palmettos (*Sabal palmetto*) while on the wing (Cruick-shank, Auk 67:237, 1950).

At 08:15 on 25 November 1978 I noted about 65 gulls in the vicinity of six date palms in an abandoned yard about 3.2 km north of Calexico, Imperial County, California. About 45 gulls were eating dates scattered on the ground beneath the palms while as many as 20 gulls—both adults and immatures—were taking the dates off the fruit stalks (Fig. 1). In the tree, birds fed in three ways. Some gulls alighted on the stalks and slowly walked along them to reach the dates. Others alighted on the leaf scars of the trunk and reached out to remove dates. Several gulls picked dates off the stalks while on the wing. No other species of gull was present during the observation period.

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OYSTER PREDATION BY THE BLACK OYSTERCATCHER IN BRITISH COLUMBIA

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Some authors (Jewett et al. 1953, Guiguet 1955) have claimed that Black Oystercatchers *Haematopus bachmani* do not, in fact, eat oysters, but there is one recent report of the event (Campbell 1966). Campbell's (1966) description of the technique used by the Black Oystercatcher to open Pacific oysters (*Crassostrea gigas*) is similar to that described for the European Oystercatcher (*H. ostralegus*) to open native oysters (*Ostrea edulis*; Dewar 1922) and that for the American Oystercatcher (*H. palliatus*) to open Atlantic oysters (*C. virginica*; Tomkins 1947). This technique involves forcing the bill between the gaping valves of submerged oysters and prying them apart. We observed Black Oystercatchers using a different method of opening Pacific oysters. The purpose of our study was to determine the size of Pacific oysters selected and the method used by the Black Oystercatcher to open them.

STUDY AREA AND METHODS

We watched two breeding pairs of Black Oystercatchers eating Pacific oysters between 28 April and 11 July 1978 on Mitlenatch Island, British Columbia (49°57′N, 125°W). The birds nested beside an approximately 1,000 m² oysterbed which was on a mud-gravel and sand-gravel substrate and which had a maximum oyster density of about 80/m² during ebbing and flooding tides.

We observed the birds through a spotting scope. We measured the time it took an oystercatcher's bill to penetrate a shell and begin removing the meat (opening time), and to remove and eat the oyster body (eat-ing time). Later, we collected these oyster shells. We divided each valve into quadrants to determine where the shells were hammered. Holes on dividing lines were recorded in the quadrant where most of the hole lay. The volume of soft body parts of 57 oysters was determined by water displacement in a calibrated cylinder. Shell lengths in the oyster population were determined by measuring all of the live oysters found along two randomly chosen straight line transects through the oysterbed.

RESULTS

When foraging, a Black Oystercatcher first tapped several oysters with its bill. After finding an apparently suitable oyster, the bird chipped a small hole through the valve, inserted its bill, and severed or paralyzed the adductor muscle. Some oysters that were hammered but abandoned had undamaged adductor muscles which were difficult for the oystercatcher to reach, owing to the irregularity of the shell's shape. Once the valves were parted the soft body of the oyster was extracted and occasionally washed before being eaten. A few oysters (6 out of 62) were eaten through the hammered hole, presumably because the bird could not part the valves. These oysters were not significantly smaller than the abandoned ones. A maximum of nine oysters was eaten by one bird in one hour.

Black Oystercatchers opened more unattached oysters (48 out of 59) than those that were attached to immovable rocks (2) or to other oysters (9). The majority of oysters (47 out of 62) were hammered and eaten out of water. We noted no preference for oysters that had been recently uncovered by an ebbing tide.

The mean diameter of 55 hammered holes was 1.7 cm. The shell of the oyster was penetrated in about 10 s. Eleven of the 60 hammered holes were made at the lip of the oyster valve while the remaining 49 did not reach the shell margin. Figure 1 shows the locations of 60 hammered holes in the right and left valves. The slight preference for the right valve (37 versus 23) resulted from the tendency of most oysters on Mitlenatch Island to lie on their left valves, as the oystercatchers always pecked at the upward-facing valve. The adduc-

TABLE 1. Eating and opening times for small (S), medium (M), and large (L) oysters by Black Oystercatchers.

	Opening time (s)			Eating time (s)[a]		
	S[b]	M	L	S	M	L
Mean	92.8	118.7	130.3	85.1	87.1	170.7
Range	19.2–388.0	47.1–270.1	73.0–173.0	31.5–125.0	35.2–190.8	73.2–375.0
S.D.	94.8	70.1	51.4	41.1	42.4	134.8
N	13	10	5	12	10	5

[a] A significant difference exists between S and L, and M and L (*t*-test, $P < 0.05$).
[b] The lengths of small oysters were 9.0–10.9 cm, medium 11.0–12.9 cm, and large ≥13.0 cm.

