

A Further Contribution
to Knowledge of the Host Relations
of the Parasitic Cowbirds

HERBERT FRIEDMANN, LLOYD F. KIFF,
and STEPHEN I. ROTHSTEIN

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ABSTRACT

Friedmann, Herbert, Lloyd F. Kiff, and Stephen I. Rothstein. A Further Contribution to Knowledge of the Host Relations of the Parasitic Cowbirds. *Smithsonian Contributions to Zoology*, number 235, 75 pages, 1977.—A very large amount of new information on cowbird parasitism, based on about 4750 instances reviewed since the senior author's 1971 addendum to his 1963 host catalog, is here brought together. The data are presented in terms of the individual host species for each of the three species of parasitic cowbirds. In some cases, especially of seldom used, or at least seldom reported, hosts, the additional records supplement, but do not alter, our understanding of the host-parasite relation; in some other cases the new data are of sufficient magnitude to support convincingly a change of status. Also, in the case of some of the North American host species, experimental studies of their reactions (as accepters or rejecters) to the eggs of the parasites cause alteration from earlier estimates based solely on empirical field observational data and help to define the nature of the host-parasite relationship more adequately and in a more meaningful way. Parasitism by the brown-headed cowbird (*Molothrus ater*) is recorded for 26 species and subspecies of birds not hitherto known to be victimized. In the case of the Neotropical shiny cowbird (*M. bonariensis*) 32 new hosts are documented; for the bronzed cowbird (*M. aeneus*) 7 new hosts are documented. In all, documentation, with such clarification as the new data permit, is given for 235 species of hosts: 140 hosts of *M. ater*, 74 of *M. bonariensis*, and 21 of *M. aeneus*. In each of these the new information is correlated with that presented in earlier papers, so as to make the total current knowledge available to investigators studying any one of these many species of birds in whose life histories the parasites may play a major or even a very minor role.

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A Further Contribution to Knowledge of the Host Relations of the Parasitic Cowbirds

*Herbert Friedmann, Lloyd F. Kiff,
and Stephen I. Rothstein*

Introduction

The present paper brings together a vast amount of new information documenting and clarifying the relations existing between the many kinds of victims of the several cowbird species and their respective parasites. It is based on observational and specimen data, supplemented by the results of still continuing experiments conducted by one of us (S.I.R.) over a number of years. It also critically reviews data available from the recent work of others in this currently very active field of research. Even the mere accumulation of additional instances of cowbird parasitism on some of the less well documented host species, while often fragmentary in nature and not always conducive to immediate biological conclusions, has a value for investigators of those individual species as well as a cumulative value and meaning in the overall problems of brood parasitism.

This report adds a very considerable number of species and subspecies of birds to the previously

known hosts of three species of cowbirds, the brown-headed (*Molothrus ater*), the shiny (*M. bonariensis*), and the bronzed (*M. aeneus*). As additional kinds of birds are found to be victimized, it becomes increasingly evident that mere additions are not necessarily meaningful in themselves, except where they are related to changes in the environment—either as replacements of other hosts, or as hosts newly available to the parasites because of recent extensions of the geographical or ecological ranges of the latter. As one example, out of a number that might be cited, concerning the expanding breeding range of the brown-headed cowbird, we may mention southern Vancouver Island, an area where the species was unknown prior to 1955, but where it is now a very well-established and common summer resident (Davidson, 1966; Tatum, 1969, 1970). Evidence of this expansion is comprised by the many instances of parasitism, on a dozen or so kinds of birds there, mentioned in this report.

The biological problems raised by the intrusion of a brood parasite into a new area or a new ecological zone have been discussed briefly by one of us (Friedmann, 1971:249–250). In all such areas it would be worthwhile to record the early host choices and preferences, and those of subsequent years, as well as the reactions of “new” hosts to the parasites. By “new” is meant not merely additions

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to previously recorded host species, but, primarily, hosts (or even local populations of known hosts) previously in no danger of cowbird parasitism. The problems are difficult to evaluate because the parasites are not individually host-specific, and, therefore, are not density-dependent on any one host species. Related problems exist in areas where the cowbird population has grown very greatly, causing critical damage to local potential hosts, as in Michigan (Mayfield, 1960, 1973; Van Velzen, 1972) and the Edwards Plateau, Texas (Oberholser, 1974).

METHODS AND PROCEDURES.—Since the last addendum (Friedmann, 1971) to the 1963 host catalog by the senior author, we have reviewed 4750 additional instances of cowbird parasitism, well over half of which, especially if not accompanied by other pertinent data, are considered as merely repetitive evidence of earlier information. The remainder are presented or summarized in this paper. Our basic interest in studying all these data is to document and, where possible, to clarify the mutual relations between the parasites and their hosts.

There is still a need for increased and statistically more significant information on the relative frequency with which many individual host species are selected by the parasites, and on the incidence of parasitism that each host experiences. This is true for even some of the familiar hosts of the brown-headed cowbird, the most completely documented of all the cowbird species. Reliable, quantitative data are needed before answers may be formed to such critical questions as the following. How much of the cowbird's total reproductive output is provided by a particular host species? By how much does the cowbird reduce a host species' reproductive output? Questions such as these are of primary importance in considerations of the demographic processes occurring in nature and in the possible evolution of adaptations for and against parasitism.

It is anticipated that these quantitative aspects of the nature of brood parasitism will be enhanced in the future with the growth of a number of comprehensive "nest record cards" depositories. These should eventually provide much larger masses of information on all the hosts of the brown-headed and the bronzed cowbirds than have been available previously. Most of these files, presently held

by organizations too understaffed to do more than make token searches, should offer large, useful (because nonselectively chosen) samples from which to estimate the relative frequency with which each of the regularly parasitized host species is victimized since they will be in a position to yield not only instances of parasitism but also the number of unparasitized nests of each species reported during the same period of years. Important qualifying limitations inherent in data of this kind are discussed below in our account of the brown-headed cowbird. Further, when the information from all of these depositories is combined, it should be possible to note geographic variation in the incidence of parasitism within each kind of host.

We have not been able to visit these various filing centers personally, but, as outlined later, we have gotten the greatest part of their data (with one exception) through the cooperation of persons affiliated with them. Only in the case of the Ontario records is there a published compilation (Peck, 1975). These sources have given us nearly half of the material assembled in the present report.

Furthermore, we have been able, through the efforts of one of us (L.F.K.), to incorporate in this paper all the pertinent data on the largest collection of birds' eggs in North America, that amassed by the Western Foundation of Vertebrate Zoology (abbreviated to Western Foundation in our annotated catalog). Other egg collections that were used as sources for data in this paper are listed in "Depositories of Unpublished Data."

Large egg collections, such as that held by the Western Foundation, composed of specimens from many smaller private collections, show an unnaturally low incidence of cowbird parasitism. Conversations with some of the older oologists, and statements in the oological literature from the turn of the century indicate that some early collectors had a marked preference for sets of eggs "uncontaminated" by cowbirds, and in exchanges between collectors there was also a bias against parasitized sets, as though they were less "complete" than they otherwise might be. This bias may not have affected rare species of hosts, and did not develop in Neotropical collecting because of the relatively small numbers of sets of such host species that became available to individual collectors.

Even in collections chiefly involving *Molothrus ater*, the data, while not necessarily reflecting ac-

tual rates of natural parasitism on the various host species, do yield reliable information of a comparative kind. Thus, there is little reason to think that any personal bias against cowbird eggs on the part of the earlier egg collectors would have resulted in their gathering of more, or of fewer, parasitized sets of one host species than of any other. Whatever biases they may have expressed were applied equally to sets of eggs of all host species. It is true that the end results, as they appear today in such a vast assemblage of specimens from many sources, are somewhat complicated by the fact that a few collectors seem to have had some interest in sets with cowbird eggs, but they were outnumbered by others with a marked preference for sets without them. In each case it seems the individual collector's attitude was consistent, regardless of the host species involved. Because the majority of them did prefer unparasitized sets, it seems safe to say that in a corpus of material of the magnitude of the Western Foundation's, any host that there shows an incidence of parasitism of over 10 percent can only be looked upon as a very frequent host choice in nature. This is examined in detail below, in our account of the brown-headed cowbird.

Aside from considerations of host-parasite relations, we are also concerned with the recent accumulations of empirical observational data on cowbird parasitism in general. In reporting these data, we have correlated them with earlier estimates, principally with the senior author's 1963 book.

The new information is presented separately for each of three species of cowbirds—the brown-headed (*Molothrus ater*), the shiny (*M. bonariensis*), and the bronzed (*M. aeneus*). We have no new information to report on the screaming cowbird (*M. rufo-axillaris*), or the giant cowbird (*Scaphidura oryzivora*). Inasmuch as each of the three species dealt with in this paper, as well as a great many of their hosts, are polytypic, we have referred the various records to their proper subspecies, both of the parasites and of the hosts, although we have stressed the species as the basic biological taxon. At the start of the account of each of the three cowbird species, we have included a list of the hosts herein reported for the first time for each of the subspecies of the parasites.

In the list relative to the brown-headed cowbird,

special mention is made in cases in which the species discussed is known to be a rejecter (defined below), and the experimental data for each are summarized. These experiments are important in uncovering various observational biases in the determination of the relative incidences of parasitism these hosts suffer. Their significance is explained in the "Discussion" at the opening of the section of this paper dealing with the brown-headed cowbird. Aside from this work by one of us (S.I.R.), it may be noted that in the course of his extensive and illuminating work on the giant cowbird in Panama, Neal G. Smith (1968) has done a considerable number of experiments on the reactions to parasitic eggs by the limited number of hosts of that cowbird. His complete report on the giant cowbird will be a great addition to our knowledge of brood parasitism in the family Icteridae. However, *Scaphidura oryzivora* is not as closely related to *Molothrus ater* as are the other two species dealt with in this paper. Experiments on the hosts of *M. bonariensis* and *M. aeneus* are needed before any meaningful comparisons may be made.

The nomenclature and sequence of the North American birds involved in the present paper follow the usage of the fifth edition of the American Ornithologists' Union's *Check List of North American Birds* (1957), and the changes recommended in the thirty-second check-list supplement (in *Auk*, 1973:411-419). We also follow Parkes and Blake (1965), in placing *Tangavius* in *Molothrus*, and in adopting the subspecific name *loyei* for the northwestern race of the bronzed cowbird (*M. aeneus loyei*, formerly *M. aeneus milleri*). Otherwise, we have not attempted to anticipate what nomenclatorial changes may be recognized in the sixth edition, still in preparation. The "common names" of South American birds are taken from the lists of Eisenmann (1955) and of Meyer de Schauensee (1966). We continue to recognize *melanogyna* as a race of *Molothrus bonariensis*.

ACKNOWLEDGMENTS.—In the course of assembling the data for this paper, from sources other than the literature, we have had the kind cooperation and assistance of many persons associated with institutions possessing egg collections or files of "nest record cards." (All such institutions are listed in "Depositories of Unpublished Data.") Thus, we have all the data, through 1974, in the files of the Ontario nest records at Toronto, given us partly

by J. C. Barlow and R. D. James and completed by Peck's 1975 tabulation of all the data included there. Mrs. W. J. Smith kindly sent us all the cowbird records through 1973 from the files at the University of British Columbia, Vancouver. We have also had all the data through 1975 from the Prairie nest records files at Winnipeg, where Mrs. J. T. Barber supplemented the data supplied us earlier by H. W. R. Copland and Dr. R. M. Hatch. From the extensive files maintained at Cornell University, Ithaca, New York, Mrs. Ruth Pantle sent us computerized data from the parts of the files available in that form, which parts are unfortunately limited in coverage. There must be a large amount of additional information still to be extracted from these files. In addition, a number of private individuals generously sent us their records, observations, or tangential information. To all of these, listed alphabetically immediately below, we express our thanks. Throughout this paper, wherever information is credited to any of these names, it is understood that it reached us by personal communication, unless a publication reference is given.

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Brown-headed Cowbird

Molothrus ater

Discussion

Because of its abundance and its great geographic range in an area with many observers, we have far more new information on this species of cowbird than on the other two considered in this paper. Also, it is the only one of these three species that has been studied experimentally as yet, with the result that it is possible to interpret some of its host relations in greater depth and accuracy than may be done for the others.

NEW HOSTS.—Some 6 species, or 26 species and subspecies, new to its host catalog are herein reported, with their pertinent data, bringing the total host list for this parasite up to 216 species, or 375 species and subspecies of birds. Aside from the 26 additions, there are some hosts that have been found to be parasitized by races of the cowbird other than those previously reported. As a result, we have 7 new hosts for *M. ater ater*, 18 for *M. ater artemisiae*, and 19 for *M. ater obscurus*.

Seventeen species are added to the list of victims definitely known to have reared the young parasite: *Tyrannus verticalis*, *Empidonax wrightii*, *Pyrocephalus rubinus*, *Auriparus flaviceps*, *Regulus satrapa*, *Sturnus vulgaris*, *Vermivora celata*, *Dendroica townsendi*, *Dendroica striata*, *Sturnella magna*, *Euphagus cyanocephalus*, *Carpodacus purpureus*, *Spinus psaltria*, *Pipilo fuscus*, *Ammodramus savannarum*, *Zonotrichia leucophrys*, and *Melospiza lincolni*. This brings the total of true fosterers (as opposed to mere victims) up to 139 out of the 216 species.

Hosts new to the previous lists are given below

for each race of the cowbird. Those that are new to the total host catalog of the species are marked by an asterisk.

New hosts for *Molothrus ater ater*: **Rallus limicola limicola*, *Actitis macularia*, **Regulus satrapa satrapa*, **Dendroica striata*, **Quiscalus quiscula stonei*, *Passerina ciris pallidior*, and *Carpodacus mexicanus frontalis*.

New hosts for *Molothrus ater artemisiae*: *Charadrius vociferus vociferus*, **Empidonax hammondi*, **Empidonax wrightii*, **Auriparus flaviceps acaciarum*, *Psaltriparus minimus minimus*, **Vireo huttoni insularis*, *Vermivora chrysoptera*, **Vermivora celata celata*, **Dendroica townsendi*, *Dendroica castanea*, **Dendroica striata*, *Icterus spurius*, **Carpodacus purpureus californicus*, **Spinus tristis jewetti*, *Amphispiza bilineata deserticola*, **Junco hyemalis shufeldti*, **Zonotrichia leucophrys pугentensis*, and **Melospiza lincolni alticola*.

New hosts for *Molothrus ater obscurus*: *Zenaidura macroura marginella*, *Tyrannus verticalis*, *Sayornis phoebe*, *Sayornis saya saya*, **Polioptila melanura melanura*, **Chamaea fasciata intermedia*, *Bombicilla cedrorum*, *Sturnus vulgaris vulgaris*, **Vireo huttoni carolinae*, **Agelaius tricolor*, **Icterus cucullatus californicus*, **Pheucticus melanocephalus maculatus*, **Pipilo erythrophthalmus falcinellus*, **Pipilo fuscus crissalis*, **Pipilo fuscus carolae*, *Spizella pusilla pusilla*, *Zonotrichia leucophrys nuttalli*, **Passerella iliaca stephensi*, and **Melospiza melodia mailliardi*.

