when they surprised us by appearing in late May or early June two months after the first egrets arrived at Audubon Canyon Ranch. Their late arrival suggested the possibility that they might have been birds that had nesting failures elsewhere and then moved to a new location for another attempt. In 1975 the first breeding egrets to arrive at Nick's Cove came shortly after 1 April, at about the time the first egrets arrived at Audubon Canyon Ranch. Apparently they came to Nick's Cove as the site of first choice. The 13 additional pairs that appeared at Nick's Cove after nest losses at

Audubon Canyon Ranch again suggest that some pairs move after nesting failures to another colony for a new nesting attempt.

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Addendum

The site of the Olema heronry that was active in 1972 but inactive in 1973 and 1974 (Pratt 1975) was visited on 14 March 1975 and on 16 June 1975. I saw no herons on either date and nothing on the ground to indicate their presence. On the visit of 16 June there were a few twigs left in one old nest and another old nest still large and in good repair. I suspect it may have been used in 1975 but not necessarily by herons. Perhaps another species such as a hawk or owl had occupied it.

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	<u>1974</u>	<u>1975</u>
Audubon Canyon Ranch	48	45
Schooner Bay	15	12
Nick's Cove	23	28
Stafford Lake	<u>14</u>	<u>21</u>
	100	106

Table 1. Number of breeding pairs of Great Blue Herons estimated for four Marin County heronries.

	Fledged Per		Fledged Per	
	Successful Nest		Breeding Pair	
	1974	1975	1974	1975
Audubon Canyon Ranch	2.0	2.2	1.8	1.2
Schooner Bay	1.9	2.5	1.5	2.1
Nick's Cove	1.9	1.9	1.3	1.4
Stafford Lake	2.0	1.7	1.7	1.2

Table 2. Nesting success in four Marin county heronries measured by fledglings per successful nest and fledglings per breeding pair.

	1974	1975
Estimate of breeding pairs	48	45
Number fledged/breeding pair	1.8	1.2
Number of nesting attempts	53	62
% attempts successful	81	40
% attempts losing eggs	4	24
% attempts losing nestlings	9	27
% hatching failure	4	3
% laying failure	0	2
% unknown failure	2	3
Number of successful attempts	43	25
% successful nests fledging one	19	20
% successful nests fledging two	60	44
% successful nests fledging three	21	32
% successful nests fledging four	0	4
Number fledged/successful nest	2.0	2.2

Table 3. Great Blue Heron nesting success at Audubon Canyon Ranch in 1974 and 1975.

	1974	1975
Estimate of breeding pairs	96	85
Number fledged/breeding pair	1.4	.06
Number of nesting attempts	112	139
% attempts successful	53	2
% attempts losing eggs	16	54
% attempts losing nestlings	21	32
% hatching failure	6	9
% laying failure	0	<1
% unknown failure	4	3
Number of successful attempts	59	3
% successful nests fledging one	17	
% successful nests fledging two	47	
% successful nests fledging three	36	
% successful nests fledging four	0	
Number fledged/successful nest	2.2	1.7

Table 4. Great Egret nesting success at Audubon Canyon Ranch in 1974 and 1975. Percentages of number fledged in successful nests in 1975 were not computed because of the small number of successful nests.