

SHORT COMMUNICATIONS

FEEDING OF WHITE IBIS ON FRESHWATER MUSSELS

Some birds open hard-shelled mussels, snails, eggs and nuts by dropping or hitting them, by dropping a stone on them or by breaking them with the bill or a spike. Gulls and crows fly up and drop mussels and snails on rocks and roads; seriemas throw eggs onto a stone (Kooij and van Zon 1964); thrushes and pittas smash snails on anvils; vultures and kites drop stones on ratite eggs. Chisholm (1972, with earlier references) reviewed these and other kinds of use of tools by birds. This paper reports how the White Ibis *Threskiornis molucca*, used a hard surface when breaking open the Australian freshwater mussel *Velsia ambigua*.

During 13-15 June 1972 White Ibises were feeding along the north-eastern edge of Lake Cowal, NSW (33°31'S, 147°23'E), in two littoral zones; an in-shore zone where the water was mainly in shallow pools, and an outer zone that was mainly covered with water up to 320 mm deep and had islets of mud. Fallen trees littered both zones.

White Ibises fed mainly in the outer zone and were observed with binoculars (15 x 50) and a spotting telescope (25 x 60 and 40 x 60). Two Ibises were collected to examine what they had eaten. Samples of mussels from the mud were obtained by searching by hand inside four quadrats of one m² in each zone.

ANVILS

Anvils (the hard surfaces used frequently by the Ibis when breaking open mussels) were found from 0.1 km inland to 1 km out into the lake. They were a small islet of pebbles, a small flat rock, and trunks and limbs of fallen trees. Exposed thick roots of living trees were also used as anvils but not thick branches that were more than 0.5 m above the ground or water. None of the anvils was less than 190 mm in width. Tree stumps and wooden fence-posts were not used as anvils.

FEEDING

The Ibises waded at a steady pace through the water. They appeared to be taking mainly mussels and to detect them by probing with the bill into the mud. In shallow water, tracks that had been left by moving mussels were followed by foot-prints of Ibises. Sometimes a foraging Ibis would halt while wading through shallow water, step back and probe with its

bill where its feet were. Presumably a mussel had been found by stepping on it.

The Ibis dealt with mussels in three ways.

On seventeen occasions Ibises were seen walking to, and nine times flying to, an anvil with a mussel in the bill. At the anvil they put the mussel down and firmly placed a foot on it. The shell of the mussel was then broken by hammering with the bill, and the contents were eaten. The shell dropped off the anvil and the bird preened, before leaving the anvil to search for more mussels.

On eleven occasions Ibises were seen walking to, and on seven occasions flying to, an anvil after being seen swallowing several mussels. Some mussels were visible as lumps in the neck. At an anvil four Ibises each regurgitated three mussels, six Ibises four mussels, and one Ibis six mussels. Most of the regurgitated mussels fell off the anvil to the ground or into the water. The Ibises first tried to retrieve them by reaching down from the anvil and retrieved some in this way, but generally the bird had to hop down from the anvil to pick up a mussel, and then hop onto the anvil again to break the mussel and feed on it. Many mussels were lost in this process. Other mussels were lost at the anvils when the bill hit the mussel at such an angle that it shot away from between the toes of the foot holding it. On the three occasions when this was observed the Ibises did not retrieve the mussel.

On nine occasions Ibises collected and swallowed mussels, but did not go to the anvil or regurgitate them.

MUSSELS

V. ambigua was very common in the lake and in dams near the lake shore. Their density in the quadrats was eight per m² in the inner and twelve and a half per m² in the outer zone. No damaged mussels were found in the quadrats. The distribution of size in the two zones and at the anvils is shown in Table I. The inner zone had mainly the larger mussels and the outer zone mainly small ones. The smallest mussel found at an anvil was 38 mm long and none of the mussels in the two zones was smaller. Mussels as short as 9 mm in length have been found at Lake Cowal in the past and presumably occurred in deeper water. Lengths of shell of five mussels found in the two Ibises that were collected were between 45 and 50 mm. The stomachs

TABLE I

Sizes of mussels in two littoral zones and at anvils

Length of Shell mm	Inner Zone %	Outer Zone %	At Anvils %
30-40	0	0	1
40-50	0	26	23
50-60	40	52	64
60-70	13	16	10
70-80	25	6	1
80-90	9	0	1
90-100	13	0	0
Number of mussels	32	50	345

contained only remains of mussels, including shell fragments, and whole left or right shells. Intact mussels were found only in the oesophagus.