Including these additions to the host catalog, the new information brought together in this report

adds to, if only to a minor degree, or alters our understanding of the host relations of the brown-headed cowbird with more than half (140) of its known species of victims.

DATA DERIVED FROM EGG COLLECTIONS.—Mention was made in our introductory paragraphs that the vast number of parasitized sets of eggs in the collections of the Western Foundation do not necessarily reflect actual rates of natural parasitism, but do give us valuable comparative data. Inasmuch as the greatest part of these records have to do with the brown-headed cowbird, we may consider them at this point. The detailed data from this collection are given in the accounts of the individual host species. In some cases the numbers of such sets are too small to be interpretable, but in others it is possible to see some trends. The magnitude of the material may be appreciated from the count that shows that brown-headed cowbird eggs are present in 472 sets belonging to 35 commonly parasitized species, which, in turn, are represented by a total of 7368 sets of eggs. There are also 168 parasitized sets of less frequently reported victims.

In some species of hosts that have a large breeding range extending across the North American continent and that are represented in the collection by sizeable numbers of sets of eggs, there is a higher frequency of parasitism in the eastern than in the western parts of their range. Examples are the yellow warbler with 85 sets of the eastern race (*Dendroica petechia aestiva*), 13 of which (15.3 percent) are parasitized, and 228 sets of the western race (*D. petechia morcomi*), with 13 (5.7 percent) parasitized; the yellowthroat, with 124 sets of its eastern races, 13 (10.5 percent) of which are parasitized, and 159 sets of its western subspecies, 12 (7.6 percent) of which have cowbird eggs; the cardinal, with 76 sets of the eastern, nominate race, 8 of which (10.5 percent) are parasitized, as compared with 104 sets of the races *Richmondia cardinalis magnirostris* and *superba*, 9 of which (8.7 percent) have cowbird eggs; and the rufous-sided towhee, with 55 sets of its eastern, typical subspecies, 9 of which (16.4 percent) are parasitized, as compared with 300 sets of 8 western races, only 2 of which (0.7 percent) are parasitized.

Notable exceptions to this trend are the lark sparrow represented by 33 sets of its eastern (not as far east as in the above mentioned species) nom-

inate form, none of which have cowbird eggs, and 195 sets of its western race (*Chondestes grammacus strigatus*), 17 of which (8.7 percent) are parasitized; and, to some extent, Wilson's warbler, which, in the eastern part of its range, is largely restricted to northern areas where neither cowbirds nor observers are abundant; of this species, 10 (6.8 percent) of 147 sets of the western race (*Wilsonia pusilla chryseola*) are parasitized, and none of 26 eastern sets have any cowbird eggs. Some species, such as the American goldfinch and the song sparrow, show local variation in frequency of parasitism, but reveal no significant, broad, longitudinal trends.

NEST RECORD FILES AND THEIR BIASES.—In earlier papers on cowbird hosts, particularly of *M. ater*, where published sources had given total numbers of nests found, as well as the number that were parasitized, these figures were duly noted; there is no need to repeat them herein. When all the large "nest record cards" depositories are examined in greater detail, these may become sources of supplementary information.

In his useful summary of the cowbird data in the Ontario nest records files, Peck (1975:7) has listed four factors that bias the apparent percentages of parasitism, all causing a lowering of the figures: (1) host nest cards where contents were not checked; (2) inability of observer to recognize cowbird eggs; (3) failure of contributor to make out a second card for the cowbird; (4) resemblance of cowbird eggs to those of the host. To these we may add a fifth, based on our experience, namely errors in assembling data for computerization.

Even allowing for these factors, the data banks of the main "nest record cards" files still present a serious problem common to all data based on empirical studies of brood parasitism: observations of natural parasitism may lead to incorrect conclusions concerning the actual incidences of parasitism. Given the dynamics of evolution, especially of responsive behavior, it is reasonable to assume that victimized species may develop reactions to, or against, parasitism because of its effect on their own reproductive output. If the reaction is against parasitism, and if this is manifested by ejection of the cowbird eggs, it is clear that much parasitism will go undetected, since many cowbird eggs will be ejected before investigators ever see them. Thus, cowbird parasitism on some species may be much

higher than suggested by observations. One of us (Friedmann, 1963:133) emphasized this problem when discussing brown-headed cowbird parasitism on the northern (Baltimore) oriole. At that time only 13 cases of parasitism were known, but in 3 of these instances cowbird eggs had been found on the ground beneath the nests, indicating ejection by the orioles. It was suggested that ejection "might play a role in the apparent paucity of records of cowbird parasitism." In assessing research on cuckoo parasitism, one of us (Rothstein, 1971) has more recently discussed the problems that may occur when frequencies of observed parasitism are equated with frequencies of actual parasitism. Because of the possibility of host rejection, we must be cautious in interpreting the significance of field observations.

It should be stressed that even if observations of a particular host species demonstrate little or no ejection of parasitic eggs, it is by no means certain that ejection is unimportant in that species. Inevitably, there is a strong bias toward seeing precisely those cowbird eggs that are not ejected. It is conceivable that all, or nearly all, of the observations of cowbird parasitism on a particular host species could appear to demonstrate acceptance even if ejection were its typical response to parasitism, because only the acceptances would be observed.

METHODS OF DEALING WITH BIASES IN EMPIRICAL DATA.—Fortunately, there is a partial solution to this problem. By experimentally placing cowbird eggs into nests one can determine accurately a species' response to parasitism and whether ejection introduces a bias into interpretations drawn from observations of naturally parasitized nests. Experiments allow an accurate determination of the frequency of ejection because the investigator can ascertain the fate of every cowbird egg in his sample. One of us (S.I.R.) is conducting a systematic program of experimental cowbird parasitizations of North American birds, using artificial, as well as real, cowbird eggs. Results of experiments on 640 nests of 43 species are summarized (Rothstein, 1975a) and detailed analyses of experiments on single species will be presented in other papers. In general, the results of these experiments have been surprisingly straightforward. Most (80.4 percent) of 245 rejections of experimental cowbird parasitism were accomplished by the host ejecting

the cowbird egg from the nest. Smaller numbers were accomplished by nest desertion, by damaging (but not ejecting) the cowbird egg, or by burying the cowbird egg under new nesting material. Because ejection was the most common form of rejection, or of host defense, the experiments indicate the host defenses can strongly bias quantitative conclusions based solely on observations of natural parasitism. Other modes of host defense, such as nest desertion, do not introduce so serious a bias because deserted nests retain the evidence of parasitism; the cowbird eggs are still present. However, even nest desertion does introduce some bias. Desertion tends to deflate the number of cases of parasitism observed and to inflate the apparent percentage of acceptances because deserted nests are less likely to be found than active ones, since their builders are not around to call attention to them by their behavior.

DESIGNATION OF SPECIES AS ACCEPTERS AND REJECTERS.—The experiments have demonstrated that host rejections occur and can strongly conceal the actual rates of natural parasitism. Besides this, the experiments help to elucidate the critical point of specific host response, in terms of acceptance and rejection, that each species shows. Again the experimental results have been straightforward. Some species show close to 100 percent rejection, i.e., rejection occurs in nearly all the experimentally parasitized nests of the species. Other species show close to zero rejection. No really intermediate species have been found, and a suitable statistical test shows a highly significant tendency for all species to show either total rejection or total acceptance (Rothstein, 1975b). Accordingly, all host species may be readily placed in one of two groups: rejecter and acceptor species.

These results have important consequences in formulating estimates of rates of natural parasitism. As the experiments showed that nearly total rejection or total acceptance is the rule, it follows that observations of nests of rejecter species are of little help in revealing actual rates of natural parasitism, whereas observations of nests of acceptor species provide reliable data. A few acceptor species may show occasional rejections, but the frequency of this response is so slight that the bias, while still real, is not very important statistically.

Experiments (by S.I.R.) have determined that the gray catbird, American robin, eastern kingbird,

cedar waxwing, blue jay, brown thrasher, and northern oriole are rejecter species (based on experiments on at least 10 nests of each species). The western kingbird, less adequately tested (2 nests) also seems to be a rejecter. Experiments on 10 or more nests of each showed the following birds to be accepter species: red-winged blackbird, common grackle, eastern phoebe, chipping sparrow, yellow warbler, mourning dove, barn swallow, black-billed cuckoo, and American goldfinch. Experiments on 6 to 9 nests of each species, gave similar accepter status to the song sparrow, cardinal, and wood thrush; experiments on fewer nests (2 to 5 of each) gave accepter responses for the rose-breasted grosbeak, mockingbird, vesper sparrow, eastern meadowlark, red-eyed vireo, prairie warbler, rufous-sided towhee, rough-winged swallow, starling, house finch, and yellow-headed blackbird. In some of the above there is no reason to assume frequent cowbird parasitism (common grackle, mourning dove, barn swallow, black-billed cuckoo, rough-winged swallow, and starling) but the tests reveal that, if parasitized, they would react as accepters.

The species mentioned above are those whose responses to cowbird eggs have been tested experimentally. While only experiments can help us to determine reliably whether a species is a rejecter or an accepter, the experimental results allow us to decide, with a fair degree of certainty, the accepter status of some species that have not been experimented upon and thus allow us to determine whether observations of natural parasitism on these species give a true or a biased picture. Inasmuch as the experiments show a significant tendency toward either almost total rejection or acceptance by each species, it follows that in the absence of experimental data, a species can be assumed to be an accepter if a large proportion (more than 20 percent) of its nests show natural parasitism and if this parasitism is always, or nearly always, accepted. This assumption is reasonable because if 20 percent or more of the nests show natural cowbird parasitism that is accepted, then at least 20 percent of the individuals must be accepters. No rejecter species tested has shown more than 13 percent acceptance. Such an assumption may introduce occasional errors because a species with a moderate level of rejection might show much cowbird parasitism that was accepted and be designated incorrectly as an accepter. But the assumption is valuable be-

cause errors are likely to be few, as results to date indicate that truly intermediate species are very rare or lacking. This allows us to categorize as accepters many species that have not yet been experimented upon. For example, no experiments have been made on the Kirtland's warbler, the dickcissel, or the lark sparrow, but these species have, in particular studies on large samples of nests, shown rates of parasitism of 55 percent (Mayfield, 1960), 78 percent (Zimmerman, 1966), and 45 percent (Newman, 1970), respectively. There can be little doubt that these species are accepters. It should be stressed, however, that no matter how much natural parasitism has been observed on a species, it is still worthwhile to test its reaction experimentally. Only experiments can determine accurately the frequency with which a species rejects, and experiments will be essential in elucidating the true nature of any species that may appear to show an intermediate level of rejection.

Unlike species that are known to be frequently parasitized, species found to be rarely or never parasitized naturally, must be subjected to experiments to determine their rejecter-accepter status. Species observed to be commonly parasitized are almost certainly accepters, but species rarely found to be parasitized may be either rejecters or accepters that are rarely parasitized, or they may be effective rejecters that are, in fact, parasitized quite commonly. In such species the need for experiment is essential, but experimentally induced cases of parasitism cannot tell us how frequently rejecter species are normally parasitized. Basically, we can conclude that the incidence of actual parasitism of a rejecter species must be higher than the incidence of observed parasitism, but we cannot be certain as to how much higher. It would seem to be maladaptive for cowbirds to parasitize rejecters, but this, by itself, does not mean that such parasitism is in fact insignificant in a quantitative sense.

OTHER PROBLEMS IN THE DETERMINATION OF THE COWBIRD'S HOST PREFERENCES.—The above discussion shows how difficult it is to determine rates of parasitism. But even if rates of actual parasitism could be determined accurately for all species, the data would not necessarily provide reliable information on another critical aspect of cowbird parasitism, namely the presence and strength of preferences cowbirds may have for particular host species. Rates of parasitism and host preferences may

not correlate well because the degree of preference for a particular host species is not the only factor determining the frequency with which the host is actually parasitized. Given a choice, a cowbird may strongly prefer a particular host species but may rarely succeed in parasitizing it because the species may have an especially well hidden nest or be especially effective at guarding its nest. Information on nest crypticity could be gathered by analyzing nest sites and the areas surrounding them. Information on nest guarding could be gathered experimentally by testing the responses of hosts to mounted or live cowbirds placed near nests. For the present, it is sufficient to emphasize that the unknown variables of nest crypticity and guarding make it difficult to infer host preferences from rates of parasitism. Importantly, Robertson and Norman (1975), have recently begun a systematic investigation of nest guarding. By placing mounted cowbirds close to active nests during controlled experiments these authors found that some species react more strongly to cowbirds than to mounted song, savannah, and house sparrows. Robertson and Norman's work also indicates that within a taxon the intensity with which acceptor species react to mounted cowbirds is directly proportional to the intensity of parasitism suffered by each species. Further studies by these authors will be directed toward determining whether intensely parasitized species are most aggressive toward cowbirds because natural selection has produced a stronger innate response in such species or because these species are so commonly parasitized that many individuals had had prior experience with cowbirds, before Robertson and Norman's experiments, and had learned that cowbirds are likely to interfere with their nests. For our immediate purposes the important point about Robertson and Norman's work is that species may differ in the efficiency with which they can repel cowbirds, and thus, even if cowbirds have equal preferences for various hosts, the amount of parasitism each host experiences may differ.

There are also the problems of equating cowbird and host preferences from data on rates of parasitism. The need to equate densities of cowbirds (when comparing data from different areas) is straightforward. Equating host densities when comparing samples may be necessary because cowbirds may form search images for common host

species in the same manner in which some predators are believed to form search images for their most abundant prey. Formation of search images for hosts would, everything else being equal, result in common species being parasitized at a higher rate than rare ones.

DATA ON THE EFFECTS OF PARASITISM.—Despite the enormous numbers of publications on cowbird parasitism, there are few species for which there are data of sufficient quality and quantity to allow an accurate determination of the effects cowbird nestlings have on the host's own young. There are also few host species for whose nests there are sufficient data on the success rates of cowbird nestlings. These data have great importance in theoretical considerations. The ecological and evolutionary significance that cowbird parasitism has for a particular host species is proportional to the degree of reproductive loss caused by each instance of parasitism (Rothstein, 1975b). It follows that any discussion of "reproductive strategy" by the cowbird must take into consideration the quality (from the parasite's point of view) of the various hosts available to it.

The paucity of data on the consequences of parasitism is due to the fact that it is much easier to observe a nest once or twice and report whether parasitism occurred than to visit a nest repeatedly to weigh nestlings and to note the number and condition of the nestlings. Notable exceptions to this important deficiency in the cowbird literature are studies on the song sparrow by Nice (1937), Brewer's blackbird by Furrer (1974), the eastern phoebe by Klaas (1975), Kirtland's warbler by Mayfield (1960), and the red-eyed vireo by Southern (1958). Many other valuable studies have reported the outcome at small numbers of parasitized nests of other species but in general the data are still too few. Perhaps the simplest, yet most effective, way to report data is to use Southern's (1958) tabular scheme. In a simple table Southern presented the individual outcome, in terms of host and parasite success, at each of 104 parasitized and unparasitized nests. The value of this method is that it places on record the crucial data for every nest and makes it possible for the reader to conduct his own analyses. Extensive analysis would not be possible if the data were presented merely in summary form.

