

Anthochaera carunculata (Red Wattle-bird).—This harsh-voiced Honeyeater is quite a common bird. When the coral trees in Bunbury gardens are in flower its barking calls are sure to attract attention as it feeds on the nectar contained in the brilliant red blooms. I have seen nests in *Banksia* and other trees.

Anthus australis (Australian Pipit).—Found everywhere in open country, even in vacant blocks in the township itself. This is a species that has increased as a result of the country being cleared by man.

Corvus sp. (Crow).—Common enough in the vicinity of slaughter-yards and places where fragments of food are to be found. So far I have never seen a local nest. I think pairs retire to the adjacent Darling Ranges, which are much less disturbed, when the breeding season arrives.

Strepera versicolor (Grey Bell-Magpie—Squeaker).—By no means common near the coast, but I occasionally see a small party or hear their notes in timbered areas.

Craicticus torquatus (Grey Butcher-bird).—Pairs are to be found breeding throughout the district. I have seen nests in large peppermint bushes in the sand hills and in *Banksia* and tea-trees further inland. Another pair nested in a very small gum sapling at no greater height than six feet. It is a common experience to see pairs in trees growing in Bunbury streets.

Eastern Bristle-bird.—Mr. A. J. Marshall writes recording an observation of "a bird that was probably the Eastern Bristle-bird (*Dasyornis brachypterus*) in timbered swamp country about 1000 feet above sea-level behind Saddleback, Kiama," on October 1, 1938. "One of the Bristle-birds," says the letter, "was seen a couple of times, once at a distance of a few yards, when the pale throat and brown wings were clearly discernible. I could have shot the animal, but decided, in view of its rareness and the fact that no extension of range was involved that it would be unwise to do so. A second bird was seen later, on our way back to Kiama."

The Breeding Habits of the Lowan in Victoria

By F. LEWIS, Chief Inspector of Fisheries and Game, Vic.

A careful study of the Lowan or Mallee Fowl (*Leipoa ocellata*) during recent years indicates that much of the usually-accepted doctrine regarding the nesting habits of this bird is somewhat faulty. For instance, it was long thought that the heat necessary for the incubation of the eggs was derived entirely from the fermentation of the vegetation incorporated in the mounds. It was believed, also, by many people, that the eggs in the mound were regularly "turned" by the hen, as are the eggs of the domestic fowl and most other birds, to ensure successful incubation. The eggs when deposited in the mound are always stood up on the small end. It is often taught and

believed that if the position of an egg is reversed, that is stood up on its large end, the hen will notice what has been done and remedy matters by returning it to its original position.

All these matters have received my careful study in recent years, and the following data are now submitted.

The habitat of the Lowan differs very greatly from that of the Scrub Fowl and Brush Turkey of northern and north-eastern Australia. The nesting mounds of those two are composed almost entirely of vegetation, and are built, as a rule, in forest country and in the wet season. Consequently, the vegetation in the mound remains damp throughout the hatching period, and the fermentation which results can easily provide the necessary heat to incubate the eggs. When the Brush Turkeys were bred at the Melbourne Zoo a few years ago, their mound consisted entirely of vegetation and it had to be hosed regularly to keep it damp, and thus cause the vegetation to ferment. Furthermore, because the birds in their natural state build in dense forest, little sunlight could reach the mounds. The habitat of the Lowan is, however, in dry, arid country of very light rainfall. Only a comparatively small amount of vegetation is incorporated in the mound, the major portion of which consists of the light sandy soil of the mallee country. Soon after the hatching season is finished in February or March—depending on the season—the Lowans scratch out and empty the large mound and spend the next few months in keeping the mound open. As spring approaches vegetation and debris for many yards around is scratched and swept up and allowed to lie at the side of the mound which has been cleaned out to a depth of two feet. If rain falls and soaks the vegetation it is then transferred to the mound and left until rain again falls. When this eventuates the vegetation is covered with the sand and the mound gradually built up to a height of about three feet above the ground level. Should the season be abnormally dry as was the spring of 1938 in Victoria, the birds do not complete the mound, and they refrain that year from laying. In the district south of the railway line from Dimboola to Nhill great numbers of birds opened out their mounds last winter but went no further. Only two mounds were completed in the district worked by me, and in only one were eggs laid. It was unfortunate for the purpose of my investigation that the spring and summer of the 1938-39 season were so dry in Victoria, but the information obtained will serve as an interesting introduction to further work.

