

I do not believe that inland gulls flew to the coast to feed, for three reasons. (1) I noted the directions of 39 departures or arrivals of gulls leaving or entering three nesting territories on 19 different days between 19 May and 26 July 1974. Only 7.7% of those arrivals or departures were in the quadrant closest to the sea (southwest), 48.8% were in the quadrant closest to the Kashunuk River (southeast), and the remainder were divided almost equally between the other two quadrants (northwest and southeast). (2) Furthermore, inland gulls did not exhibit the coastal gulls' tide-related activity pattern. Gulls in large numbers flew over the river channel in Kokechik Bay at low tide, surface plunging for fish, and then walked ahead of the rising water's edge to pick up invertebrates and *Fucus* from the intertidal zone mud. At high tide, Glaucous Gulls were nearly absent from the bay. Such a pattern was not evident among the isolated pairs nesting inland at the Kashunuk River in 1974, where the numbers of inland gulls passing observation points on the Kashunuk River within 2 h of low tide ( $\bar{x}$  = 7.71 gulls per session,  $N$  = 14 two-h observation sessions) were not different from numbers of gulls passing at other times ( $\bar{x}$  = 9.60 gulls per session,  $N$  = 20; Mann-Whitney  $U$ -test,  $z$  = -0.94,  $P$  > 0.05). (3) Finally, the species of invertebrates eaten by inland gulls (isopods and small clams) were not the same as those eaten by colonial gulls nesting near the mouth of the Kashunuk River. On one visit to the colonies in early August 1974, I noticed that the accumulated pellets and food remains were nearly all of a distinctive clam species different from those consumed by inland gulls; remains of other invertebrates, fish, etc., were relatively scarce. Isopods, clams and *Eleginus* all occur within the inland study area, which is close enough to the coast for the tidal flux to reverse the Kashunuk's direction of flow routinely.

The bulk of this paper is part of a Ph.D. dissertation, supervised by C. M. Kirkpatrick and submitted to Purdue University in May 1976. The research was sponsored by the National Wildlife Federation, the American Petroleum Institute, the Frank M. Chapman Memorial Fund of the American Museum of Natural History, and the Dickinson College Research and Development Fund. I received help in the field from Calvin J. Lensink, Jerry L. Hout, Christian P. Dau, Ann H. Strang, and Gary L. Strang.—CARL STRANG, *Biology Dept., Dickinson Co., Carlisle, Pennsylvania 17013*. (Current address: *Forest Preserve District of DuPage County, Willowbrook Wildlife Haven, 525 S. Park Blvd., Glen Ellyn, Illinois 60137*.) Accepted 20 Nov. 1981.

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**Vocal behavior of the Northern Oriole.**—The vocal behavior of several species of Icteridae has been described, e.g., Red-winged Blackbird (*Agelaius phoeniceus*) (Orians and Christman, Univ. Calif. Publ. Zool. 84, 1968; Smith et al., *Condor* 82:259-266, 1980), Brown-headed Cowbird (*Molothrus ater*) (West et al., *J. Comp. and Physiol. Psychol.* 93:124-133, 1979), Common Grackle (*Quiscalus quiscula*) (Ficken, *Auk* 80:52-72, 1963; Wiley, *Anim. Behav.* 24:570-584, 1976), Western Meadowlark (*Sturnella neglecta*) (Fish et al., *Am. Zool.* 2:409, 1962; Falls and Krebs, *Can. J. Zool.* 53:1165-1178, 1975), and Eastern Meadowlark (*S. magna*) (Lanyon, *Bull. Am. Mus. Nat. Hist.* 134:1-26, 1966), but little information on vocalizations exists for *Icterus* spp. The purpose of this note is to describe the vocalizations of male Northern (Baltimore) Orioles (*Icterus galbula galbula*), and particularly the song variation found in one locality in Michigan.

**Methods.**—This study was conducted in an area of approximately 140 ha in Kensington Metropark, located in Oakland County in southeastern Michigan, from 9 May-25 June 1980.