One of us (S.I.R.) is actively pursuing the experimental study of host reactions to cowbird

parasitism and has a number of further reports in hand. Pending further elucidation of this sort, we present the following new information based on a large number of observations and of record specimens concerning a great many individual host species. It is our hope that the data here presented and the questions discussed may stimulate others to further studies of the many problems raised by the biology of brood parasitism.

Data on Individual Host Species

VIRGINIA RAIL

Rallus limicola Vieillot

On 7 June 1971 at McGarry Township, Kearns, Ontario, Mr. J. S. Nickerson found a nest of a Virginia rail containing 8 eggs of the rail and 1 of the brown-headed cowbird (Ontario nest records, Toronto). This is the first time a cowbird has been reported laying an egg in a nest of this species. The rail can only be looked upon as an accidental host choice, an error on the part of the parasite.

KILLDEER

Charadrius vociferus (Linnaeus)

The killdeer, an obviously unsuitable bird as a host for the brown-headed cowbird, has figured hitherto in the host catalog of that parasite solely on the basis of its inclusion in a list of cowbird victims compiled by Oberholser prior to 1920. When he was asked about it in 1921 he could not recall the source or the locality of the record, but he considered it to be valid and that it pertained to the nominate race of the cowbird.

Recently Harold Mossop (1963) reported a cowbird's egg with 4 eggs of the killdeer in a nest of the latter in Manitoba. On geographic grounds this must involve the northwestern race of the cowbird, *M. ater artemisiae*, for which it is a "first." The fact that there is now a second "record" (both without detailed data) does not alter the status of the killdeer as a cowbird "host." It is to be looked upon as a purely accidental involvement.

SPOTTED SANDPIPER

Actitis macularia (Linnaeus)

This unlikely host was first reported as a victim

of the brown-headed cowbird at Edmonton, Alberta in 1964 (Friedmann, 1966:2) and since then, surprising as it may seem, 4 additional instances have been reported: 1 from Utah (Friedmann, 1971:241); another from Alberta (near Leduc, 5 June 1960) and 1 from Manitoba (Lake Manitoba, 26 June 1970) reported by Hatch (1971); and 1 from Ontario (5 June 1965) in the nest records index at the Royal Ontario Museum. The Ontario record is the first one that involves the nominate race of the parasite; the others all refer to *M. ater artemisiae*.

WILSON'S PHALAROPE

Steganopus tricolor Vieillot

To the 2 earlier records of this improbable victim parasitized in Utah (Friedmann, 1963:45) may be added another from Manitoba. Hatch (1971:17) found a nest of this phalarope at Watchorn Bay, Lake Manitoba, about 10 miles west of Moosehorn, Manitoba, 15 June 1970, containing 1 cowbird egg and 4 eggs of the host.

MOURNING DOVE

Zenaida macroura (Linnaeus)

The number of records of parasitized nests of the mourning dove continues to grow slowly, although the dove is hardly a likely host species. To the half dozen earlier records (Friedmann, 1971:241) may be added 1 taken in Kent County, Delaware, 24 May 1958, now in the Delaware Museum of Natural History, and another from Cameron County, Texas, 22 May 1927, now in the collection of Oregon State University. The last one is the first record involving the small race of the cowbird (*M. ater obscurus*).

Aside from the fact that this bird is, like all doves, not suitable as a host for the cowbird, the fact remains that when parasitized it accepts the alien egg.

GROUND DOVE

Columbina passerina (Linnaeus)

A third record of this ground dove (subspecies *C. passerina pallescens*) was collected by R. D. Camp at Brownsville, Texas, on 24 May 1927, and

is now in the collections of the Western Foundation. A fourth instance, also from Cameron County, Texas (not certainly from Brownsville), 4 June 1927, is in the collection of Oregon State University. The earlier 2 records were also from the Brownsville area of Cameron County. Four records from this area suggest that it is not unusual for the dwarf cowbird to lay into nests of this dove, even though such actions are not likely to be fruitful.

YELLOW-BILLED CUCKOO

Coccyzus americanus (Wilson)

A sixth instance of cowbird parasitism on this species was reported from Kansas by "Woods" (1972:14-15), a case observed 10 years earlier than his published note. This record enlarges the geographical area over which such parasitism has been found (the earlier records were from Connecticut, Pennsylvania, Ohio, Illinois, and Michigan), but the fact remains that the cuckoo is generally unmolested by the parasite.

BLACK-BILLED CUCKOO

Coccyzus erythrophthalmus (Wilson)

A fifth case of parasitism on this rarely chosen host can be added to the 4 reported previously (Friedmann, 1971:242). One of us (S.I.R.) found a nest, on 24 June 1969, that contained 2 young cuckoos about 3 or 4 days old and 1 cowbird egg. This was 1 of 14 cuckoo nests studied in 1968 and 1969 in Cheboygan and Emmet counties, Michigan. On 27 June the cowbird egg was missing, but 2 half-shells from it were found almost directly beneath the nest. The half-shells were dried out, indicating that the cowbird egg had hatched. Probably, since the usual food of cuckoos—bristly caterpillars—was unsuitable to the cowbird infant, it died shortly after hatching and its dead body was removed by the host.

EASTERN KINGBIRD

Tyrannus tyrannus (Linnaeus)

An uncommonly reported host choice, the eastern kingbird was known earlier (Friedmann,

1963:49) to have been parasitized only from some 15 records. To these we may now add 9 more: 2 from Illinois (Graber, Graber, and Kirk, 1974:8); 4 from Ontario (Ontario nest records files, out of 716 nests reported); 1 from North Dakota (R. E. Stewart); 1 from Maryland (Delaware Museum of Natural History); and 1 from Cincinnatus, New York (Western Foundation). One of the Illinois records is of a nest containing a large young cowbird which "probably" fledged.

In attempting to evaluate this increase in the number of instances of parasitism on this flycatcher, we must take into consideration the fact that one of us (S.I.R.) has found the eastern kingbird to be a rejecter species. Experiments at each of 33 nests resulted in ejection of an artificial or real cowbird egg. These experiments involved samples of the kingbird population in Connecticut, Maryland, Michigan, and Manitoba. Because ejection of the alien egg is the typical response, it follows that much of the parasitism that may be perpetrated on this species would go undetected. This makes it all the more remarkable that there should be as many as 5 additional observed records since the 1963 compilation; this can only mean that the eastern kingbird is victimized somewhat frequently.

The Illinois instance (above) of a well-developed young cowbird in a kingbird's nest suggests that the host's usual rejection reaction is to the newly laid cowbird egg, and that if it is not then ejected, the kingbird will tolerate and incubate it, and rear the young parasite. Whether, in this particular instance, there was some physical or other obstacle to removal of the egg is not known.

WESTERN KINGBIRD

Tyrannus verticalis Say

This rarely recorded host, originally listed (Friedmann, 1963:49) without a definite case, has since been reported 3 times as a cowbird host. T. S. Smith (1972) found a parasitized nest in York County, Nebraska, in June 1971, from which a young brown-headed cowbird and a young kingbird were fledged. A parasitized set of eggs of this kingbird from Merced County, California, collected by H. R. Eschenburg, 23 May 1936, is now in the Delaware Museum of Natural History; another set, taken

in Wasco County, Oregon, 11 June 1933, is in the collection of Oregon State University.

Smith's observation adds the western kingbird to the list of victims known to raise the young of the parasite. The Merced County, California, egg record is the first for the southwestern race of the cowbird (*M. ater obscurus*).

This species has been designated tentatively as a rejecter. Artificial cowbird eggs were ejected from the 2 nests to which they were added (Rothstein, 1975a). The paucity of observed cases of natural parasitism agrees well with this rejecter behavior of the western kingbird.

GREAT CRESTED FLYCATCHER

Myiarchus crinitus (Linnaeus)

To the 5 earlier records (Friedmann, 1963:50) of this rarely reported victim may be added 6 more, 3 from New York (Bull, 1974:537) and 3 from Ontario (out of 201 nest records in the files at Toronto). The great crested flycatcher seems to be protected from cowbird parasitism by its pugnacity and by its habit of nesting in holes.

EASTERN PHOEBE

Sayornis phoebe (Latham)

In the collections of the Western Foundation is a set of 4 eggs of this species with 1 of the dwarf cowbird (*M. ater obscurus*), taken at Marble Falls, Texas, 20 May 1940, by F. F. Nyc, Jr. Mr. Nyc informs us that in 1974 he found 2 more parasitized nests near Blanco, Texas. These 3 are the first records for the eastern phoebe as a victim of this subspecies of the parasite. The eastern phoebe has long been known to be very frequently parasitized by the eastern, nominate, race of the brown-headed cowbird.

Although over 600 records of this flycatcher as a cowbird victim have been reported, in only a few "source studies" were the totals given of the number of nests, parasitized or not, found by the reporters. One of us (Rothstein, 1975b) found 136 nests in Connecticut and Michigan. Of these, 28 (20.6 percent) were parasitized. A survey of published studies in which were given the total numbers of nests found, as well as the number with cowbird eggs or young, revealed another 358 nests,

64 of which (17.4 percent) were parasitized. Klaas (1975) has reported that parasitism occurred at 95 (24.3 percent) of 391 phoebe nests in Douglas County, Kansas, and Schukman (1974) noted 6 out of 66 nests (9.1 percent) were so affected in Ellis County, Kansas. Inasmuch as a fairly large part of these cases were early in the breeding season of the phoebe (Friedmann, 1929:207), and inasmuch as the incidence of parasitism probably decreases as the season progresses (Friedmann, 1963:51), it is likely that the early losses incurred by the host are offset by gains made later in the summer.

Cowbird parasitism is extremely deleterious to the eastern phoebe because of the great disparity in the incubation periods of the 2 species. The cowbirds generally hatch 4 to 6 days before the phoebes. Data on 19 parasitized nests followed to completion show that only 6 phoebes were fledged, a rate of 0.3 host young per parasitized nest (Rothstein, 1975b). Similarly, Klaas (1975:8) found that only 3 of 100 phoebe eggs resulted in fledglings in 39 nests in which 1 or more cowbird eggs hatched and which were not destroyed by predation, storms, or other factors which bring about loss of an entire nest. Besides these 3 host fledglings, parasitized nests produced another 26 phoebes, but all of these were from nests at which cowbird eggs failed to hatch. Considering all sources of mortality, 46.0 percent of 1203 phoebe eggs in unparasitized nests produced fledglings, while only 9.0 percent of 323 phoebe eggs in parasitized nests were productive. As for cowbird eggs in Klaas's study, 41.7 percent of 139 produced fledglings.

The frequency of parasitism on the phoebe varies greatly in adjoining and not dissimilar areas. Thus, in their detailed account of this flycatcher in Illinois, Graber, Graber, and Kirk (1974:24-26) state that while it is a common host choice in most of the state, with 29 percent of the nests parasitized in central Illinois, and 33 percent in a southern part (north of Franklin County), yet in one extreme southern area (south of Saline County), where 7 nests were studied, not a single one had any cowbird eggs or young. The collections of the Western Foundation contain 90 sets of eggs of this species, 10 of which (11.1 percent) have cowbird eggs with them. The nest records files at Cornell University have data on 2679 nests from all parts of the range of the eastern phoebe. Of these, only 121 (4.5 percent) were parasitized. The Ontario nest

records at Toronto show that 91 (9.1 percent) of 995 nests reported were parasitized.

In the northwestern part of its range—Saskatchewan and Manitoba—the eastern phoebe appears to be seldom molested by the brown-headed cowbird; in the Prairie Nest Records at the Manitoba Museum there are data on 177 nests of this flycatcher, only 1 of which was parasitized.

SAY'S PHOEBE

Sayornis saya (Bonaparte)

Donald W. Lamm reported a nest of Say's phoebe at Tucson, Arizona, 22 March 1973, with 3 eggs of the host and 1 of the brown-headed cowbird (*M. ater obscurus*). When revisited later there were 3 young phoebes and no cowbird. This is the first time Say's phoebe has been reported as a victim of the southwestern race of the parasite. The small number of previous instances (Friedmann, 1963:53) all involved the nominate race. To these may be added 2 more Kansas records: 1 from Oberlin, Decatur County, 31 May 1909 (now in the collections of the Western Foundation); and the other from Ellis County, 1974 (Schukman, 1974).

This species and the related black phoebe (*Sayornis nigricans*) provide a marked contrast with the eastern phoebe, as they are only seldom found to be parasitized. Schukman's study provides some direct, comparative data because he studied Say's phoebe and the eastern phoebe in the same area. The 1 parasitized Say's phoebe nest he found was among 30 nests of that species studied, whereas 6 of 66 eastern phoebe nests in this area were parasitized.

ACADIAN FLYCATCHER

Empidonax vireescens (Vieillot)

To the data previously available (Friedmann, 1963:53–54), which indicated that the Acadian flycatcher was a not uncommon host, but usually not a very frequently chosen one in many areas, it may be added that in Pope County, Illinois, a high incidence of parasitism, as much as 50 percent (of 12 nests examined), was noted by Graber, Graber, and Kirk (1974:35). This is higher than has been found elsewhere, although in parts of Indiana and

of Pennsylvania this flycatcher is a regular, fairly frequent host. Ontario may be added to the areas where this flycatcher is known to be parasitized; 1 nest (out of a total of 24 reported) has been so recorded (Peck, 1975).

TRAILL'S FLYCATCHER

Empidonax traillii (Audubon)

The division of the "Traill's flycatcher complex" into 2 species, the willow flycatcher, *E. traillii*, and the alder flycatcher, *E. alnorum*, necessitates a review of the records of cowbird parasitism of the former composite. So far as may be judged from the data available (the original data slips, from which the early (Friedmann, 1929) compilation was made, are no longer available), most of the eastern records appear to deal with the willow flycatcher. The alder flycatcher, now restricted to the boreal forest region, may be largely allopatric with the brown-headed cowbird.

The following comments, therefore, refer to the willow flycatcher portion of this complex. In their detailed study of the flycatchers of Illinois, Graber, Graber, and Kirk (1974:42) write that "Traill's flycatcher must be very uncommonly parasitized by cowbirds in Illinois, as we know of but 1 other record (Poling 1889) than the 1 reported by Friedmann (1963)." (The latter was a case found near Chicago in 1947.) The absence of Illinois records is certainly puzzling, particularly when we consider the number of cases reported from nearby areas in Michigan and Ohio. We have noted numerous records subsequent to the 1963 compilation (Friedmann, pp. 54–55) from many areas, but none from Illinois. Yet there is no dearth of nest records year after year in Illinois for this flycatcher, and there is no scarcity of cowbirds there.