Because of the arid nature of the country where the Lowan breeds in Victoria, I have long held the opinion that the heat resulting from the fermentation of the vegetation in the mound is negligible in its effect on the incubation of the eggs. Dozens of mounds which I have examined in

the breeding season have shown little or no signs of fermentation. It appears to me that the main use for the vegetation in the mound is to retain moisture which is so necessary for assisting in the incubation of the eggs. To obtain data on this subject, I arranged with a young man who is keenly interested in and has studied the Lowan for many years, to keep regular observations for me and take temperatures of the actual mound during the entire breeding season. Temperatures were taken twice a day and on two days each week at the commencement, but later on, the mound was visited more frequently. Care was taken to obtain the temperature and leave the vicinity of the mound so that the operations of the parent birds were not interfered with to any extent. The result was that the birds attended to the mound right through the season, although carefully watched from a safe distance. Temperatures were taken as shown below:

- (a) in the shade of the body;
- (b) on the surface of the mound;
- (c) in the actual egg chamber.

Several interesting habits of the birds were noted. The mound was visited daily by the birds, sometimes by both, although mostly by the female alone, but never before 10 a.m. If the weather was bright and warm the bird proceeded to open out the mound, often right down to the eggs—obviously to allow the heat of the sun to penetrate and thoroughly warm the interior of the mound. Early in the afternoon the mound would be closed and the sand heaped up to a height of roughly three feet. The mound under observation was approximately forty-five feet in circumference and contained about six tons of material, so that the work of opening and closing it each day was no light task. No doubt the inherited instinct of the Lowan teaches it when and how to build its mound, but when it comes to the bird's regulating the heat of the interior—as I think there is evidence that it does—something more than instinct, amounting almost to intelligence, appears to be indicated.

During the period of observation the highest temperatures ever recorded in Victoria and exceedingly heavy summer rains were experienced. So severe was the heat that many Magpie-Larks, Magpies and other birds in the district died. The reactions of the Lowan to these exceptional conditions are extremely interesting. The female apparently knew that extreme heat and heavy rain were both detrimental to the eggs in the mound and did her best to avoid bad results.

Usually egg laying commences about the beginning of November in Victoria, but the abnormal weather conditions resulted in a later commencement and a much prolonged laying season. The abnormal conditions were also probably responsible for the fact that out of the ten eggs laid only

one was successfully incubated. All the eggs were marked and numbered as laid, and particulars of same are as follows:

| Egg No. | Laid | Remarks |
|----------------|---------|--|
| | 1938 | |
| 1 | Nov. 20 | Egg broken by intruder—chick well formed. |
| 2 | " 22 | Examined Feb. 5—no development, egg infertile. |
| 3 | " 24 | Examined Feb. 15—young well developed, but dead. |
| 4 | " 26 | Examined Feb. 15—no development, egg infertile. |
| 5 | " 30 | Hatched Feb. 8—9½ weeks' incubation. |
| 6 | Dec. 7 | Examined Feb. 24—chick dead. |
| 7 | " 14 | Examined Feb. 28—chick dead. |
| 8 | " 18 | Examined March 6—egg infertile; no development. |
| 9 | " 25 | Examined March 6—egg infertile; no development. |
| | 1939 | |
| 10 | Jan. 4 | Egg reversed Feb. 16; removed March 20. Egg infertile; no development. |
| Season 1938-39 | | 10 eggs were laid in 37 days—from Nov. 20 to Jan. 4. Only one hatched. |
| Season 1937-38 | | 9 eggs were laid in 12 days—from Jan. 14 to Jan. 26. All hatched. |

It will be noted that the egg laying did not commence until November 20—about three weeks later than usual—and extended over an exceptionally long period until January 4, 1939. The usual clutch consists of about ten eggs, and the laying is completed in from 18 to 20 days. When large numbers of eggs, exceeding that number, are found in the mound, it would appear that more than one pair of birds is using it. It was noted that when an egg was deposited in a mound it was left lying on its side and covered up. Next day the Lowan stood it up on end—small end down. Such practice was noted on several occasions. All the eggs as laid were marked with a cross on the top and the date. On not one occasion was an egg turned—all being left standing upright, throughout the season, on the small end. The last egg, laid on January 4, was reversed on February 16, and, although after March 6 it was the only egg left in the mound, the Lowan regularly visited it, opening up the mound whenever conditions were suitable. She made no attempt to right the position of the egg, which remained upside down until finally removed for examination on March 20, when it was found to be infertile, as no development had taken place.

The taking of temperatures commenced on December 1, 1938, and continued until March 20, 1939, when the last egg (no. 10) had been in the mound for seventy-five days. It was then taken and opened, and proved infertile. The temperatures, which I personally took, on December 1, were:

Temperature in the shade—78 deg.