TABLE 1  
LENGTH AND FREQUENCY CHARACTERISTICS OF SONGS OF MALE ORIOLES

Male	No. songs measured	$\bar{x}$ song length (sec)	$\bar{x}$ low frequency (kHz)	$\bar{x}$ high frequency (kHz)	$\bar{x}$ frequency range (kHz)
1	80	1.27 $\pm$ 0.280	1.8 $\pm$ 0.12	3.7 $\pm$ 0.21	1.8 $\pm$ 0.21
2	18	1.19 $\pm$ 0.203	1.9 $\pm$ 0.03	3.7 $\pm$ 0.10	1.8 $\pm$ 0.12
4	20	1.25 $\pm$ 0.335	1.9 $\pm$ 0.11	3.8 $\pm$ 0.30	2.0 $\pm$ 0.35
5	20	0.98 $\pm$ 0.312	1.5 $\pm$ 0.16	3.6 $\pm$ 0.14	2.1 $\pm$ 0.22
13	139	1.50 $\pm$ 0.458	1.9 $\pm$ 0.17	4.3 $\pm$ 0.46	2.4 $\pm$ 0.47
15	17	1.16 $\pm$ 0.078	1.8 $\pm$ 0.05	3.9 $\pm$ 0.08	2.0 $\pm$ 0.10
16	16	1.19 $\pm$ 0.373	1.8 $\pm$ 0.08	3.8 $\pm$ 0.61	2.0 $\pm$ 0.66
18	20	2.02 $\pm$ 0.271	1.6 $\pm$ 0.11	3.6 $\pm$ 0.19	2.0 $\pm$ 0.25
19	11	2.47 $\pm$ 0.502	1.9 $\pm$ 0.14	4.2 $\pm$ 0.51	2.4 $\pm$ 0.60
21	20	0.93 $\pm$ 0.319	1.7 $\pm$ 0.24	3.7 $\pm$ 0.07	2.0 $\pm$ 0.28
22	18	1.03 $\pm$ 0.310	2.0 $\pm$ 0.04	4.0 $\pm$ 0.31	2.0 $\pm$ 0.30
25	14	1.77 $\pm$ 0.589	1.5 $\pm$ 0.08	3.9 $\pm$ 0.33	2.3 $\pm$ 0.48
27	14	1.43 $\pm$ 0.428	1.9 $\pm$ 0.09	3.4 $\pm$ 0.13	1.5 $\pm$ 0.14
30	20	1.50 $\pm$ 0.295	2.0 $\pm$ 0.08	3.9 $\pm$ 0.41	1.9 $\pm$ 0.43
Total	427	—	—	—	—

Observations and recordings were made from 05:00–09:00 EST. Oriole vocalizations were recorded at 9.5 cm/sec with a Uher 4000 Report IC tape recorder equipped with a Uher 517 microphone and a 61-cm aluminum parabolic reflector. Wide band sonagrams for song analysis were prepared using a Kay Elemetrics Sona-Graph, model 6061B, connected to a Tandberg series 15 tape recorder.

To familiarize myself with the behavior of orioles, two males (no. 1 and no. 13) were observed and recorded regularly throughout the breeding season as defined above. Male 1 was observed for 25 h over 19 days and male 13 was observed for 90 h over 20 days. Songs of other males were also recorded. Orioles were not banded but most males were readily recognizable as individuals by their characteristic songs and commonly used song-posts.

Males arrived on the study area during the second week of May and established territories that were usually contiguous with those of other orioles. Females arrived on the territories 2–14 days after the males. Little courtship could be observed because of the density of the foliage. Females built nests after searching for nesting material, generally within the confines of the territory. Eggs were laid from late May through early June. Males made frequent trips to the nest during the incubation and nestling stages of the breeding cycle; both males and females fed the nestlings. The young fledged within 2 weeks of hatching. For the purposes of data analysis, the oriole breeding season was divided into four periods: (1) before the females arrived on the males' territories, (2) after female arrival, but before incubation, (3) incubation, and (4) the nestling period.

Song length, song frequencies, and song figure characteristics were all measured directly from sonagrams. Song figures were transferred to tracing paper and were tested against one another for similarities and differences by attempting superimposition. A song figure was arbitrarily defined as a continuous trace on a sonagram, or a series of traces separated by no more than 20 msec. Two figures were considered to be identical when they were superimposable on tracing paper. Slight deviations in duration and/or frequency were tolerated to