The Western Foundation's collections contain 237 sets of eggs of this species, 20 of which (8.4 percent) are parasitized. Breaking this down by subspecies, there are 57 sets of nominate *E. traillii*, 7 of which (13.7 percent) have cowbird eggs, and 186 sets of *E. traillii brewsteri*, 13 of which (6.9 percent) are parasitized. This difference seems to be borne out generally: the western populations of *E. traillii* (*E. t. brewsteri*) experience only about half as much parasitism as do the eastern ones (*E. traillii*,

possibly plus *E. alnorum*). The Cornell University nest records files have entries on 130 nests of the Traill's flycatcher (not broken down by races). Only 6 (4.6 percent) of these were parasitized. In Nebraska, Holcomb (1972:55) studied 88 nests of this flycatcher; 7 of these (8.0 percent) were parasitized, but in none of them were any cowbird fledglings produced. The Ontario nest record files have data on 159 nests of the entire Traill's flycatcher complex. Of these, 27 (17.0 percent) were parasitized. Of these 27 cases, 5 are definitely known to refer to *E. traillii* and 1 to *E. alnorum*.

LEAST FLYCATCHER

Empidonax minimus (Baird and Baird)

To the relatively few (19 in Friedmann, 1963:55) earlier records of this flycatcher as a victim of the brown-headed cowbird, we may now add 20 additional instances, an increase of over 100 percent. In 1970, the least flycatcher was noted for the first time in southern Vancouver Island, near Victoria, and was found to be parasitized. This record involves the parasite race *M. ater artemisiae*, as does also a parasitized set of eggs from Alberta, now in the collection of the Delaware Museum of Natural History. Also pertaining to *M. ater artemisiae* are 5 records of parasitized nests of the least flycatcher in Manitoba, 1960–1971, in the files of the Prairie Nest Records Scheme at the Manitoba Museum of Man and Nature.

Two additional records for the eastern race of the cowbird, *M. ater ater*, are: 1 from Marlboro, Massachusetts, 2 June 1912, in the collections of the Western Foundation; and 1 from Ontario in the Ontario nest card files at the Royal Ontario Museum of Zoology. Bull (1974:537) lists 7 instances of parasitism on the least flycatcher in New York State; 6 of these are additions to the 1963 compilation. The Ontario nest records files at Toronto have data on 151 nests of the least flycatcher and 3 of these (2.0 percent) were parasitized.

HAMMOND'S FLYCATCHER

Empidonax hammondi (Xantus)

E. M. Hall found a nest of this flycatcher containing 3 eggs of the host and 1 of the brown-headed cowbird (*M. ater artemisiae*) at Virginia Lakes, Mono County, California, 29 June 1950.

This is the first time Hammond's flycatcher has been reported as a victim of the parasite to our knowledge.

DUSKY FLYCATCHER

Empidonax oberholseri Phillips

Previously known (Friedmann, 1971:242) as a victim of the brown-headed cowbird in California (1 record), Washington (1 record), and British Columbia (2 records), the dusky flycatcher has now been found to be parasitized in southern Alberta (Kondla and Pinel, 1971), near Conquest, Saskatchewan (Prairie Nest Records Scheme), and near Jefferson, Colorado (Kingery, 1974:932). Also, 5 more California records, all from Mono County, may be added: a set of eggs taken 10 June 1934, now in the Santa Barbara Museum of Natural History; 2 other parasitized sets, from June Lake, in the collections of the Western Foundation; and 2 instances of parasitism observed (not collected) by Schmitt—on 21 July 1973 near Poison Creek, and on 31 July 1973 near the Little Walker River—both of fledged young cowbirds attended and fed repeatedly by dusky flycatchers.

This rapid increase in the number of records makes it apparent that the dusky flycatcher is a fairly frequent host choice of the brown-headed cowbird (race *M. ater artemisiae*).

GRAY FLYCATCHER

Empidonax wrightii Baird

Yaich and Larrison (1973:14–16) found a nest of this flycatcher at Wenas Park, 10 miles from Naches, Washington, 26 May 1972. The following day a brown-headed cowbird laid an egg in it alongside the 2 eggs of the host. This is the first record in print for this species as a cowbird victim. Mr. R. M. Lais informed us that another parasitized nest was found in the Malheur Lake area, central Oregon, by T. W. Haislip. In reply to request for more explicit data on this record, Mr. Haislip generously expanded it, as follows. In 1970 and 1971, in the western juniper woodlands of central Oregon, he found the gray flycatcher to be the most abundant breeding bird, averaging about 25 pairs per 100 hectares (cowbirds averaged about 3 "pairs" per 100 hectares). Of 28 nests found, 7 were parasitized; there was 30 percent parasitism in

1970, and 20 percent in 1971. Of the 7 parasitized nests only 3 fledged a single cowbird apiece. In none of the 7 did any of the host young survive, and in no nest was more than a single cowbird egg found.

It appears that the gray flycatcher is a regular host choice of the brown-headed cowbird in central Oregon, and probably is more affected elsewhere than the absence of published records would indicate.

WESTERN FLYCATCHER

Empidonax difficilis Baird

The report of two additional instances of cowbird parasitism on the western flycatcher at Victoria, southern Vancouver Island, by Lemon (1969) bears out the inference derived from earlier cases in that area that this species is probably regularly affected by the parasite. Since Miss Lemon's paper, still another similar case has been reported from the same area on 29 August 1970, a very late date, but considered a valid record by the group of observers at Victoria. In California, from whence 7 records were formerly known (Friedmann, 1963:55-56) 4 more are now added, 3 from Santa Clara County, all presently in the collections of the Western Foundation, and 1 from Solvang, Santa Barbara County, in the Santa Barbara Museum of Natural History.

While the records of cowbird parasitism are increasing in number, the western flycatcher does seem to enjoy a very low frequency of this intrusion, compared to other members of its genus. Of 157 sets of eggs of this species in the Western Foundation, only 6 (3.8 percent) contain cowbird eggs. This relative immunity may be due to the bird's choice of nest sites—cliffs and manmade structures, such as barns and bridges. In this the western flycatcher is similar to the western species of *Sayornis* and the house finch, which use similar nest sites, with similarly slight cowbird parasitism.

WESTERN WOOD PEEWEE

Contopus sordidulus Sclater

To the 7 earlier records of this flycatcher as a victim of the brown-headed cowbird (Friedmann, 1963:57; 1971:242) may be added 2 more: a set of 2 eggs of the host and 1 of the parasite (subspecies

M. ater obscurus) taken at Santa Paula, Ventura County, California, 7 July 1934; and another (involving the cowbird race *M. ater artemisiae*) at Mammoth, Mono County, California, 29 June 1974. Both records involve the host subspecies *C. sordidulus veliei*, and both sets of eggs are now in the collections of the Western Foundation.

OLIVE-SIDED FLYCATCHER

Nuttallornis borealis (Swainson)

A fourth instance of this flycatcher as a cowbird victim was noted in southern Vancouver Island, British Columbia, in 1969: a nest containing 3 eggs of the host and 1 of the parasite, reported to us by Dr. J. B. Tatum. The 3 earlier records were from Alberta and Mono County, California (Friedmann, 1963:57).

VERMILION FLYCATCHER

Pyrocephalus rubinus (Boddaert)

Previously reported as a victim of the brown-headed cowbird a small number of times in Texas, Arizona, and California, the vermilion flycatcher has recently been found to be parasitized at Redrock, Gila Valley, southwestern New Mexico (Hubbard, 1971:25), where, on 13 June 1968, a male vermilion flycatcher was watched repeatedly feeding a recently fledged young brown-headed cowbird. In addition to this record, 3 others—2 of them from Imperial County, California, and 1 from Huachuca Plains, Arizona—are in the collections of the Western Foundation, and 2 from Tucson, Arizona, are in the Santa Barbara Museum of Natural History. All the records from southwestern New Mexico west to California involve the host race *P. rubinus flammeus* and the cowbird subspecies *M. ater obscurus*.

HORNED LARK

Eremophila alpestris (Linnaeus)

Kondla and Pinel (1971) noted the horned lark as a cowbird victim in southern Alberta, the fourth instance known to us of parasitism on the lark race *E. alpestris leucolaema*. Previously we knew but a single record for the subspecies *E. alpestris*

enthymia, to which may now be added 9 more: 4 from Manitoba (3 in the Prairie Nest Records Scheme, and 1 from Lake's End, Manitoba, in the collections of the Western Foundation), and 5 from North Dakota, reported to us by R. E. Stewart. In this latter area the 5 parasitized nests constituted 19.2 percent of a total of 26 active nests noted, a much higher incidence of parasitism than has been reported elsewhere for the horned lark. In 1 of these nests there was excessive multiple parasitism—6 cowbird eggs with 2 of the host's. In New York State, Bull (1974:537) reports 2 parasitized nests of *E. alpestris praticola*. The Ontario nest record files at Toronto reveal that 5 (4.2 percent) of 119 nests reported from that province were parasitized. The Cornell files contain 1 record of a parasitized nest, from Holstein, Nebraska.

BARN SWALLOW

Hirundo rustica Linnaeus

A parasitized nest of this uncommonly victimized bird was collected in McHenry County, North Dakota, 1 July 1931, and is now in the Santa Barbara Museum of Natural History. This is only the second record for the barn swallow (race *H. rustica erythrogaster*) as a host of the northwestern race of the brown-headed cowbird, *M. ater artemisiae*, the previous one being from Manitoba (Friedmann, 1971:243). To the few instances of parasitism by the nominate race of the cowbird known earlier (Friedmann, 1963:59-60) may be added 2 from Ontario (Peck, 1975:10), and a parasitized set of eggs collected in St. Marys County, Maryland, now in the Delaware Museum of Natural History.

Inasmuch as the barn swallow has been found experimentally to be an acceptor species, the small number of observed instances of parasitism on it indicates that it is really very infrequently victimized by the cowbird. This is borne out by the fact that in the nest records files at Toronto, the 2 Ontario records were the only ones out of 1977 nests; in the files at Cornell University, of 3676 nests reported, none were parasitized.

BLUE JAY

Cyanocitta cristata (Linnaeus)

The blue jay is a rarely reported victim; in the 1963 review (Friedmann, p. 61) only 3 (possibly 4)

records were known. Our purpose in discussing it here is merely to point out that it is a rejecter species. Artificial or real cowbird eggs were experimentally placed in 24 nests in Connecticut; these were ejected by the jays from 22 of them. The 2 remaining nests were deserted. A similar experiment on 1 nest in Michigan resulted in an ejection (Rothstein, 1975a). Whether the small number of known cases of parasitism on this species is due to a low rate of actual parasitism, as well as to the observational bias caused by egg ejection, remains to be determined. Purely casual observations, unreliable as they may be, suggest that the blue jay is too large and too aggressive for the cowbird to parasitize to any extent; in other words it seems likely that the actual incidence of parasitism is low.

BLACK-CAPPED CHICKADEE

Parus atricapillus Linnaeus

Previously (Friedmann, 1963:62; 1966:2) only 5 instances were known to us of this bird as a cowbird victim. To these may be added another, from Ontario, the only nest parasitized out of 223 active nests reported to the Ontario nest records files at Toronto.

VERDIN

Auriparus flaviceps (Sundevall)

Austin (1970:432) observed a fledged young brown-headed cowbird (*M. ater artemisiae*) attended and repeatedly fed by a verdin in southern Nevada. This is the first record for the subspecies *A. flaviceps acaciaryum* as a cowbird host; there were earlier records for the eastern race, *A. flaviceps ornatus* (reported as *A. flaviceps annexus* in Friedmann, 1963:64). All of the few earlier records were of eggs only; the present case is the first one of a verdin rearing the young cowbird.

BUSHTIT

Psaltriparus minimus (Townsend)

To the 5 earlier records of this bird as a cowbird victim (Friedmann, 1963:64; 1966:3) may be added

2 more: 1 observed near Victoria, British Columbia (Crowell and Nehls, 1973:911), and 1 at North Saanich, Vancouver Island, 10 June 1973, observed by Stuart Johnston. On geographic grounds these records must refer to the nominate race of the bushtit and to the subspecies *M. ater artemisiae* of the parasite; they are the first records for that race of the cowbird parasitizing the bushtit.

In the case of the record from North Saanich, the nest had been under observation since 1 June, but was found to be damaged, with the entrance enlarged, on 10 June. By 13 June, it was evident that the bushtits had deserted. The nest was then examined and was found to contain three bushtit eggs and one cowbird egg; the nest and eggs are now in the British Columbia Provincial Museum.

WHITE-BREADED NUTHATCH

Sitta carolinensis Latham

This rarely used host was previously (Friedmann, 1963:64-65) known as a cowbird victim only 5 times, from Pennsylvania, Illinois, and New York (once). Bull (1974:537) mentions 3 New York instances, 2 of which are obviously additions to our earlier records.

WRENTIT

Chamaea fasciata (Gambel)

Baptista (1972:881) noted a pair of wrentits attending a fledged young brown-headed cowbird at Lake Merced, San Francisco, 21 July 1969. He correctly allocated this record to the subspecies *C. fasciata intermedia*, the first one reported for that race as a victim of the cowbird (*M. ater obscurus*). Baptista also reported two additional instances of cowbird parasitism on the subspecies *C. fasciata rufula*, observed by Stewart in the Point Reyes Bird Sanctuary, 3.5 miles south of Bolinas, Marin County, California. One of these cases is reported in greater detail by Stewart, Chamberlain, and Story (1971:1004): on 18 May, the nest contained 3 eggs of the wrentit and 1 of the cowbird; on June 9 it contained only the young parasite, which fledged on the following day.

There are still less than a dozen recorded instances of the wrentit as a cowbird victim, but no less than 3 races of the host are involved in them.

BEWICK'S WREN

Thryomanes bewickii (Audubon)

This wren is seldom reported as victimized by the brown-headed cowbird, but 4 of its subspecies—*T. b. bewickii*, *T. b. cryptus*, *T. b. altus*, and *T. b. calophonus*—are involved in the 8 previously known instances (Friedmann, 1971:243). We may now add 6 more records, as follows. To the single previous case of *T. b. calophonus* as a victim (Friedmann, 1971:243) may be added 4 more: Lemon (1969:395) found a parasitized nest at Victoria, southern Vancouver Island, on 12 June 1967, and 3 additional cases from the same area since then have been reported to us by J. B. Tatum, suggesting that in southern Vancouver Island this wren may be more frequently parasitized than it is known to be elsewhere. In the nest reported by Lemon, the wrens reared the young parasite but none of their own young.

A third record for the nominate race of the wren, observed in Tennessee (Cornell University nest record cards), is also mentioned in Lemon's paper. Finally, an additional instance of the race *T. b. cryptus* as a cowbird victim is a parasitized set of eggs, taken at San Angelo, Tom Green County, Texas, 30 April 1954, in the collection of the Delaware Museum of Natural History.