There is a very good positive correlation between the lengths of mussels found in the outer zone and at the anvils ($r = 0.97$). The correlation between the lengths found in the inner zone and at the anvils was less good ($r = 0.68$). These correlations were significant at the 99 per cent and 95 per cent levels respectively according to Student's *t*-test. The correlations confirm that Ibises were mainly feeding in the outer zone and indicate that they were not selecting mussels of particular sizes.

An analysis of the mussels below some anvils (nine ashore and nine in the inner zone) showed that the ratio of damaged to intact mussels was about 12 to 1. Table II shows an analysis of the way in which mussels had been damaged.

This is the first time that the use of an anvil and the use of a foot in holding food have been recorded in an Ibis. It is similar to the way in which the Swamphen *Porphyrio p. melanotus* holds a hard unripe fruit of the Moreton Bay fig in its foot on a hard substrate to chop it up with the bill (Rowley 1968). The behaviour of the Ibis contrasts with the way the White-winged Chough *Corcorax melanorhamphus* opens mussels by either holding a mussel in the bill and hitting it against a hard object, an anvil (Hobbs 1971), or hammering a mussel with

TABLE II

Incidence of various kinds of damage to mussels at anvils

Shell broken	
Left	130
Right	173
Both	57
Total	360
Area broken	
Ventral margin	249
Ventral and anterior margins	38
Ventral and posterior	26
Anterior margin	15
Anterior and posterior margins	13
Posterior margin	7
Ventral margin and near umbo	7
Ventral, anterior and posterior margins	3
Area near umbos	2
Total	360

the bill or with a shell fragment, a spike held in the bill (McDonald 1970).

It is remarkable that the Ibis has evolved the use of an anvil for feeding on mussels, which are only a minor item in its diet (Carrick 1959), even though they may be seasonally very important (Vestjens unpublished).

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WHITE IBIS EATS SNAKE

Pitt Town Common consists of 46 hectares of seasonal fresh swamps, (Goodrick 1970, CSIRO Tech. Mem. 5) 6.5 km east of Windsor, NSW. In the centre of the swamp a farm dam has been constructed to provide water for stock when the swamp dries out. When flooded, the banks of the dam form an island on which many waterbirds roost.

On 25 July 1972 at 14:00 roosting on the island was a fairly typical collection of waterbirds that feed in the swamp, including a Pelican *Pelecanus conspicillatus*, four Royal Spoonbills *Platalea regia*, eight Yellow-billed Spoonbills *P. flavipes* and eight White Ibis *Threskiornis molucca*, some of which were feeding round the edge of the island. My attention was drawn to the island by a commotion among the birds roosting there and I observed the Pelican chasing one of the White Ibis.

Using 7 x 50 binoculars from a distance of 90 metres, I had a perfect view of the Pelican and most of the other White Ibis pursuing another White Ibis

which held in its bill a small brown-coloured snake. The snake was light-brown above and whitish below, approximately 45 cm in length and resembled a Brown Snake *Pseudonaja textilis*. The Ibis had apparently captured the snake while probing round the banks of the island; the snake wriggled profusely while being held. Eventually the Ibis was sufficiently far in front of its pursuers to stop and swallow the still struggling snake.

The food of the White Ibis consists of molluscs, insects, crustacea, amphibia and occasionally reptiles and mammals (Frith 1969, Birds of the Australian High Country: 78) although no limit is given for the size of the reptiles. In the 202 stomach contents of White Ibis examined by Carrick (1959, CSIRO Wildlife Res. 4: 69-92) the remains of only one snake was found. I know of no published observations relating to a White Ibis eating a snake. Judged by the reaction of the other ibis and the Pelican, snakes are readily eaten by these birds.

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NOTICE

The Annual Congress of the Union will be held in Port Moresby, TPNG, from 12 to 14 October. It will be followed by a Field-outing at Bulolo from 15 to 22 October. Accommodation has been booked at both places for thirty people. The programme will be published later.