TABLE 2  
SONG FIGURE CHARACTERISTICS AND SONG PATTERN REPERTOIRE SIZES OF 14 MALE ORIOLES

Male	No. songs measured	$\bar{x}$ No. figures/song	$\bar{x}$ No. figure types/song	No. figure types in figure repertoire	No. different song patterns sung
1	80	8.5 ± 0.91	3.3 ± 0.51	5	8 <sup>b</sup>
2 <sup>a</sup>	18	7.6 ± 1.22	5.7 ± 0.69	6	3
4	20	6.5 ± 1.10	6.2 ± 0.67	8	3
5	20	5.7 ± 1.10	5.7 ± 1.10	9	5
13	139	11.2 ± 3.75	7.3 ± 1.76	24	12 <sup>b</sup>
15	17	7.0 ± 0.58	3.0 ± 0.00	4	2
16	16	10.7 ± 3.98	4.3 ± 2.25	7	4
18	20	12.4 ± 1.60	9.0 ± 1.10	15	9
19	11	13.4 ± 5.07	5.2 ± 0.72	10	6
21 <sup>a</sup>	20	5.4 ± 1.10	5.4 ± 1.10	7	3
22	18	4.9 ± 1.23	4.9 ± 1.23	11	8
25	14	9.0 ± 2.57	7.4 ± 2.10	16	12
27 <sup>a</sup>	14	7.4 ± 2.82	6.9 ± 1.46	24	10
30 <sup>a</sup>	20	8.6 ± 1.70	3.4 ± 0.94	4	6
Total	427	—	—	150	—

<sup>a</sup> Indicates a male that sang songs identical to one of its neighbors.

<sup>b</sup> Twenty songs used to make this measurement in order to standardize the number of song patterns found in 20 (or less, if few songs recorded) consecutive songs.

approximately ±15%, as there is at least this amount of variation within any one male's recorded songs; this variation is due to both the individual male and to recording artifacts, e.g., the changing distance of the animal from the microphone (Richards and Wiley, *Am. Nat.* 115:381-399, 1980).

A song figure was considered to be part of a song if it was separated from the other song figures by no more than 500 msec. Often males attached a call to their song, as a prefix; these calls were also given in non-song contexts. If the call was not separated from the main body of the song by more than 500 msec, it was considered to be part of the song, and was included in all song measurements.

Fourteen of 18 male orioles recorded provided sufficient numbers of songs for analysis (at least 10 songs/male of good acoustic quality, as judged by clarity and completeness of sonagrams). The remaining four males are included here, even though only a few songs were recorded for each, because each sang songs identical to one of the other 14 (see below). Sonagrams of 427 songs were used to measure song characteristics of the 14 male orioles. For 12 of these males, sonagrams of 20 consecutive songs/male, or less if fewer songs were recorded, were prepared (Table 1). Males 1 and 13, for which more songs were recorded, had five groups of 20 consecutive songs and eight groups of 20 consecutive songs analyzed, respectively. Additional sonagrams were made to examine the sequences of songs sung by males 1 and 13.

Mean song rates were determined for males 1 and 13 by averaging their song rates over several 10-min taped periods. Intervals between songs were measured directly from tape recordings, using a stopwatch.

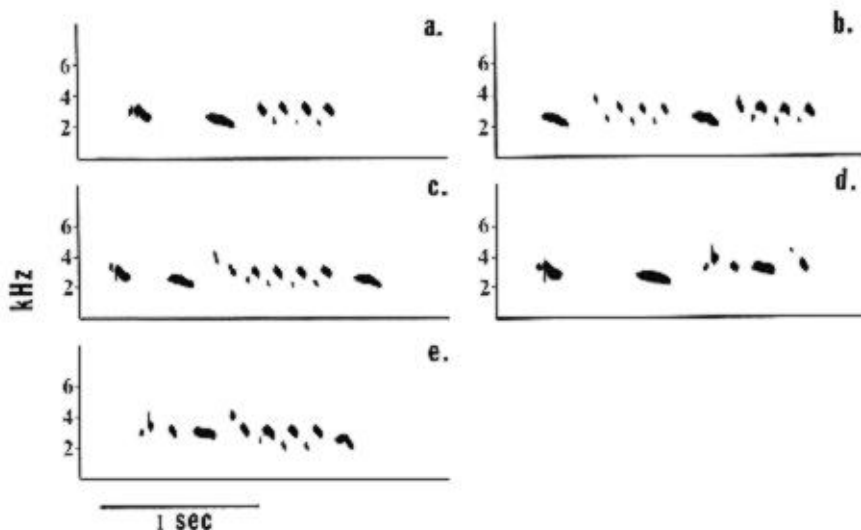


FIG. 1. Five of the song patterns sung by male 13. The last seven song figures in (a) constitute a characteristic grouping for male 13; the song patterns illustrated here differ mainly in the arrangement of this grouping, e.g., in (b) there are two of these groupings, in (c) the grouping is expanded (to nine figures) and the entire grouping is absent from (d).