CAROLINA WREN

Thryothorus ludovicianus (Latham)

Previously (Friedmann, 1963:39, 68) this uncommonly selected host had been known on 1 occasion, out of a dozen instances of parasitism, to rear a young cowbird to the fledging stage. A new observation indicates a much greater successful host potential for this wren. Luther (1974) reported a nest in which no fewer than 3 of the young parasites were reared to the fledging stage, an unexpected proof of the ability of a pair of these wrens to raise, not 1, but 3 nestlings, each larger than their own. There were originally 2 young wrens in the nest as well, but they died early in the competition for food with their parasitic nestmates.

At the time of the 1963 compendium (Friedmann, p. 68) only 14 instances of cowbird parasitism on this wren were reported. To these may

be added the following. In Anne Arundel County, Maryland, in 1973 and 1974, Paul Woodward, together with Eugene S. Morton, found 13 nests of this bird, 9 in "natural" settings and 4 on man-made structures. Of these, 5 (all nests in natural sites) were parasitized, and each of these fledged 1 or more young cowbirds but no young wrens. The failure of the wren nestlings may be due to the much longer incubation period of their species, giving too great an advantage to the more rapidly developing parasites. In Ontario the Carolina wren appears to be free of cowbird parasitism (16 nests reported to the files at Toronto, none with cowbird eggs).

GRAY CATBIRD

Dumetella carolinensis (Linnaeus)

Before the experimental studies discussed earlier in this paper, the gray catbird and the American robin were the only species known to eject cowbird eggs frequently. But the actual incidence of ejection was not known. Experiments on 53 catbird nests resulted in 50 (94.3 percent) ejections. The cowbird eggs in the 3 remaining nests were accepted. The experiments were conducted in Connecticut, Manitoba, Nebraska, Michigan, and Maryland (Rothstein, 1975a).

Experiments on 17 additional nests show that after egg laying has ceased, catbirds correctly distinguish between their own and foreign eggs in a number of different contexts. Catbirds always ejected cowbird or other types of foreign eggs even when these egg types outnumbered the catbird's eggs or were the only types present (Rothstein, 1975c). These experiments were done to test Rensch's (1925) question of whether birds that reject parasitic eggs actually recognize either their own or the parasitic egg, or whether they simply reject the egg type that is in the minority. In nearly all cases the parasitic egg is in the minority, so rejection could function efficiently as a host defense even if birds did not recognize their own or a parasitic egg. Contrary to the generally held belief, the experiments showed that catbirds do indeed "know" the appearance of their own eggs. Other experiments (Rothstein, 1974) suggested that catbirds learn the appearance of their egg type from the first egg(s) they lay and that it is possible to

"teach" a catbird that a cowbird egg is its own egg type if eggs are experimentally switched shortly after laying begins.

The Ontario nest records files at Toronto include 9 instances of cowbird parasitism on the gray catbird; these constitute 1.3 percent of 707 nests reported; the files at Cornell University record 4 instances (out of 367 nests in all), 3 from Michigan and 1 from Kentucky.

BROWN THRASHER

Toxostoma rufum (Linnaeus)

Experiments showed this species to be a rejecter. Artificial or real cowbird eggs were ejected from 25 nests and accepted at only 1 (Rothstein, 1975a). These experiments were conducted in Connecticut, Nebraska, Michigan, and Manitoba. It was not previously known that the brown thrasher typically ejects cowbird eggs but there are at least 5 known cases in which naturally deposited cowbird eggs disappeared from thrasher nests (see Rothstein, 1975a, and Graber, Graber, and Kirk, 1970:30). In 1 instance reported by Mengel and Jenkinson (1970) the investigators believed that the cowbird rather than the thrashers removed the cowbird egg. But because Mengel and Jenkinson did not actually see the cowbird remove her own egg and because their belief is based on only 1 nest, their suggestion that cowbirds remove their own eggs is in need of further substantiation. Whether thrashers alone or cowbirds and thrashers remove cowbird eggs, it is clear that the amount of parasitism detected is only a fraction of the actual parasitism that occurs. Graber, Graber, and Kirk (1970) detected parasitism at 2 percent of all brown thrasher nests in their study area of northern Illinois. This sounds like a very low figure until the biases are accounted for. The 2 percent of thrasher nests recorded as parasitized were probably ones at which acceptance (as well as parasitism) occurred; parasitism was unlikely to have been detected at other nests where ejection occurred. The experiments cited above showed that acceptance occurs at only 1 in 26 nests. This means that if each of the 2 percent of the nests recorded as parasitized was an acceptance, then the actual rate of parasitism was about 26 times as high, or 52 percent. If only half the nests observed to be parasitized resulted

finally in acceptances, then the actual rate of parasitism was 26 percent.

The brown thrasher is the only rejecter species discovered so far that may on occasion have difficulty distinguishing between its eggs and those of the cowbird. Thrasher eggs are larger and are evenly marked with fine speckles throughout their surface while cowbird eggs have fewer but larger speckles that are often concentrated at the wider pole. Unusually large cowbird eggs with a thrasher-like maculation, however, are sometimes found (S.I.R., pers. observ.). If thrashers, on occasion, have difficulty distinguishing cowbird eggs from their own eggs, then the experiments may have slightly overestimated the rate of rejection that would occur in natural parasitism because the artificial and real cowbird eggs used in the experiments were strongly distinct from thrasher eggs. The experiments, however, still provide a reliable measure of the frequency of thrasher nests at which rejection of nonmimetic eggs occurs. P. F. Elliott, moreover, has informed us that in Riley County, Kansas, in 1974 and 1975, 3 of 8 brown thrasher nests were parasitized and in none of them were the cowbird eggs ejected. One nest fledged 3 thrashers and a cowbird.

Throughout the total range of the brown thrasher the number of observed cases of parasitism reported shows a growth from 31 in 1963, to 79 in 1975. The fact that this species is known to be a rejecter makes it probable that it is parasitized considerably more frequently than the relatively small number of records indicate (relative, that is, to the total number of nests found by observers). The nest records at Cornell University show 15 instances of parasitism among 1038 nests reported. These are distributed as follows: Kansas 2, Maryland 1, Michigan 1, Minnesota 1, Missouri 2, Nebraska 4, New York 2, Wisconsin 2. The Ontario nest record files at Toronto include 14 such cases out of 484 nests reported. The collections of the Western Foundation have 156 sets of eggs of this bird, 3 of which (1.9 percent) were parasitized. Indeed, if we may cite negative evidence, it seems that thrashers generally are not molested to any degree by the brown-headed cowbird. Some 9 species of thrashers are sympatric in their breeding range with the cowbird, but the brown thrasher is the only one for which there are numerous records of parasitism. Three other species of *Tox-*

ostoma (*T. longirostre*, *T. bendirei*, and *T. curvirostre*) and 1 of *Oreoscoptes* (*O. montanus*) have but a single record apiece; the other 4 species of *Toxostoma* (*T. redivivum*, *T. lecontei*, *T. dorsale*, and *T. ocellatum*) have never been reported as cowbird victims. We have no information as to the reactions (accepter or rejecter) of any of these species except *T. lecontei*, which is an accepter (S.I.R., unpublished experiments).

Lest it seem that the paucity, or absence, of instances of cowbird parasitism on thrashers of the genus *Toxostoma*, other than *T. rufum*, be due to small numbers of nests found, it may be mentioned that the Western Foundation's collections contain the following large series of sets of eggs, all from areas of sympatry with the brown-headed cowbird, and none of them with any of the parasite's eggs: *T. longirostre*, 62 sets; *T. bendirei*, 88 sets; *T. curvirostre*, 228 sets; *T. redivivum*, 245 sets; *T. lecontei*, 140 sets; and *T. dorsale*, 83 sets.

The absence of cowbird eggs in all these sets may be due to absence of parasitism or to a possible rejecter response to them by the species of thrasher.

AMERICAN ROBIN

Turdus migratorius (Linnaeus)

Information on natural parasitism of the robin has changed little since the 1963 review (Friedmann, pp. 72-73). We include this species mainly to report the experimental parasitizations. The experimental results confirm the widespread belief that the robin typically rejects cowbird eggs and allow a quantification of that belief. Artificial or real cowbird eggs were rejected at 45 of 46 nests. Seven of the rejections were by nest desertion and the remainder by egg ejection (Rothstein, 1975a). These experiments were done in Connecticut, Michigan, Nebraska, Maryland, Manitoba, and New Brunswick.

Recent data of considerable magnitude on the incidence of parasitism on the robin are as follows. The files at Cornell University show 7 instances among 7482 nests reported (a little over 0.1 percent) distributed among Maryland, Massachusetts, Nebraska, New York, and Wisconsin; the files at Toronto show 9 instances among 3586 nests (a little under 0.3 percent) in Ontario. An unusually high incidence of parasitism was reported to us by P. F.

Elliott who found cowbird eggs in 2 out of 5 nests in Riley County, Kansas, in 1974 and 1975. The cowbird eggs disappeared, presumably ejected by the robins, on the day they were laid or on the next day. Also, robin eggs disappeared from both parasitized nests, possibly by removal by the cowbirds. It is of interest that cowbirds are able to carry off eggs as large as those of the robin (see also Blincoe, 1935; Rothstein, 1975a).

The robin and the gray catbird both show close to 100 percent rejection, but they differ in the time taken for rejection. Forty-five robin and 52 catbird nests were visited the day after they were parasitized experimentally. The cowbird egg had not yet been rejected at 42.2 percent of the robin nests but only 23.1 percent of the catbirds had not rejected after 1 day. This comparison is statistically significant. Other lines of evidence also indicate that catbirds are more intolerant than robins of foreign eggs (Rothstein, 1975c). Thus, cowbird eggs placed in robin nests are more likely to be found and reported than those placed in catbird nests. Therefore, if numbers of cases of observed parasitism are similar in both species, then the actual parasitism is likely to be higher in the catbird. As it happens, the 1963 review (Friedmann, pp. 69-70, 72-73) noted 26 cases of parasitism for both species. Furthermore, the total number of robin nests that have been examined is greater than that of catbird nests, since the former species is more abundant, is more widespread, and has a more easily found nest. Thus cowbird eggs are observed in a higher percentage of the total of catbird nests examined than of robin nests, even though they probably disappear more rapidly from the former.

These findings strongly imply that cowbirds parasitize catbirds more frequently than they do robins, although they have virtually no chance of success with either species. Whether this probable difference is due to host preference by the cowbird or to some other factor (such as differences in defense of the nest) is uncertain.

WOOD THRUSH

Hylocichla mustelina (Gmelin)

The high incidence of cowbird parasitism on the wood thrush in Iowa and Minnesota noted earlier

(Friedmann, 1963:73-74) is repeated in Illinois according to Graber, Graber, and Kirk (1971:16). They write that, from their own records and from the literature, they have egg data on 69 nests, 33 of which (47.8 percent) were parasitized. Their records cover various parts of Illinois, and the incidence of parasitism is similar in all areas covered. The Western Foundation has 97 sets of eggs of the wood thrush, 6 of which (6.2 percent) have 1 or more cowbird eggs. The Cornell University files have data on 409 nests of this thrush, 55 of which (13.4 percent) were parasitized; the Ontario nest records files show a higher incidence of parasitism—36 cases (30.5 percent) of 118 nests. Harrison (1975:204) found an even greater frequency in Pennsylvania, where 11 out of 12 nests observed had cowbird eggs.

HERMIT THRUSH

Catharus guttatus (Pallas)

The subspecies *C. guttatus sequoiensis* had been previously reported as a victim of the brown-headed cowbird but once (Friedmann, 1963:75, at which time the record was erroneously referred to the race *C. guttatus polionotus*). Two additional records are in the collections of the Western Foundation; they are, like the first one, from Mono County, California—10 June 1936 and 12 June 1950, respectively. Bull (1974:537) reports a surprising 16 instances of parasitism in New York State on the eastern hermit thrush, *C. guttatus faxoni*; 14 of these are additions to our earlier records. From Ontario (Ontario nest records files, Toronto), come another 5 instances out of 84 nests reported, an incidence of parasitism of 6.0 percent in that province.

SWAINSON'S THRUSH

Catharus ustulatus (Nuttall)

The nominate race of this thrush had previously (Friedmann, 1963:75) been recorded only twice as a victim of the dwarf race of the brown-headed cowbird (*M. ater obscurus*). Five more records, from Santa Barbara, Los Angeles, and San Luis Obispo counties, California, may now be added; the sets

are in the Santa Barbara Museum of Natural History and the Western Foundation. In Alberta, Kondla and Pinel (1971) reported a sixth instance of parasitism on the race *C. ustulatus swainsoni* by the cowbird, *M. ater artemisiae*. In southern Vancouver Island, in July 1971, 2 records of parasitism on this thrush were noted, and were reported to us by Dr. J. B. Tatum.

VEERY

Catharus fuscescens (Stephens)

Although the veery subspecies *C. fuscescens salicicola* was previously known to be parasitized by the brown-headed cowbird, a new picture of the extent to which it is imposed upon in the western prairie provinces of Canada is revealed by the files of the Prairie Nest Records Scheme which include 14 such instances in Alberta, Saskatchewan, and Manitoba, out of a total of 28 nests reported, or an incidence of 50 percent. These records suggest some geographical difference in the frequency of parasitism. In Alberta and Manitoba 8 nests were reported, all but 1 of which were parasitized, while in Saskatchewan 20 nests were reported, 7 of which (35.0 percent) had cowbird eggs or young in them.

One of us (S.I.R.) noted 2 additional cases of parasitism among 3 nests of this thrush found near Delta, Manitoba, in late June and July 1970. When found, 1 of the nests had 3 veery nestlings, 1 cowbird nestling, and 1 veery egg. The other nest eventually held 1 veery egg and 4 cowbird eggs although initially 3 veery eggs were present with the 4 of the cowbird. The single veery egg left in the nest hatched on 3 July, even though its shell had 3 or 4 small holes in it 4 days earlier, presumably inflicted by an adult cowbird. The nest was destroyed by a predator before any of the cowbird eggs hatched. That the veery may be prone to multiple parasitism is suggested by Harrison's experience (1975:161); he found 3 parasitized nests at Oconto, Wisconsin, containing 3, 3, and 5 cowbird eggs, respectively.

In the collections of the Western Foundation, 5 (9.6 percent) of 52 sets of eggs of this species are parasitized. The Ontario nest records files at Toronto have data on 139 nests, 28 of which (20.1 percent) were parasitized.

EASTERN BLUEBIRD

Sialia sialis (Linnaeus)

An unusually high incidence of cowbird parasitism on this ordinarily infrequently reported victim was reported by Musselman (1946) in Illinois, where, in 1945, out of a total of 268 active nests examined, 7 (2.6 percent) contained eggs of the brown-headed cowbird. Previously (Friedmann, 1963:76-77) only a single Illinois record, and only 30 from the entire range of the eastern bluebird, were known to us. Two further Illinois records may be noted: 1, from Bureau, is now in the Santa Barbara Museum of Natural History; another, from near Amboy, is in the collections of the Western Foundation. Pinkowski (1974:45) has recently reported 2 parasitized nests in Michigan. The nest data in the files at Cornell University contain records of 8435 nests, of which only 6 (0.07 percent) had cowbird eggs in them. The Toronto files show 3 parasitized nests out of 1367 reported, an incidence of 0.2 percent in Ontario.