Temperature on the surface of the mound—82 deg.

Temperature in the mound eighteen inches below the surface—92 deg.

Temperatures taken, with reports and weather conditions, are as follows:

| Date 1938 | | Time | Weather | Shade Temp. | Temp. on Mound | Temp. in Mound | Remarks |
|--------------|----|----------------------------------|------------------|----------------|-------------------|-------------------|--|
| Dec. | 11 | 10 a.m. | cold, cloudy. | 82 | 82 | 86 | Six eggs in mound, laid from Nov. 20 to Dec. 7. |
| " | 14 | 1 p.m. | sunny | 86 | 100 | 87 | No. 7 egg laid. |
| " | 18 | 10 a.m. | hot | 88 | 104 | 92 | No. 8 egg laid. |
| " | 21 | 2 p.m. | " | 88 | 114 | 92 | |
| " | 25 | 2 p.m. | " | 96 | 106 | 92 | No. 9 egg laid. |
| 1939 | | | | | | | |
| Jan. | 1 | 10 a.m. | " | 98 | 108 | 94 | Mound thatched. |
| " | 4 | 4 p.m. | " | 92 | 118 | 94 | 20 points of rain on Jan. 3. No. 10 egg laid. |
| " | 8 | 1 p.m. | " | 112 | 124 | 95 | Mound built up high. |
| " | 11 | 1 p.m. | " | 102 | 116 | 96 | Mound built up high. |
| " | 13 | 1 p.m. | " | 116 | 130 | 98 | Many birds died as result of extreme heat. |
| " | 15 | noon | cool | 70 | 76 | 92 | Mound built up and thatched. |
| " | 16 | | | | | | 150 points of rain. |
| " | 18 | 1 p.m. | warm | 82 | 94 | 90 | |
| " | 22 | 10 a.m. | cool | 74 | 82 | 88 | Mound opened to within 2 inches of eggs. |
| " | 25 | 10 a.m. | sunny | 88 | 94 | 90 | Mound opened up nearly to eggs. |
| " | 25 | 4 p.m. | warm | 92 | 100 | 92 | Mound opened up nearly to eggs. |
| " | 29 | noon | " | 92 | 100 | 92 | Mound opened up nearly to eggs. |
| Feb. | 1 | 3 p.m. | " | 90 | 94 | 90 | |
| " | 5 | 2 p.m. | " | 90 | 116 | 96 | Mound built up high. No. 5 egg hatched. |
| " | 12 | 2 p.m. | hot | 102 | 116 | 94 | Mound built up high. |
| " | 15 | 9 a.m. | cool | 68 | 84 | 90 | Mound built up high. |
| " | 16 | Position of egg no. 10 reversed. | | | | | |
| " | 18 | 9 a.m. | cool | 62 | 70 | 90 | Mound opened up to 2 inches of eggs. |
| " | 18 | 3 p.m. | warm | 86 | 108 | 96 | |
| " | 19 | 9 a.m. | cool | 68 | 70 | 92 | Mound built up. |
| " | 20 | 9 a.m. | cool | 60 | 68 | 90 | |
| " | 20 | 3 p.m. | warm | 80 | 98 | 94 | |
| " | 21 | 3 p.m. | hot | 94 | 110 | 96 | Mound built up. |
| " | 22 | 8 a.m. | warm | 74 | 90 | 96 | Mound built up. |
| " | 23 | 3 p.m. | sultry | 90 | 108 | 96 | Mound thatched; 6 points of rain. |
| " | 24 | 3 p.m. | warm | 88 | 108 | 94 | Egg no. 6 opened; chick dead. |
| " | 25 | 5 p.m. | heavy rain | 66 | 60 | — | Internal temperature not taken because of cold weather and rain. |
| " | 26 | 9 a.m. | cold | 58 | 60 | 88 | Lowan on mound all day. |
| " | 26 | 5 p.m. | sunny, cold | 62 | 74 | 90 | |
| " | 27 | 5 p.m. | cool | 64 | 64 | 88 | |
| " | 28 | 5 p.m. | " | 70 | 74 | 88 | Egg no. 7 opened—chick dead. |