*Results.*—Male oriole songs are composed of a series of short, discrete song figures, ranging in number from 4–20 ( $\bar{x} = 8.5 \pm 2.6$ ,  $N = 427$  songs). Each male sang several variations of his song, here called song patterns, which were composed of varying numbers and sequential combinations of figures. For example, the last seven song figures in Fig. 1a constitute a characteristic grouping for male 13; in the subsequent three sonograms (Fig. 1b–d), this group of figures is modified or absent. For most males, the majority of their song patterns were quite similar and often only the addition, subtraction, or positional change of a single figure distinguished one song pattern from another. Based on 20 consecutive song samples, individual males possessed from 2–12 song patterns ( $\bar{x} = 6.5 \pm 3.4$ ,  $N = 14$  males, Table 2).

Male 1, with a repertoire of five figures (song figure repertoire = the total number of different figures found in all analyzed songs of a given male, ranging from 4–24,  $\bar{x} = 10.7 \pm 6.7$ , in 14 males, Table 2), sang nine different song patterns during one period of 100 consecutive songs. Male 13, with 24 song figures in its repertoire, sang 42 different song patterns during a similar period (Fig. 2). There was a positive correlation ( $r = 0.80$ ,  $P < 0.01$ ,  $N = 14$ ) between the figure repertoire size and the number of song patterns sung by each male.

Ten of the 18 males sang unique sets of song patterns (e.g., Fig. 3a–g). Four pairs of males possessed at least some song patterns that were identical. It was not possible to record enough songs for each of these pairs to determine if complete song pattern repertoires were identical, but they did appear to possess identical figure repertoires. Males with identical songs had adjacent territories; however, eight of the remaining 10 males (four pairs) occupied adjacent territories and did not sing identical songs.

Song figures varied in morphology (many quite simple, others complex), frequency range

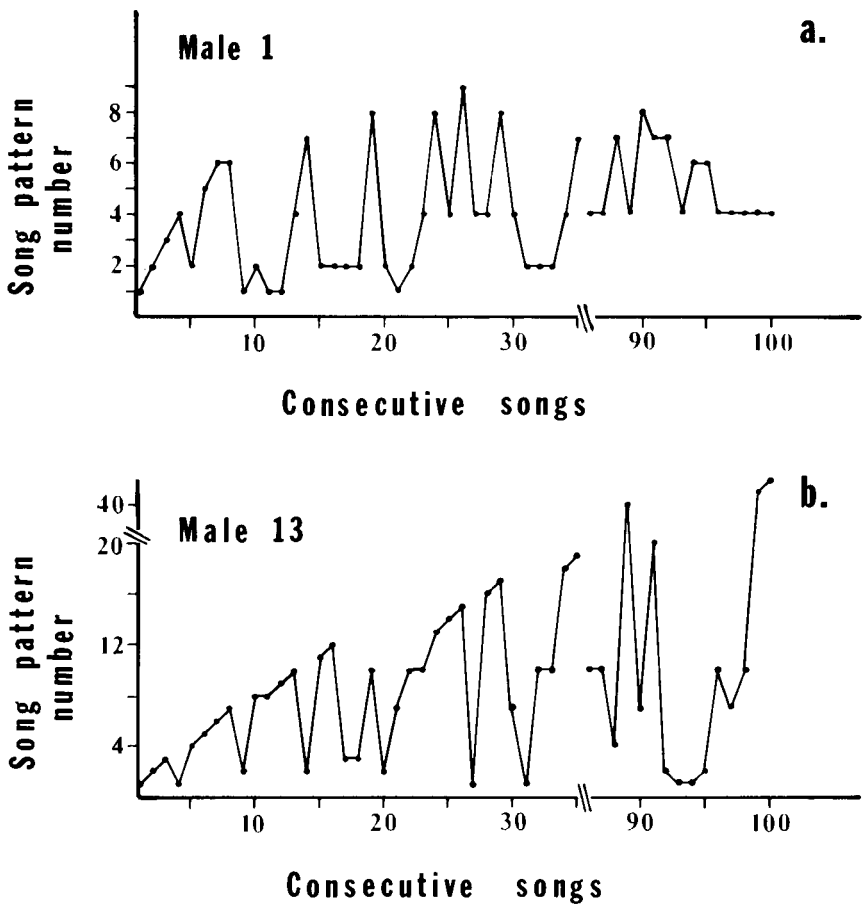


FIG. 2. (a) Song pattern sequence used by male 1 during a singing period of 100 consecutive songs; (b) song pattern sequence used by male 13 during a singing period of 100 consecutive songs. Note: different song patterns were consecutively numbered, starting with one, for each male; hence, song pattern two for male 1, for example, is not the same as song pattern two for male 13.