MOUNTAIN BLUEBIRD

Sialia currucoides (Bechstein)

Dr. J. Lane informs us that 1 egg of the brown-headed cowbird was found with 3 of the mountain bluebird in a nest box 4 miles southwest of Kimnay, Manitoba, in July 1972. This is only the third record for this bluebird as a cowbird victim; the others were in Alberta and British Columbia (Friedmann, 1963:77; 1971:244). That the mountain bluebird is really an extremely unusual host is evidenced by the fact that the Brandon, Manitoba, junior bird students have erected 3500 bluebird nest boxes since 1959, at intervals of a few hundred feet, on tops of fence posts, for about 1000 miles in southwestern Manitoba, and this was the only instance of cowbird parasitism they noted. In 1971, 646 pairs of bluebirds, mostly mountain bluebirds, raised their young in these boxes and over 2600 nestlings were banded; in 1972, over 4100 nestling bluebirds were banded, with no young cowbirds among them. As mentioned in an earlier compendium (Friedmann, 1963:77), the British Columbia nest records scheme showed no instance of cowbird parasitism in their records of 115 nests of the mountain bluebird.

BLUE-GRAY GNATCATCHER

Polioptila caerulea (Linnaeus)

The blue-gray gnatcatcher is now a fairly well documented host of the brown-headed cowbird (39 records in Friedmann, 1963:77-78), and the only reason for mentioning it in this paper is to add a notable increase in our data for its western subspecies *P. caerulea amoenissima* in California. In the collections of the Western Foundation there are 8 parasitized sets of eggs from California, from Stockton south to San Diego County. The total number of sets of blue-gray gnatcatcher's eggs (all races), from the United States and Canada, but not counting Mexico, in the Western Foundation's collections is 153, out of which 13 (8.5 percent) are parasitized. Breaking this down to subspecies, we have *P. caerulea caerulea*, 48 sets, 5 (10.4 percent) parasitized; *P. caerulea amoenissima*, 105 sets, 8 (7.6 percent) with cowbird eggs.

BLACK-TAILED GNATCATCHER

Polioptila melanura Lawrence

In central Coahuila, Mexico, W. K. Taylor (1966:136-137) found the nominate race of this gnatcatcher to be victimized by the brown-headed cowbird (*M. ater obscurus*). Previously 3 other races of this host had been so recorded—*P. m. californica*, *P. m. lucida*, and *P. m. margaritae*—but Taylor's record is the first one for typical *P. melanura* in print. A second record is a parasitized nest found in the Big Bend National Park, Texas, 6 June 1969, reported by Wauer (1973:143); a third and fourth are 2 sets of eggs from near Gonzalez, Tamaulipas, Mexico, now in the collections of the Western Foundation. Inasmuch as the total number of records for all races of this gnatcatcher is fairly few, it may be noted that the Western Foundation has in its collections 4 more parasitized sets of eggs of *P. m. lucida* from Arizona and Sonora, and 1 more of *P. m. californica* from Riverside County, California. These bring the number of records up to 27.

The Western Foundation has 87 sets of eggs of this gnatcatcher, not counting some from Baja California. Of these, 10 (11.5 percent) are parasitized; of nominate *P. melanura* there are 2 sets,

both with cowbird eggs; of *P. melanura lucida*, 34 sets, 7 (20.6 percent) parasitized; of *P. melanura californica*, 51 sets, only 1 of which has a cowbird egg.

GOLDEN-CROWNED KINGLET

Regulus satrapa (Lichtenstein)

To the 2 earlier records of the kinglet as a host of the brown-headed cowbird (Friedmann, 1971:245) may be added 4 more. Lemon (1969) mentioned a fledged young cowbird attended by a golden-crowned kinglet near Victoria, southern Vancouver Island, 1 August 1967, the same area from which both of the earlier records had come. This makes it seem that this unusually small host may be victimized there fairly regularly. Near Bellingham, Washington, on 2 August 1973, another instance of a young cowbird with golden-crowned kinglets as its fosterers was observed by Lavers (1974). All these records involve the host race *R. satrapa olivaceus* (the allocation of the 2 earlier records to *R. satrapa amoenus* was an error), and the parasite race *M. ater artemisiae*. A record from Highland Forest, Onandaga County, New York (Crumb, 1974) is the first for *R. satrapa satrapa* and *M. ater ater*. A second, from Maine, is recorded by Harrison (1975:164).

RUBY-CROWNED KINGLET

Regulus calendula (Linnaeus)

In spite of its diminutive size, the ruby-crowned kinglet must be rated as a regular, if not a favorite, host choice of the brown-headed cowbird. To the 10 previously reported instances of parasitism (Friedmann, 1971:245) may be added 4 more, 3 from Mono County, California. These 3 are represented by 2 sets of eggs in the Santa Barbara Museum of Natural History and another set in the Western Foundation. These California records all refer to the race *R. calendula cineraceus* of the host and *M. ater artemisiae* of the parasite. The fourth record is from Mt. Desert Island, Maine (Harrison, 1975:165).

CEDAR WAXWING

Bombycilla cedrorum Vieillot

Since the last review, significant new information on this species has come to light. Experiments show it to be a rejecter species. Rejection of artificial or real cowbird eggs occurred at 40 of 58 nests, 69.0 percent (Rothstein, in press(b)). Two of these nests were located in Manitoba, 1 in New Brunswick, and the rest in Michigan. Unlike other rejecters, waxwings showed a nest stage-dependent response. Waxwings parasitized on or before the third day of incubation rejected at an 87.5 percent rate. Those parasitized after the third day of incubation rejected at a 40.0 percent rate. Since most natural parasitism occurs during the host's laying period, 87.5 percent is close to the figure for the rate at which natural parasitism is rejected. Instead of ejecting cowbird eggs, the rejection mode used almost exclusively by most rejecters, most (60.0 percent) waxwing rejections were by nest desertion. In addition to these differences, most waxwings wait at least 1 day before rejecting, whereas in other species most individuals reject within 1 day.

The fact that waxwings reject cowbird eggs helps to explain the small number of observed cases of parasitism on this widespread, abundant species. In the 1966 paper (Friedmann, p. 3) only 22 cases were noted, but this figure has now more than doubled. In the collections of the Western Foundation there are 3 parasitized sets of eggs, 1 each from Illinois, Massachusetts, and Ontario; the Delaware Museum has 1 parasitized set from New York; the Toronto files include 24 parasitized nests, constituting 6.5 percent of 372 nests reported from Ontario; in the Prairie Nest Cards Scheme are 2 more from Manitoba. Bull (1974:537) notes 7 cases of parasitism in New York State; 5 of these are additional to our earlier figures. One of us (Rothstein, in press(a)) has surveyed data on 334 nests from Cheboygan and Emmet counties, Michigan. Cowbird eggs or young were seen in 25 (7.5 percent) of these Michigan nests. The Michigan data were collected between 1924 and 1969. These new data show that in at least one area the waxwing is a regular host. Furthermore, the rate of observed parasitism is just a minimum figure for the rate of actual parasitism, as the bulk of cowbird parasitism on this rejecter species may go undetected.

The partly frugivorous diet waxwings feed their

nestlings makes it probable that cowbirds, even if accepted, would often die because of inadequate nourishment. Thus, the waxwing offers cowbirds little chance of reproductive success. But the fact that there are now over 50 known cases of parasitism on this species shows that the cowbird not infrequently victimizes unsuitable hosts to its own loss. Such a wastage of reproductive potential seems contrary to basic evolutionary principles. At the same time, it is not always to its loss, as instances have been reported where the waxwings accepted and reared the young parasites (Friedmann, 1963:40, 81).

It may well be that the waxwing's habit of rejecting the cowbird eggs as a rule played an important role in the experience of the late L. M. Terrill (1961:5) in southern Quebec, where, in over 50 years of field work, he found 329 nests of this species, but found cowbird eggs in only 4 of them. The fact that the waxwing is a relatively late breeder and often nests after the cowbird's laying season is past its height, probably is also partly responsible for the low incidence of parasitism in Terrill's observations.

Recently De Sante and Le Valley (1971:904) reported a parasitized nest from near Berkeley, California. This is the first record of the waxwing as a host of the dwarf race of the cowbird *M. ater obscurus*, and is also an extension of the breeding range of the waxwing in California.

STARLING

Sturnus vulgaris Linnaeus

At Berkeley, California, on 10 May 1969, Harriet P. Thomas (1973:207) watched a starling repeatedly feeding a large fledgling brown-headed cowbird. The repetitive feeding indicated a foster-parent-parasite relationship, not a casual response to the food call of a strange fledgling. This observation is the first evidence that the starling can and does rear the parasite, and it is also the first record of the starling's being parasitized by the southwestern race of the cowbird *M. ater obscurus*. The two previous records of the starling as a cowbird victim were in Maryland and Illinois. The aggressive and pugnacious nature of the starling, coupled with its habit of nesting in holes, apparently keeps it largely free of cowbird molestation.

BLACK-CAPPED VIREO

Vireo atricapilla Woodhouse

Although no quantitative data are given, Oberholser (1974:842) implies that this vireo is becoming increasingly imposed upon in Texas, where manmade changes have resulted in growth of the cowbird population, especially in the Edwards Plateau. There the black-capped vireos are said to be "finding it more difficult to raise their own young" because of the greater abundance of the parasites. This does not support Graber's contention (1961:325-326) that the black-capped vireos (both sexes) tend to sit on the nest after the first egg is laid, a habit of covering the eggs that might safeguard them from cowbird parasitism. However, Graber's own observations show that this is far from totally protective, as she writes (p. 335) that this vireo suffers large reproductive losses due to cowbird parasitism: "Its nesting success is low compared to that of other passerines, but not lower than that of a closely related, more widely distributed species, *Vireo bellii*."

In Graber's experience cowbird eggs are usually deposited before the vireo's clutch is completed. The cowbird egg hatches 2 to 4 days before those of the vireo,

and by the time the young vireos hatch, the cowbird outweighs each of them more than ten times. In one nest, a three-day old cowbird weighed 11.31 grams while its nest mate, a newly hatched vireo, weighed 0.86 grams. The cowbird is able to raise its head far above the vireo in begging, and gets most of the food. The cowbird requires about as much food as four vireo chicks so it is hungry and begs most of the time. The vireo chick gets scarcely any food, and is trampled and crushed by its parasitic nestmate. After a day or two, the vireo chick dies and its body is removed (p. 330).

In addition to the one-sided competition between nestlings of the vireo and the cowbird, Graber's figures on egg losses are impressive evidence of what the vireo suffers. In 76 active nests that she studied, a total of 243 vireo eggs were laid, more than half of which, or 134 (55 percent), were lost before hatching, and of these she estimates cowbird parasitism was responsible for the loss of 97 (72 percent). She concludes that the black-capped vireo's low reproductive success is "probably compensated for by the survival rate and longevity of adults."

WHITE-EYED VIREO

Vireo griseus (Boddaert)

Two instances of parasitism in Ontario (out of 2 nests reported to the nest records files, Toronto) extend to the northwest the area over which the white-eyed vireo is known to be affected by the cowbird.

HUTTON'S VIREO

Vireo huttoni Cassin

To the 8 earlier records of this vireo as a victim of the brown-headed cowbird (Friedmann, 1963:83) may be added 5 more: 3 from California (San Luis Obispo, Ventura, and Santa Barbara counties) in the Santa Barbara Museum of Natural History and the Western Foundation; 1 from near Victoria, British Columbia (Crowell and Nehls, 1973:911); and 1 from Oregon, reported by Anderson (1970:420). In the 1963 summary of available information, 2 records were considered as involving the host race *V. huttoni stephensi*, 1 from New Mexico, and 1 from Brewster County, Texas. The former is correctly allocated to *V. h. stephensi*, but the latter can only refer to *V. huttoni carolinae*, a subspecies not hitherto reported among the victims of the parasite. The record from Victoria, Vancouver Island, refers to the host race *V. huttoni insularis*, which is the first one reported for that form.

BELL'S VIREO

Vireo bellii Audubon

The various races of Bell's vireo have long been known to be frequent victims of the brown-headed cowbird, a situation that is even more strongly emphasized by the rapid accumulation of additional instances. In 1963 there were some 82 actual instances compiled; by 1975 this has grown by more than 50 percent. The Western Foundation alone has in its collections some 46 parasitized sets of eggs (23.3 percent) out of a total of 197 sets. By subspecies, the figures are: *V. bellii bellii* and *V. bellii medius*, 58 sets, 17 (29.3 percent) parasitized; *V. bellii arizonae*, 13 sets, 5 (38.4 percent) parasitized; *V. bellii pusillus*, 120 sets, 24 (20.0 percent) parasitized.

There is a possibility that the high incidence of parasitism on this bird in southern California, coupled with an accelerated rate of destruction of its habitat may be causing it locally to diminish critically in numbers. Similarly, in the central valley of central and northern California, Remsen and Gaines (1973:916) considered that this vireo, as well as the yellow warbler and the yellowthroat, were nearly extinct, "probably due to cowbird parasitism." The excessive victimization of Bell's vireo is also noted in southern Texas, where, in 1971, 23 nests were reported and 17 of these contained cowbird eggs or young (Webster, 1971:877).

YELLOW-THROATED VIREO

Vireo flavifrons Vieillot

In 1963 (Friedmann, pp. 85-86) it was concluded that the frequency of cowbird parasitism on this vireo varied from place to place, but that quantitative data were still meager. It may be noted that the Ontario nest records files at Toronto reveal that 17 (32.7 percent) of 52 nests reported from the province were parasitized.

SOLITARY VIREO

Vireo solitarius (Wilson)

New information has been amassed on the western race of this vireo, *V. solitarius cassinii*, hitherto reported as a victim of the brown-headed cowbird only 7 times in print (Friedmann, 1963:87). To these records may be added 10 more: 3 from southern Vancouver Island—Victoria (Crowell and Nehls, 1973:911), Alouette Lake, 1 August 1970, and Saanich, 28 July 1973 (the last 2 reported to us by Dr. J. B. Tatum); and 7 from California—Tulare, Santa Barbara, Ventura, Tuolumne, and Alameda counties—4 of which were found by E. M. Hall or by R. J. Quigley.

The vireo subspecies *V. solitarius plumbeus* was previously reported as a victim even less frequently than *V. s. cassinii*, but here again, hitherto unpublished records raise the number by 4 cases, all from Arizona, reported to us by Hall. The Western Foundation's collections contain a total of 166 sets (of all races of the vireo), 8 of which (4.8 percent) are parasitized. It so happens that all 8 are of the subspecies *V. solitarius cassinii*, forming 6.1 percent

of the 131 sets of eggs of that race in the collections. That the solitary vireo is, indeed, more often victimized in the west than in the east is shown by the total of all records known to us: *V. solitarius solitarius*, 6; *V. solitarius alticola*, 2; *V. solitarius plumbeus*, 15; *V. solitarius cassinii*, 17.