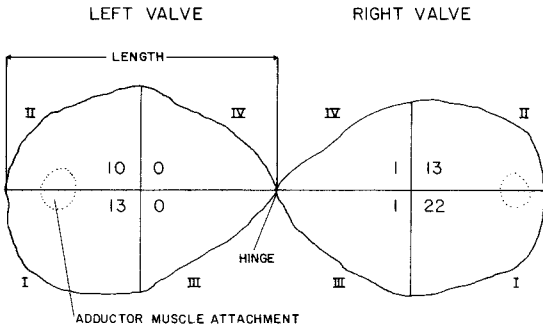LEFT VALVE   RIGHT VALVE

FIGURE 1. Outside views of the left and right valves of a Pacific oyster. Each valve is divided into quadrants (I–IV). The number of holes hammered by Black Oystercatchers in 60 oyster shells are shown.

FIGURE 3. Relationship between shell length and soft body volume of 57 Pacific oysters.

tor muscle was located in quadrants I or II in all hammered oysters and this may explain why most of the holes occurred there, although the shell is thinner farthest from the hinge. European Oystercatchers hammer edible mussels (*Mytilus edulis*) at the weakest part of the shell (Norton-Griffiths 1967).

There were no significant differences in opening times for oysters of different shell lengths (Table 1). The large range in opening times resulted from the variable accessibility of the adductor muscle. Oystercatchers took significantly longer to eat large oysters than to eat small or medium-sized individuals (Table 1).

The mean shell length of 304 randomly selected oysters was identical to that of 57 oysters hammered by the oystercatchers (Fig. 2).

Although the shape of the oyster shells on Mitlenatch Island was highly variable, the volume of soft body meat was approximately directly proportional to shell length (Fig. 3).

DISCUSSION

Although the oystercatchers required, on average, 31.6% (301 vs. 205.8 s) more time to open and eat a large oyster than a medium oyster, they gained only 24.6% more volume of oyster meat (from Fig. 3). Medium-sized oysters took 13.6% (205.8 vs. 177.9 s) more
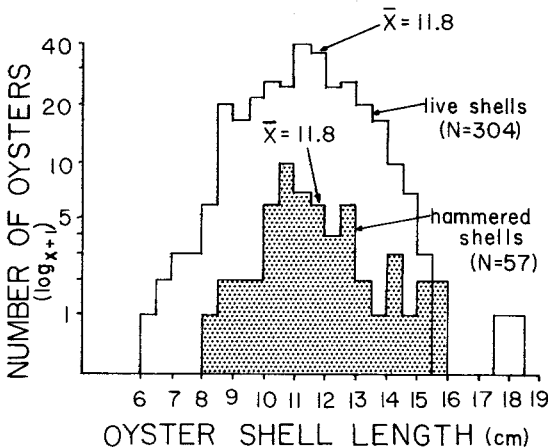

FIGURE 2. Frequency distribution of 304 randomly sampled live Pacific oyster shell lengths and 57 Pacific oyster shell lengths hammered by Black Oystercatchers.
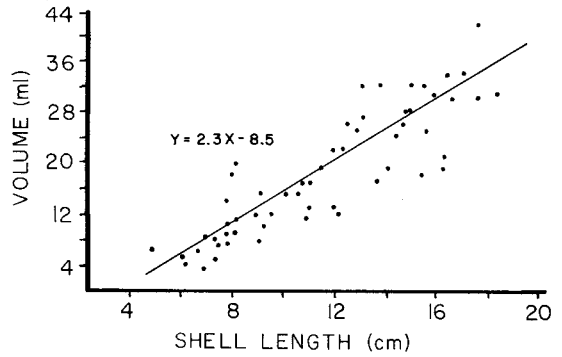
time to open than small oysters, on average, but the oystercatchers gained 20.6% in volume of oyster meat (from Fig. 3). It is puzzling why the birds did not prefer medium-sized oysters when these were the most profitable. Perhaps the oystercatchers were unable to distinguish small differences in profitability between the various sizes of oysters, particularly when similar-sized oysters showed such wide variation in volume (Fig. 3).

Why do Black Oystercatchers on Mitlenatch Island hammer oysters instead of "stabbing" them as reported for the American Oystercatcher eating Atlantic oysters (Tomkins 1947)? The oysters on Mitlenatch do not gape unless they are covered by about 10 cm of water. Because most of these oysters lie on their sides, a Black Oystercatcher would have to submerge its head to push its bill between the valves. Oysters eaten by the American Oystercatcher occur in small clumps, with individual oysters standing on end (Tomkins 1947).