| | | | | | | | |
|------|---|---|------|----|-----|----|--|
| Mar. | 1 | 8 a.m. | „ | 60 | 64 | 88 | Mound opened right to eggs; no. 10 egg still unturned. |
| „ | 1 | 4 p.m. | warm | 80 | 96 | 94 | } Mound opened by Lowan. |
| „ | 2 | 8 a.m. | „ | 76 | 78 | 90 | |
| „ | 2 | 3 p.m. | „ | 88 | 102 | 96 | |
| „ | 4 | 8 a.m. | „ | 76 | 78 | 90 | |
| „ | 4 | 3 p.m. | hot | 94 | 108 | 96 | |
| „ | 7 | 8 a.m. | warm | 68 | 74 | 90 | |
| „ | 7 | 3 p.m. | „ | 88 | 106 | 94 | |
| „ | 8 | 8 a.m. | cool | 66 | 66 | 92 | } |
| „ | 8 | 3 p.m. | „ | 86 | 96 | 94 | |
| „ | 8 | Egg no. 10 still not turned, although bird exposes it to the sun during the warm period of the day. | | | | | |

Several interesting facts appear to be indicated by the figures given above. First it would appear that the Lowan endeavours to regulate the heat of the mound by keeping the temperature somewhere around 92 degrees. She also seems to have an acute weather knowledge, sensing the approach of great heat or heavy rain. On January 1 the mound was built up and thatched, apparently to lessen damage by rain or wind and to facilitate the run off of the water. Two days later 20 points of rain fell. January 8 was the commencement of a heat wave. The temperature of the mound was 95 degrees, and in order to prevent the extreme heat penetrating to the mound, the mound was built up exceptionally high. The temperature on the surface of the mound, it will be noted, on January 13—the hottest day of the season—was 130 degrees, but in the egg chamber, due to the thick cover of the sand, the temperature was only increased to 98 degrees. On January 15 the temperature of the mound was normal, but the bird again built it up high and thatched it. Next day 150 points of rain fell. Some cool weather followed, resulting in the internal temperature falling to 88 degrees on January 22, so to remedy that the mound was opened to the sun for several succeeding days, thus raising the temperature to 92 degrees by the afternoon of January 25. And so the record goes on, which seems clearly to indicate that the Lowan has an uncanny temperature sense and opens up the mound to receive the rays of the sun whenever she thinks conditions justify such action. Whenever she thinks the weather adverse, she keeps the mound closed, and even takes steps to overcome the deleterious effects of extreme heat or heavy rain.

In the opinion of my assistant, the season under review was the worst he had experienced over a long period of years. As a rule, practically every egg in the mound hatches. The poor results of this year were undoubtedly due to the adverse conditions of an abnormal season. The lack of moisture in the early part of the season no doubt affected the eggs. Poultry keepers know that eggs must

be moistened regularly, otherwise they fail to hatch, and if the vegetation in the mound has been insufficiently moistened in the early part of the season, the death of the partly-developed chicks may thus be explained.

The information already obtained on this subject is so interesting that I hope to continue the work during other and more favourable seasons.

1939 Congress and Camp

As announced in the last issue, the Congress and Camp-out for 1939 have been fixed for Leeton, in the Murrumbidgee Irrigation Area, N.S.W., in September. Further details of the arrangements are now to hand.

This year the Congress and the Camp-out will be held in conjunction in order to give visitors full advantage of the week which is being devoted to the fixtures, and enable them to spend the whole time in camp. Members and visitors will go into camp on Saturday, September 16, and have the whole of the next day free to become acquainted with the local birds. The sittings of the Congress will begin on Monday, September 18, at the Hotel Hydro, Leeton. Members will be transported to and from the hotel by car. As the whole of the time will be spent under canvas, it will not be necessary to book accommodation at the hotel.

Given favourable weather, the camp should prove most interesting to those who have not been to the irrigation area before. A site has been selected on the banks of the Murrumbidgee, between Leeton and Narrandera, and about 12 miles by road from Leeton. There will be facilities for swimming and boating. The country in the vicinity is heavily timbered with river red gum, box, undergrowth and "suckers"; on the high ground there are pines, belar and other classes of timber. There are lagoons, sunken creeks and billabongs from the river all through the country, which form nesting places for ducks and other water birds. The timber also contains many forms of birds. This applies especially to the Murray pine forests, which support Honey-eaters, Babblers, Apostle-birds, Choughs and other birds in great abundance. Trips will be arranged to points of interest in the area.

Members going to Leeton by car will take the all-weather road from Leeton to Narrandera, and some miles out will turn down a by-road to the river. A notice will be erected at the turn-off, giving directions how to reach the camp.

A cook will be engaged, tents will be erected for those requiring them, and all members will share equally in the cost, which, on present estimates, should not exceed about £2 for the week. Present indications are that there will