RED-EYED VIREO

Vireo olivaceus (Linnaeus)

Of 27 nests from Saskatchewan, Manitoba, and Alberta reported to the Prairie Nest Cards files at the Manitoba Museum, 5 had cowbird eggs in them, a lower incidence of parasitism than obtains farther south and east. We may recall that in the Douglas Lake area of Michigan, Southern (1958) reported cowbird eggs in 72.1 percent of the nests of this vireo (75 parasitized out of 104 active nests studied). Other sizeable samples reported in the 1963 compilation (Friedmann, pp. 88, 89) showed 36.4 percent parasitism in Ohio and 41.3 percent in southern Quebec. The nest records files at Toronto show 65 cases of parasitism out of 240 nests in Ontario (27.1 percent).

Although this vireo often deserts its nest if a large number of cowbird eggs are laid or if all the vireo eggs are removed by cowbirds (Southern, 1958), there are several cases known in which vireos continued to incubate clutches consisting only of cowbird eggs. Incubation of 5 cowbird eggs continued at 1 of the nests studied by Southern (1958:195) after the 2 vireo eggs that were present were removed (presumably by cowbirds). Harrison (1975:172) cites a bird incubating at a Pennsylvania nest that contained 4 cowbird and no vireo eggs. One of us (L.F.K.) found that incubation of 3 cowbird eggs continued after he removed the only vireo egg from a nest in Cabell County, West Virginia. Another of us (S.I.R.) studied a comparable nest at the University of Michigan Biological Station, Pellston, Michigan. This last nest had a number of unusual features. Two cowbird eggs were laid on one morning and the 6 cowbird eggs the nest eventually held were laid over a span of at least 9 days. When discovered on 18 June 1963, the nest held 1 vireo egg and 2 cowbird eggs. The vireo egg disappeared on 25 or 26 June, but incubation of the 6 cowbird eggs then present continued until at least 8 July. The nest was probably abandoned

on 9 July, and the cowbird eggs were removed (presumably by a predator) by 10 July. Thus, incubation continued for about 21 days, during the last 13 or 14 of which the nest held no host eggs. It is likely that the cowbird eggs failed to hatch because their combined mass was too great to allow successful incubation by a bird as small as a vireo (see Friedmann, 1963:21–22 for a discussion of the incubation capabilities of hosts).

PHILADELPHIA VIREO

Vireo philadelphicus (Cassin)

To the 2 earlier records (Friedmann, 1963:89) of this very rarely reported victim may be added 4 more: 2 parasitized nests found in Ontario (out of a total of 24 nests) recorded in the Ontario nest records files at the Royal Ontario Museum of Zoology; another, also from Ontario (Humber River, 15 June 1915), now included in the collections of the Western Foundation; and a sight record of a Philadelphia vireo attending a fledged young cowbird near Pyramid Lake, Jasper National Park, Alberta, noted by Rogers (1972:881).

Inasmuch as very few sets of eggs of the Philadelphia vireo are to be found in collections, it may be that these 6 records of parasitism indicate a relatively high incidence of cowbird interference.

WARBLING VIREO

Vireo gilvus (Vieillot)

While the warbling vireo, as a species, is well known as a frequent victim of the brown-headed cowbird, its western population, forming the race *V. gilvus leucopolius*, has been so reported in print only twice (Friedmann, 1963:90). Six more instances may be added: a parasitized set of eggs taken in Tuolumne County, California, 6 June 1939, now in the collections of the Western Foundation; a statement (Crowell and Nehls, 1973:911) of this vireo's being parasitized in the Victoria area, Vancouver Island; and 4 records from Saskatchewan and Manitoba in the Prairie Nest Records files at the Manitoba Museum. In Ontario the incidence of cowbird parasitism on this vireo (*V. g. gilvus*) is unusually low: 1 such nest out of a total of 62, or 1.6 percent (Peck, 1975).

BLACK-AND-WHITE WARBLER

Mniotilta varia (Linnaeus)

In the earlier compendium (Friedmann, 1963:91) but a single instance was noted of this warbler as a victim of the northwestern race of the cowbird, *M. ater artemisiae*. We may now add 2 more cases observed in Alberta (Prairie Nest Records).

SWAINSON'S WARBLER

Limnothlypis swainsonii (Audubon)

To the 14 earlier records of the Swainson's warbler as a cowbird victim (Mississippi, North Carolina, Oklahoma, and West Virginia) may be added 1 more—a set of 2 eggs of the warbler and 1 of the cowbird, collected at Phyzizy's Swamp, Savannah River, South Carolina, on 2 June 1899, now in the holdings of the Western Foundation.

TENNESSEE WARBLER

Vermivora peregrina (Wilson)

To the small number of previous records (Friedmann, 1963:94–95) of this warbler as a cowbird victim may be added 2 more from Alberta, 1 in 1956 (Prairie Nest Record Cards), a nest containing two half-grown young cowbirds and one addled warbler egg, and another in 1974, which was 1 out of 4 nests found that year.

GOLDEN-WINGED WARBLER

Vermivora chrysoptera (Linnaeus)

A nest of this warbler containing 3 eggs of the host and 1 of the brown-headed cowbird, found on Little George Island, in Lake Winnipeg, Manitoba, 5 July 1971, reported by Houston (1971:872), is the first record of this species as a victim of the northwestern cowbird, *M. ater artemisiae*. The nominate race of the parasite was previously reported as imposing on the golden-winged warbler only occasionally; a total of 17 instances up to 1963 (Friedmann, p. 93) had been recorded. To these may be added 19 more: 2 from Massachusetts (from Malden and Bradford), now in the collections of the Western Foundation; 9 from New York (Bull (1974:537) lists 11 cases, 2 of which were included in our ear-

lier figures); and from Ontario, 8 out of 22 nests reported (Ontario Nest Records) an incidence of 36.4 percent.

BLUE-WINGED WARBLER

Vermivora pinus (Linnaeus)

In the 1963 compilation (Friedmann, p. 94) mention was made of 35 records of this warbler as a cowbird victim. Only 1 of these instances was from New York State. Bull (1974:537) notes 16 such cases of parasitism from that area, a notable increase in the available data, both locally and generally. One record from Ontario, out of 4 nest cards in the files at Toronto, extends the area where this warbler and the brown-headed cowbird are mutually involved.

ORANGE-CROWNED WARBLER

Vermivora celata (Say)

Two parasitized nests of the nominate race of the orange-crowned warbler were found near Saskatoon, Saskatchewan, by Gehlert (1969:223), 23 and 29 June 1969, 1 with eggs of the 2 species, the other with 2 young cowbirds nearly ready to fledge. These are the first instances known to us of *V. celata celata* as a victim of the brown-headed cowbird (*M. ater artemisiae*), and the first record of this warbler's rearing the young parasites.

Previously we knew of 3 records for the race *V. celata lutescens* (Friedmann, 1971:246). To these we may now add 7 more: 6 cases from southern Vancouver Island, British Columbia, where this warbler appears to be parasitized regularly (Tatum, 1973:51; Crowell and Nehls, 1973:911; and a report received from Dr. J. B. Tatum); and one from Samish Island, western Washington (Lavers, 1974:830).

NASHVILLE WARBLER

Vermivora ruficapilla (Wilson)

This infrequently reported victim of the brown-headed cowbird was known (Friedmann, 1963:95) to be parasitized in 16 instances in Quebec, Massachusetts, New York, Michigan, Ontario, Minnesota, and Manitoba. Nine more cases may be added:

a set of 2 eggs of the host and 1 of the parasite, collected near Oconto, Wisconsin, 28 May 1962, now in the holdings of the Western Foundation; 4 instances in Ontario, (7 parasitized nests—3 previously known to us—out of 48 nests (14.6 percent) reported to the nest records file of the Royal Ontario Museum); and 4 instances of parasitism in New York State (out of 5 mentioned by Bull, 1974:537). The Ontario data are the first to reveal a high incidence of parasitism anywhere.

LUCY'S WARBLER

Vermivora luciae (Cooper)

To the few earlier reports of cowbird parasitism on this warbler in California, Arizona, and Texas, may be added 7 more, 6 from Arizona and 1 from New Mexico. The Arizona records are 1 each from Yavapai County, 9 May 1946, and from Fort Lowell, 26 May 1908, and 3 from near Wickenburg, Maricopa County (all these 5 are presently in the collections of the Western Foundation), and 1 from Tucson (in the Santa Barbara Museum of Natural History). In New Mexico, Hubbard (1971:25) found a parasitized nest of Lucy's warbler near Cliff, Gila Valley, 20 June 1968.

This warbler is relatively seldom observed, but the number of instances of parasitism on it reported suggests that it is probably a fairly frequent host choice. The Western Foundation has 44 sets of eggs, 5 of which (11.4 percent) are parasitized.

YELLOW WARBLER

Dendroica petechia (Linnaeus)

The chief reason for mentioning this very commonly imposed upon host is to note a sizeable group of northwestern records from Saskatchewan, Manitoba, and Alberta, in the Prairie Nest Cards at the Manitoba Museum. Of 194 nests reported, 31 (15.9 percent) were parasitized. This is relatively similar to data from southern Quebec, where of 307 nests examined, 42 (13.6 percent) were parasitized (Friedmann, 1963:98), but is much lower than in Ohio and Michigan, where various observers reported an incidence of parasitism of from 35.6 to 42.0 percent. In Ontario, the nest records on file in Toronto reveal a lesser frequency of parasitism, 25.7 percent (218 parasitized nests out of 848 nests

reported). The files at Cornell University show that 115 (22.4 percent) of 513 yellow warbler nests reported (all races) were parasitized. The great collections of the Western Foundation contain 348 sets of eggs of the yellow warbler (all races sympatric to the brown-headed cowbird); 28 of these (8.0 percent) are parasitized. These data, broken down by subspecies shows: *D. petechia aestiva*, 85 sets, 13 (15.3 percent) parasitized; *D. petechia morcomi*, 228 sets, 13 (5.7 percent) parasitized; *D. petechia rubiginosa*, 12 sets, 1 of them parasitized; *D. petechia sonorana*, 8 sets, 2 (25.0 percent) parasitized; *D. petechia amnicola*, 15 sets, none of them parasitized.

MAGNOLIA WARBLER

Dendroica magnolia (Wilson)

The Ontario nest records files at Toronto reveal that 6 (10 percent) of 60 magnolia warbler nests found in that province were parasitized, the highest frequency yet reported for this species as a cowbird host. Harrison (1975:184) reported 2 parasitized nests in Maine, out of 16 observed, a still higher incidence (12.5 percent), but based on a much smaller sample. He also found 2 nests in Pennsylvania, both of which were parasitized. Previously (Friedmann, 1963:100) only 17 records were known in all (including 2 of the above noted Ontario ones). With 25 instances now known to us, it appears that the magnolia warbler, while infrequently reported as a cowbird host, is regularly victimized.

BLACK-THROATED BLUE WARBLER

Dendroica caerulescens (Gmelin)

This infrequently reported victim was known earlier (Friedmann, 1963:100) on the basis of only 10 records, 3 of which were from New York. Bull (1974:537) increases the New York instances to 7. Peck (1975) reports that in Ontario 2 out of 21 nests reported (9.1 percent) were parasitized.

YELLOW-RUMPED WARBLER

Dendroica coronata (Linnaeus)

The first section of notes following have to do with that portion of this species previously con-

sidered a separate species, the Audubon's warbler (*D. coronata auduboni*). In the Santa Barbara Museum of Natural History there is a set of four eggs of Audubon's warbler with one of the brown-headed cowbird (subspecies *M. ater artemisiae*), collected 26 June 1937, at Mammoth, Mono County, California. This is the second record for that area, and only the fifth one known to us for this race of the yellow-rumped warbler throughout its entire range. Rogers (1971:881) has recently listed this race as a cowbird victim, as has Tatum (1973:62) in Vancouver Island. The Prairie Nest Records files have 3 more records from Alberta, 1 of which is the first one showing that the Audubon's warbler can and does rear the young parasite (at Exshaw, Alberta, 13 July 1968). Pettingill and Whitney (1965:102) report a young cowbird attended by a female Audubon's warbler in the Jewel Cave National Monument, in the Black Hills, South Dakota, on 26 July 1958. This record refers to the host subspecies *D. coronata memorabilis*, for which race it is the second record; the first one (Friedmann, 1963:102) was from Montana.

Of the nominate, eastern race, formerly called the myrtle warbler, Bull (1974:537) lists 5 instances of parasitism in New York State. Peck (1975) reports 21 (27.3 percent) of 77 Ontario nests were parasitized.

BLACK-THROATED GRAY WARBLER

Dendroica nigrescens (Townsend)

To the 5 earlier records (Friedmann, 1963:102; 1971:246) of parasitism on this warbler may be added 2 more. In the collections of the Western Foundation is a parasitized set of eggs taken at Red Bluff, Tulare County, California, 19 May 1937, by C. Andresen. Mr. Alan Pistorius writes us that he and his companions watched a male black-throated gray warbler repeatedly feeding a young fledgling brown-headed cowbird more than twice its own size, at 3000 feet on the east slope of the California coast range southwest of Lodoga, near the Colusa County-Lake County line, on 6 July 1972.

TOWNSEND'S WARBLER

Dendroica townsendi (Townsend)

Dr. J. B. Tatum (1973:62) notes that there was re-

ported to him 1 record of this warbler as a victim of the brown-headed cowbird in southern Vancouver Island. He considered the record acceptable, since the warbler is a common summer resident there. He did not have an exact date for the observation, which is the first one involving Townsend's warbler as a cowbird host. The record involved a fledged young cowbird attended by its fosterers.

BLACK-THROATED GREEN WARBLER

Dendroica virens (Gmelin)

To the 15 earlier records of parasitism on this warbler gathered over several decades (Friedmann, 1963:103) may be added 18 more: a parasitized set of eggs taken near West Haven, Connecticut, 12 June 1916; 4 Ontario records, out of 26 nests (15.4 percent) reported to the nest card files at Toronto; another Ontario record, from Kingston, mentioned by Quilliam (1973:174); and 12 instances of parasitism in New York State (out of 14 mentioned by Bull, 1974:537).

GOLDEN-CHEEKED WARBLER

Dendroica chrysoparia Sclater and Salvin

Recent manmade changes in the ecology of much of the Edwards Plateau, Texas, have caused a great increase in the cowbird population there, and this, in turn, may have seriously affected the golden-cheeked warbler. This bird is said (Oberholser, 1974:842) to be parasitized much more frequently than previously, and while no figures are given, it is suggested that the incidence of parasitism may be excessive.

CERULEAN WARBLER

Dendroica cerulea (Wilson)

In the 1963 compilation (Friedmann, p. 104) only 12 records were known of cowbird parasitism on this warbler. The number, while still small, may be increased to 18. Bull (1974:537) lists 5 instances from New York State (1 of which was included in the earlier statement), and 2 other cases were found

in Ontario (out of 29 nests reported to the Ontario nest records files, Toronto).