(some figures almost pure tones, others modulated in frequency over the entire bandwidth of the song) and duration (from 30–230 msec,  $\bar{x} = 107 \pm 52$  msec). One hundred fifty different song figures were distinguished from the 427 songs of the 14 males. Of these, only three figures were found in the figure repertoires of more than one male and in each of these cases only two males shared the same figure. Adding the figure repertoires of the four identical-song males, bringing the sample size to 18 males, a total of 44 song figures, or 29% of the 150 known figures, were shared by at least two males.

All male orioles used similar frequency spectra in their songs (Table 1). The frequency

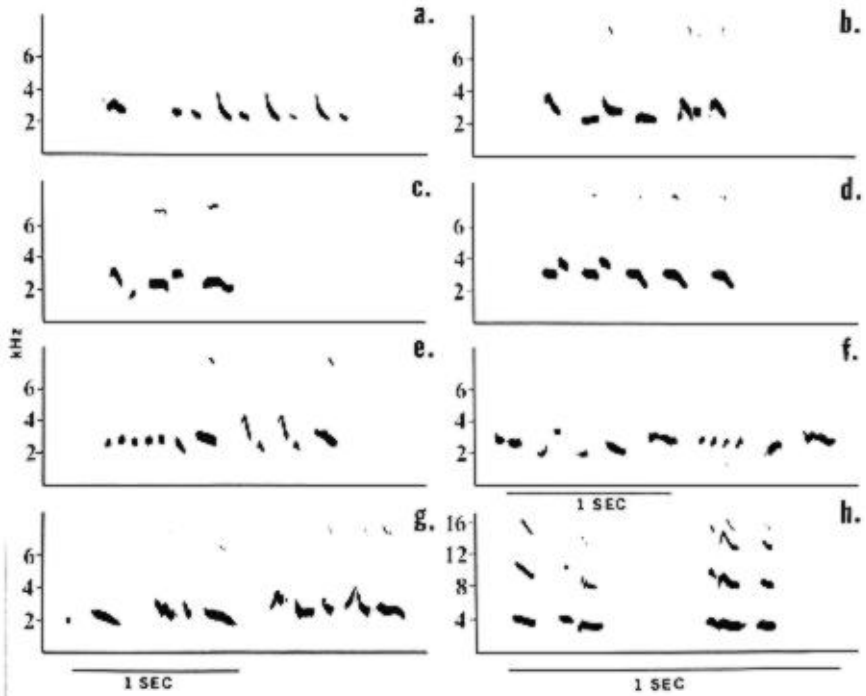


FIG. 3. (a-g) Song patterns sung by seven male orioles from the same population, illustrating differences between males. Only one song pattern for each male is shown. (h) Sonagram of a song illustrating the harmonic structure of male oriole song.

ranges of a male's song patterns were usually the same, as many of the song patterns consisted of the same song figures in different orders. The mean frequency range for all 427 songs analyzed was 2.1 kHz. The mean low frequency was 1.8 kHz; the mean high frequency was 3.9 kHz. Harmonics were found to be characteristic of many of the orioles' songs (Fig. 3h).

Oriole songs had a mean duration of approximately 1.4 sec. Certain males sang relatively short songs, consisting of from four to six figures; mean song durations for these males were less than 1 sec (Table 1). Other males sang songs that averaged over 2 sec in duration and routinely consisted of 12-14 figures.

Singing was not organized into "bouts" as described for various other species such as Cardinals (*Cardinalis cardinalis*) (Lemon, Behaviour 32:158-177, 1968) and Indigo Buntings (*Passerina cyanea*) (Thompson, Z. Tierpsychol. 31:39-59, 1972). Before the females arrived on territories, the males sang almost incessantly during the morning hours, at times singing series of songs separated by intervals as brief as 4 sec (e.g., male 13, Fig. 4a). After pairing of males and females occurred, mean intervals between songs increased (Fig. 4b). In the case of males 1 and 13, song rates progressively decreased during the remainder of the breeding season (Fig. 5).