Pacific oysters were introduced into British Columbia coastal waters in 1912 or 1913 but did not become widespread in Georgia Strait until the summer of 1958 (Quayle 1969). Local residents claim that oysters were first seen on Mitlenatch Island in the 1950s. Campbell (1966) mentioned the first occurrence of Black Oystercatcher predation on Mitlenatch in 1966. Therefore, the oystercatchers learned to open oysters on the island in at most eight years. We cannot explain why the behavior has been seen, to date, only on Mitlenatch Island.

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NEST SITE SELECTION IN EASTERN BLUEBIRDS

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Factors affecting the choice of a suitable nesting site by birds are under strong selective pressures that favor individuals who choose sites where the chance of rearing a brood is greatest (Smith 1974, Gibo et al. 1976). Nests of cavity-nesting species have a greater likelihood of success than those of open-nesting species, but success rates of cavity-nesters may differ between natural (tree hole) and artificial (nest box) sites (Lack 1966). Thus, natural selection may favor any mechanism such as imprinting or learned behavior that leads to a preference for the natal type of nest site by birds successfully reared in those site-types.

The Eastern Bluebird (*Sialia sialis*) nests in tree cavities (Pinkowski 1976), nest boxes (Kibler 1969), crevices (Laskey 1971), and rarely in open, exposed situations (Sprunt 1946, Allaire 1976). Male bluebirds typically display at several nest sites, one of which is selected by the female for egg-laying (Krieg 1971); thus both adults of a nesting pair are involved in site selection and a predisposition toward the natal site-type may exist in males, females, or both. In this note I examine data obtained on a nesting population of bluebirds to see if individuals that were reared in artificial cavities tend to prefer these when selecting their own nesting sites.

The study area in southeastern Michigan has been described in detail elsewhere (Pinkowski 1976, 1977). Approximately 50 nest boxes were available in 1968–1977, and bluebirds nested in these as well as natural tree cavities. All birds reared in the study area were color-banded and their natal site-types were known. Other bluebirds entered the study area as adults, and most of these birds were probably raised in natural cavities because: (1) bluebird nests in natural cavities were frequently seen in areas adjacent to the study area; and (2) there were no extensive nest box projects within approximately 150 km of the study area, this distance being greater than that separating breeding and hatching locations of most bluebirds (Pinkowski 1971). In the analysis I consider each member of a nesting pair as a separate individual regardless of whether one or both birds were raised in the same type of site.

Of 324 bluebird nests in the study area, 295 (91.0%) were in artificial sites. Seventy-eight of 648 nesting birds, including 38 males and 40 females, were reared in artificial sites in the study area, and 68 (87.2%) of these birds nested in artificial sites. Likewise, 522 of 570 (91.6%) birds that were not reared in the study area

nested in artificial sites. Thus, the proportion of nests in artificial sites was not greater for birds reared in those site-types than it was for other birds, most of which were evidently reared in natural sites. Although slightly more males that were reared in artificial cavities nested in artificial cavities than was true of females (94.7% vs. 80.0%), a *G*-test for three-way tables (Sokal and Rohlf 1969:601–607) revealed that type of site used, known or presumed natal site-type, and sex were independent ($G = 6.3$, df = 4, $P > 0.1$).

For all birds of known age nesting in the study area, yearlings were more likely to use natural cavities than were adults (Table 1). Bluebirds nesting in the study area apparently preferred nest boxes to natural cavities (Pinkowski 1976), and this preference may explain the disproportionate number of natural sites used by yearlings. First-year males and females began nesting later than older birds (Pinkowski 1977), and possibly the yearlings were relegated to the less preferred, natural sites.

Individual bluebirds nested in both natural and artificial sites during the same or different seasons. One male nested three times in two different nest boxes in 1970 but twice in the same natural cavity in 1971. A female who hatched in a nest box in 1973 nested in a natural cavity in 1974 and a nest box in 1975. Another female who was reared in a nest box in 1974 used a natural cavity for her first nest in 1975 and a nest box for her second nest that year. During 1976 one of two female broodmates reared in a nest box nested for the first time in a natural cavity, whereas the other used a nest box; this same pattern was also noted that year for two male broodmates. Finally, a female who hatched in a nest box in 1976 nested in a natural cavity in 1977 after her first nest (which was in a nest box) failed. Altogether, six of eight site-type changes that occurred in the same nesting season followed an unsuccessful nest; this is not surprising in view of the strong dependency of site tenacity on nesting success in bluebirds (Pinkowski 1977).

The lack of a relationship between natal site-type and nest sites selected by bluebirds is similar to the findings of Cink (1976), who found no evidence for

TABLE 1. Relationship between age of nesting Eastern Bluebirds and type of site used for nesting.[a]

Age	Natural site		Artificial site	
	No.	Percent	No.	Percent
Adult	5	4.2	112	95.7
Yearling	9	17.3	43	82.7

[a] Based on birds of known age only; type of site used is dependent on age ($G = 5.9$, df = 1, $P < 0.05$ using Yates' correction for continuity).