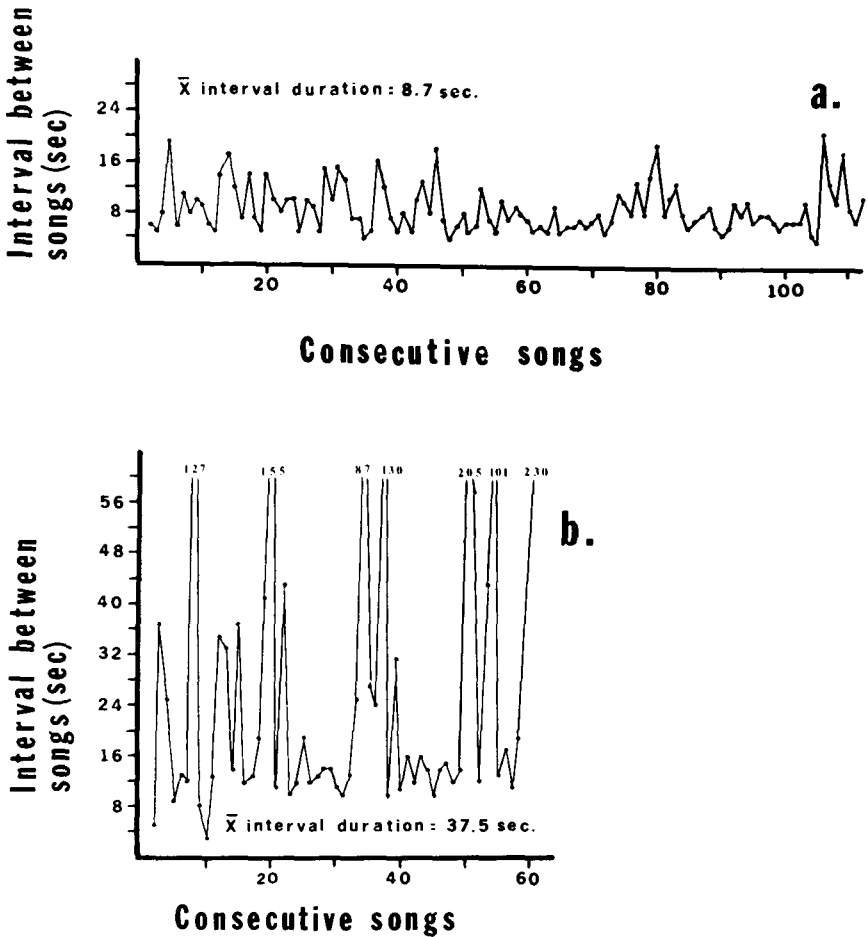


FIG. 4. (a) Intervals between songs for male 13 before the arrival of a female on his territory; (b) intervals between songs for male 13 after female arrival.

Sequences of song patterns sung by male orioles did not follow any regular pattern (Fig. 2a,b), as has been reported for Fox Sparrows (*Passerella iliaca*) (Martin, *Condor* 79:209–221, 1977) and several species of wrens (Kroodsma, *Am. Nat.* 111:995–1008, 1977), nor did the orioles sing each of their song patterns before repeating one, as in Western Meadowlarks (Falls and Krebs, *Can. J. Zool.* 53:1165–1178, 1975). Instead, a less ordered arrangement of consecutive song patterns exists; however, at least in the one case which lends itself to statistical analysis, the arrangement of consecutive songs is not random (Kolmogorov-Smirnov test for goodness-of-fit for the 99 song pattern transitions from male 1, Fig. 2a, Table 3;  $P < 0.05$ ). Some song patterns were uttered more frequently than others (e.g., male 1,

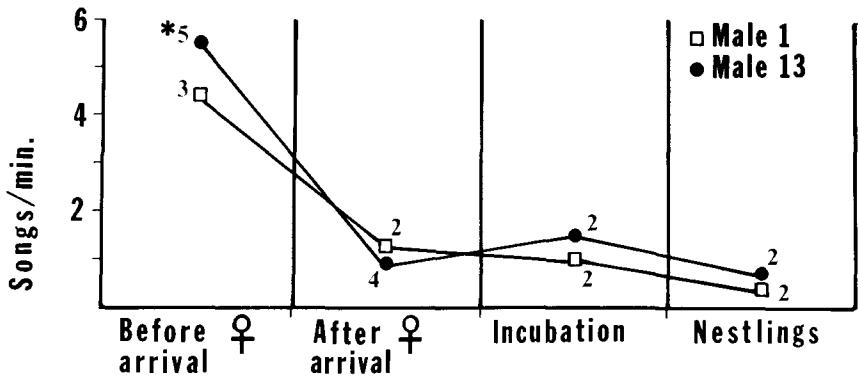


FIG. 5. Song rates for two male orioles during the course of the breeding season. \*Note: These numbers refer to the number of 10-min periods used to compute the song rate data points.

patterns 2, 4, Fig. 2a), and some patterns were repeated consecutively (e.g., pattern 4, Fig. 2a). The average intervals between consecutive similar song patterns ( $14 \pm 15.1$  sec,  $N = 41$ ) and consecutive different song patterns ( $14 \pm 11.6$  sec,  $N = 157$ ) for males 1 and 13 (data pooled from Fig. 2) were alike ( $P > 0.05$ ,  $t$ -test of the equality of two means).

Males each possessed several different short calls (Fig. 6a-e) and a "chatter" call of variable length. The short calls varied extensively in duration (23-227 msec), but all used the same general frequency range (1.5-3.7 kHz). As much of the males' behavior was obscured by foliage, and as these calls were often difficult to distinguish in the field, the assignment of specific functions to these short calls on a contextual basis was impossible. Short calls were usually interspersed between songs and frequently incorporated into the

TABLE 3  
SONG PATTERN TRANSITIONS FOR 100 CONSECUTIVE SONGS FROM MALE 1<sup>a</sup>

Preceding song pattern	Following song pattern									Total no. songs
	1	2	3	4	5	6	7	8	9	
1	1	3	0	1	0	1	0	0	0	6
2	2	5	1	2	1	1	4	1	0	17
3	0	0	0	1	0	0	0	0	0	1
4	1	3	0	24	0	6	4	4	0	42
5	0	0	0	0	0	1	0	0	0	1
6	1	2	0	5	0	3	2	0	1	14
7	0	3	0	6	0	2	1	0	0	12
8	0	1	0	3	0	0	1	0	0	5
9	0	0	0	1	0	0	0	0	0	1
Total	—	—	—	—	—	—	—	—	—	99

<sup>a</sup> These 100 song patterns correspond to the graph in Fig. 2a.



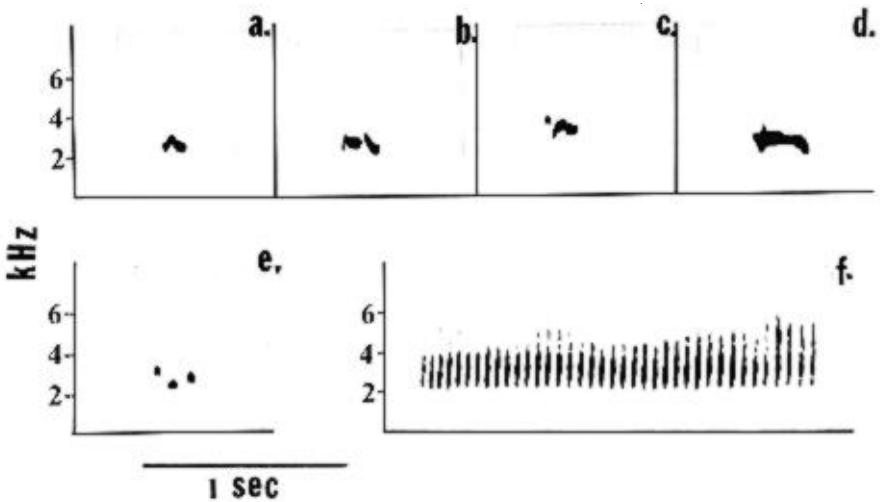


FIG. 6. (a-e) Male oriole "short" calls; (f) male oriole "chatter" call.

songs; in the latter case, calls served as song prefixes or appeared in other parts of the song. Twenty-six percent of the songs analyzed for male 1 included a call figure; similarly, 58% of the songs from male 13 contained call figures.

Chatter calls consisted of up to 38 repetitions of the same call figure ( $N = 62$  chatter calls from 14 males). Individual chatter figures varied from 23–69 msec, with all figures in a given chatter call being of fairly uniform duration, and frequencies used extended from below 1.5 kHz to above 6.5 kHz (Fig. 6f). Each male produced chatter calls of different durations. For example, 17 chatter calls were recorded from male 13 including calls of 3, 4, 6, 7, 8, 9, 10, 18, and 20 figure repetitions. "Chatter" was given during male-male agonistic encounters, during interspecific chases by the male and during human intrusion into the territory, suggesting a possible general agonistic function for this call. Males also gave chatter calls as they approached females and/or nestlings when they brought food to the nest. Females possessed similar chatter calls and uttered them in agonistic situations (Beletsky, unpubl. data).

*Discussion.*—The songs of most males in the present study differed markedly in mean duration, and in the number and types of song figures used. Similar patterns of variation, in which the songs of few or none of the males in a population are similar, have been found in such species as eastern populations of Rufous-sided Towhees (*Pipilo erythrophthalmus*) (Borror, Condor 77:183–195, 1975; Ewert, Anim. Behav. 28:379–386, 1980) and Common Yellowthroats (*Geothlypis trichas*) (Borror, Living Bird 6:141–161, 1967; Wunderle, Auk 95:389–395, 1978).

While the songs of most male orioles differed, some males sang identical songs; this observation is worthy of consideration. Among 18 males, four pairs of male orioles (the members of each pair holding adjacent territories) sang identical songs. One possible explanation for this phenomenon is that some males, during the first spring they establish territories, adjust their songs to those of their neighbors, as has been described for Indigo Buntings (Thompson, Auk 87:58–71, 1970) and Canaries (*Serinus canaria*) (Güttinger, Z. Tierpsychol.

49:285–303, 1979). Alternate explanations are that the identical song males are either: (1) parent-offspring pairs, in which case the male offspring learn their songs from their fathers, or (2) siblings or unrelated males reared in the same locality, learning their songs from the same adult male, returning to the same area to breed, establishing adjacent territories and singing identical songs. I do not possess enough data to comment on the possible validity of these hypotheses.

*Acknowledgments.*—I would like to thank the Huron-Clinton Metropolitan Authority for permission to work in Kensington Metropark, and W. L. Thompson, J. T. Armstrong, E. Shy, D. Ewert, D. Martin, J. W. Hardy, N. Flood and an anonymous reviewer for many helpful comments on earlier drafts of this manuscript.—L. DAVID BELETSKY, *Dept. Biological Sciences, Wayne State Univ., Detroit, Michigan 48202. Accepted 5 Jan. 1982.*

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**Documentation and status of Cory's Shearwater in the western Gulf of Mexico.**—Cory's Shearwater (*Puffinus diomedea*) has only been reported in the western Gulf of Mexico (W of longitude 94°) since 1975, when several birds were observed and one photographed about 64 km ESE from Port Aransas, Texas, by Scott Holt (Univ. Texas Marine Lab., pers. comm.) on 6 September 1975. Prior to this, the only published record for the entire Gulf of Mexico proper was a sighting off the Alabama coast in September 1973 (Imhof, *Alabama Birds*, 2nd ed., Univ. Alabama Press, Alabama, 1976; Duncan and Havard, *Am. Birds* 34: 123, 1980). Although Murphy (*Serial Atlas of the Marine Environment: Distribution of North Atlantic Birds*, *Am. Geogr. Soc.*, 1967) listed four specimens taken from the Cuban Straits off the Florida Keys, there is no documented specimen for the Gulf proper.

*Specimen description.*—On 12 August 1980, I found a dead female Cory's Shearwater (Univ. Dallas collection No. 2575) washed ashore on Mustang Island, 6 km S of Port Aransas, Nueces Co., Texas. This was 2 days after the passage of Hurricane Allen through the western Gulf and 96 km N of where the eye of the storm made landfall on the south Texas coast. Other pelagic species found dead the same day and within 2 km of the shearwater included three Sooty Terns (*Sterna fuscata*) and an Audubon's Shearwater (*P. lherminieri*). The previous day a dead Manx Shearwater (*P. puffinus*) (most unusual) and Brown Booby (*Sula leucogaster*) were found in this area (Webster, *Am. Birds* 35:201–204, 1981). No other Cory's Shearwater was encountered during this time.

The specimen was preserved as a study skin and subsequently identified as *P. d. diomedea* (Mediterranean race) by George E. Watson of the National Museum of Natural History, Washington, D.C. The plumage exhibited signs of extensive molt and heavy wear, with the feather bases showing especially on the secondaries and "rump." The condition of the plumage and distance from the Mediterranean at that time of year are evidence that the bird was an immature, prebreeding individual, in agreement with Forsythe (*Wilson Bull.* 92:265–266, 1980; specimen off South Carolina in July 1973) and Jouanin et al. (*Oiseau* 47:351–358, 1977; banded specimens of the eastern Atlantic race, *P. d. borealis*, recovered off Rhode Island and in the Atlantic Ocean away from their nesting grounds). The present specimen and previous western Atlantic specimen records (Murphy 1967, Jouanin et al. 1977, Forsythe 1980) suggest that the smaller Mediterranean subspecies may be more regular in southern U.S. waters compared to the *borealis* subspecies.

*Distribution in the western Gulf.*—Numerous cruises since 1975 in the western Gulf have