BLACKBURNIAN WARBLER

Dendroica fusca (Müller)

This very uncommonly reported victim was known until now as a cowbird host on the basis of only 10 records (Friedmann, 1963:105). Four more may be added: a set of 3 eggs of the host and 1 of the parasite, collected 2 miles south of Hamilton, New York, 3 June 1925, by R. C. Harlow, now in the collections of the Western Foundation; another from New York (Bull, 1974:537); a parasitized nest found at MacLennan, Algoma District, Ontario, reported to the Ontario nest records files at Toronto (this finding and 1 of the records included in the 1963 compendium comprised 2 out of 14 nests reported); and another from Kingston, Ontario, listed by Quilliam (1973:159, 174). The last is one of the few instances in which the warbler was reported as rearing the young parasite.

CHESTNUT-SIDED WARBLER

Dendroica pensylvanica (Linnaeus)

In Ontario this warbler seems to be more frequently parasitized than was previously (Friedmann, 1963:106) reported. In the nest record files at Toronto are data on 150 nests found in that province, and of them no fewer than 30 (20.0 percent) were parasitized. Of these 30 records, 28 are additional to what we had known previously, a notable increase, from 75 records in 1963 to 103 in 1975.

BAY-BREASTED WARBLER

Dendroica castanea (Wilson)

Previously (Friedmann, 1963:107) the bay-breasted warbler was known as a victim of the nominate race of the brown-headed cowbird in Quebec Province, Canada. There were only 2 records. We may now add 2 more, from the Prairie Nest Cards files in Winnipeg, which add this species to the host list of the northwestern race of the parasite, *M. ater artemisiae*. One record was observed in Alberta in 1965, the other in 1974.

BLACKPOLL WARBLER

Dendroica striata (Forster)

The blackpoll warbler was added to the known hosts of the brown-headed cowbird by Gilligan and Wright (1969) at Sauvie Island, near Portland, Oregon, 24 July 1969, when they saw a fledged young cowbird attended and repeatedly fed by one of these warblers. The locality is somewhat outside the warbler's normal breeding range, but the record seems acceptable, since the identification was corroborated by several other observers and was accepted as valid by the editors of Audubon Field Notes, who were aware of the geographic problem it presented. The cowbird in this case is the northwestern race, *M. ater artemisiae*.

In the east, Bull (1974:537) notes 1 record of parasitism on the blackpoll warbler in New York State, by the nominate race of the parasite, a nest found at Balsam Round Top Mountain, Ulster County, 24 June 1969, with 4 eggs of the warbler and 1 of the cowbird.

PINE WARBLER

Dendroica pinus (Wilson)

The pine warbler was known as a rarely reported victim of the brown-headed cowbird, on the basis of 10 instances (Friedmann, 1963:107), either of collected eggs or of observations of the warbler feeding a young cowbird. To these may now be added 2 more; a parasitized set of eggs in the Royal Ontario Museum of Zoology and an observed (not collected) instance in Ontario, 7 June 1916, reported to the Ontario nest records files at that museum. Ontario is the only "region" (in an admittedly loose use of the term) where there is reason to believe the pine warbler is a regular, if not frequent, host choice; 4 of the 12 records are from Ontario.

The paucity of records of cowbird parasitism on this warbler is borne out by the fact that the Western Foundation's collection contains 29 sets of eggs of the pine warbler from within the breeding range of the brown-headed cowbird, but not one of them is parasitized.

NORTHERN WATERTHRUSH

Seiurus noveboracensis (Gmelin)

In 1963 (Friedmann, pp. 113-114) only 15 in-

stances of cowbird parasitism on this warbler were mentioned, 1 of them from New York State. The recorded situation in that state is now greatly changed. Bull (1974:537) mentions 20 more records from that area, where, in suitable localities, this species must be a frequently chosen victim. Part of Bull's data stems from the studies of S. W. Eaton (1957) published unfortunately in a seldom consulted journal of limited availability. In Ontario, the only area from which a fairly high incidence of parasitism had been recorded earlier—8 (20.0 percent) of 40 nests examined—only a single additional case has been reported in the past 20 years, although there were, in 1974, data on 74 Ontario nests in the nest records files at Toronto, causing the incidence of parasitism to drop from 20.0 to 12.2 percent (9 out of 74 nests).

LOUISIANA WATERTHRUSH

Seiurus motacilla (Vieillot)

Bull (1974:537) mentions some 30 instances of cowbird parasitism on this warbler in New York, of which the earlier compendium (Friedmann, 1963:114-115) included 15. These 15 additions bring the total known records up to 86. While over a third of the total are from one state, there is no reason to think there is a greater frequency of parasitism there than elsewhere.

MACGILLIVRAY'S WARBLER

Oporornis tolmei (Townsend)

To the 9 earlier records of this warbler as a host of the brown-headed cowbird (Friedmann, 1963:117) may be added 4 more instances: a parasitized nest found at Lake Tahoe, California, 14 June 1938, now in the Santa Barbara Museum of Natural History; another from Laurel Creek, Mono County, California, in the Western Foundation's collections; a record noted in Tatum (1971:51) of an observation near Victoria, Vancouver Island, of a fledged cowbird attended by foster parents of this species; and a similar observation, 5 August 1975, at an elevation of 8000 feet, near Mammoth, California (S.I.R.).

YELLOW-BREASTED CHAT

Icteria virens (Linnaeus)

To the few earlier records (Friedmann, 1963:120-122) from western Canada may be added 3 more parasitized nests found in Alberta (Prairie Nest Records), the first instances reported from that province.

YELLOWTHROAT

Geothlypis trichas (Linnaeus)

Over 300 cases of cowbird parasitism on this warbler have been reported. These should yield some significant indices, but the evidence is mixed. Thus, in the collections of the Western Foundation, 124 sets of eggs of eastern races include 13 that are parasitized (10.5 percent); 159 sets of California races include 12 parasitized sets (7.5 percent). However, data from a few eastern areas where sizeable samples are available (Friedmann, 1963:117-120), yield the following: southern Quebec, 113 nests, 8 of which (7.1 percent) are parasitized; Ohio, 41 nests, 19 (46.3 percent) parasitized; Michigan, 90 nests, 35 (38.8 percent) parasitized.

Two records of parasitized nests of the host race *G. trichas campicola* from Alberta, in the Prairie Nest Cards Scheme, are the third and fourth instances for that subspecies of the yellowthroat. Another record, from Canston, British Columbia, listed previously (Friedmann, 1963:120) as *G. trichas occidentalis* is probably better considered as *G. trichas campicola*. A new, and valid, record for *G. trichas occidentalis*, from Barr Lake, Colorado, is in the collections of the Western Foundation.

As an indication of the ability of the yellowthroat to rear a sizeable brood, mention may be made of a nest observed in the Goleta Slough, Santa Barbara County, California, by Kelly Steele, that fledged 1 young cowbird and 3 young yellowthroats.

HOODED WARBLER

Wilsonia citrina (Boddaert)

In the 1963 compilation (Friedmann, pp. 122-123) some 32 instances of parasitism on this warbler were noted, but the number seemed to have grown slowly enough to suggest that the bird was generally an infrequently selected host. This was concluded al-

though there were a number of records from Michigan and from Maryland, where the hooded warbler was imposed upon more often than elsewhere. This picture is changed now, since in New York State alone, Bull (1974:537) mentions 27 records, all but 3 of which are new to our earlier figures. These indicate that there this bird is a common host choice. A single instance of parasitism in Ontario (out of data on 3 nests in the files at Toronto) adds a new northern locality of record.

WILSON'S WARBLER

Wilsonia pusilla (Wilson)

Until now this warbler has been reported as a cowbird host only a small number of times, but it appears, from recent evidence, that it must be a fairly regular, possibly even a favorite choice of the parasite in southern Vancouver Island and in southern California, if not elsewhere. In the former area, Lemon (1969) reported a fledged young cowbird attended by a Wilson's warbler (race *W. pusilla chryseola*) near Victoria, on 13 August 1968. This is the first time the subspecies *W. p. chryseola* has been found to rear the young parasite (one previous instance is known for the subspecies *W. pusilla pileolata*). Since Lemon's paper, 2 additional observations of fledged young cowbirds attended by adults of this warbler have been reported in the same area (J. B. Tatum).

From southern California there are no fewer than 16 additional records, all of sets of eggs with cowbird eggs; 6 of these are in the Lawrence Stevens collection in the Santa Barbara Museum of Natural History (all from San Luis Obispo and Santa Barbara counties); 10 are in the collections of the Western Foundation (Santa Clara, San Benito, Alameda, Ventura, and Los Angeles counties). The 6 parasitized sets from San Luis Obispo and Santa Barbara counties allow some idea of the rate of parasitism there. These 6 sets are among only 11 sets from these 2 counties in that museum. This rate of parasitism, 6 out of 11 (54.6 percent), is the highest for any species of host on which that museum has data from the adjacent coastal counties of San Luis Obispo, Santa Barbara, and Ventura.

The fact that the subspecies *W. p. chryseola* is the segment of the total population of *Wilsonia pusilla* that is affected heavily by the parasite is

shown by the holdings of the Western Foundation, which contain 174 sets of eggs of the species as a whole, 11 of which (6.3 percent) are parasitized; all 11 of these are *W. pusilla chryseola* (out of 148 sets of that subspecies). Of the 34 known records of parasitism, no less than 28 are from California (Mono County south to Los Angeles County); the others are from southern British Columbia, Alberta, and Colorado.

CANADA WARBLER

Wilsonia canadensis (Linnaeus)

In 1963 (Friedmann, pp. 123–124) only 11 records were given for this bird as a cowbird host. Bull (1974:537) gives that number for New York State alone (1 of his records was included in the earlier account). To the 3 cases from Ontario reported in the 1963 compilation may be added 1 more (4 cases out of data on 19 Ontario nests in the files at Toronto). It appears that in suitable localities the Canada warbler may be fairly regularly parasitized.

HOUSE SPARROW

Passer domesticus (Linnaeus)

That the house sparrow is only a very occasional host choice of the brown-headed cowbird is suggested by the small number of definite records of parasitism out of many hundreds of nests examined (742 in Ontario alone, none of them parasitized), and especially by the fact that in most areas only single instances have been reported—1 each from California, Kentucky, Maryland, New York, and Ohio, and 2 each from Colorado and Michigan. In the 1963 compilation (Friedmann, p. 125) were noted indefinite statements of "regular" parasitism of house sparrows in Pennsylvania and in eastern Kentucky, but no numbers or cases were given in their original support. To all these we may add the following: Bull (1974:537) lists 2 more instances from New York; "Woods" (1972:14–15) mentions 1 from Kansas; Bennett (1973:9) reports 1 from Nebraska; and Wauer (1973:178) lists the house sparrow as a cowbird host in the Big Bend National Park, Texas. This last record involves the race *M. ater obscurus* of the parasite, previously noted but a single time in this relationship—in southern California (Friedmann, 1963:125).

The fact that the eggs of the house sparrow and of the brown-headed cowbird are quite similar may have caused other cases of parasitism to remain undetected.

BOBOLINK

Dolichonyx oryzivorus (Linnaeus)

A parasitized nest found near Oak Lake, Manitoba, 3 July 1959, is the second recorded instance of the bobolink as a victim of the northwestern race of the parasite, *M. ater artemisiae*. The record is in the files of the Prairie Nest Records Scheme. Throughout its breeding range the bobolink is relatively seldom victimized by the brown-headed cowbird. Since the 1963 compilation (Friedmann, p. 125) when 22 records of parasitism were reported, only 11 additional ones have come to our attention—from New York, Illinois, Wisconsin, and Ontario, and the above case from Manitoba. In Ontario, 6 out of 58 nests reported had cowbird eggs in them, an incidence of parasitism of 10.2 percent (Peck, 1975), a higher incidence than elsewhere.

EASTERN MEADOWLARK

Sturnella magna (Linnaeus)

Previously (Friedmann, 1963:126–127) there were some 32 records of cowbird parasitism on this uncommonly reported host. We may now more than double this number, as follows. In the nest record files at Cornell University there are data on 244 nests of the eastern meadowlark, 15 of which (6.1 percent) had cowbird eggs in them. In Nebraska Bennett (1973, 1974) reported 3 more instances of parasitism; the Western Foundation has a parasitized set of eggs from Amboy, Illinois. In Ontario, the nest records files at Toronto show that 8 (3.9 percent) of 206 nests reported were parasitized (Peck, 1975). P. F. Elliott informs us that in Riley County, Kansas, in 1974 and 1975 he found 28 (70.0 percent) of 40 nests to be parasitized. These data support the earlier (1963) statement that the eastern meadowlark is parasitized most heavily in the central part of North America, although none of the data previously available showed an incidence of parasitism approaching that of Elliott's sample. The meadowlarks in Elliott's study fledged a number of cowbirds. These are the first cases

known in which cowbird parasitism of this species was successful. Elliott also found some evidence that cowbirds in his area had specialized on and adapted to particular host species, as indicated by the fact that cowbird eggs found in meadowlark nests were significantly heavier than those found in the nests of smaller hosts such as the grasshopper sparrow and the dickcissel (Elliott, 1975).

YELLOW-HEADED BLACKBIRD

Xanthocephalus xanthocephalus (Bonaparte)

To the few (11) records of parasitism on this blackbird available in 1963 (Friedmann, pp. 127-128) may be added 5 more: 2 from Spokane County, Washington, where M. F. Willson (1966) examined 371 nests, 2 of which contained cowbird eggs; 1 from Sea Island, Victoria area, Vancouver Island, 13 June 1971, reported to us by Dr. J. B. Tatum; and 1 each from Illinois and Minnesota, in the collections of the Western Foundation. Willson's report gives a clear indication of the very infrequent parasitism this host experiences, which helps to explain the paucity of published records. The only observer who considered the yellow-headed blackbird to be a frequent victim was F. C. Lincoln (1920:69), who gave no figures but merely stated it to be so in the Clear Creek district of Colorado. In light of more recent knowledge, Lincoln's statement appears to be open to question.

RED-WINGED BLACKBIRD

Agelaius phoeniceus (Linnaeus)

It has long been known that the red-winged blackbird's suffering from the intrusions of the brown-headed cowbird varies greatly in different areas of the continent. In the eastern United States and Canada it is seldom molested, but in the western prairie regions the picture is quite otherwise. Thus, the Prairie Nest Records Scheme has no fewer than 62 cases of parasitism on this host in Alberta, Manitoba, and Saskatchewan in recent years alone, a third as many as were available from the entire range of the blackbird in 1963 (Friedmann, p. 130). The total number of records for the host throughout its range has grown from about 180 in 1963 to over 500, and, as might have been an-

anticipated, by far the most of these are from the central part of the United States and Canada. In the collections of the Western Foundation there are 1210 sets of eggs of this blackbird, 28 of which (2.3 percent) are parasitized. However, 17 of these are from the Gulf Coast of southeastern Texas (23.9 percent of 71 sets from there); 3 are from the Rocky Mountains (6.0 percent of 50 sets); elsewhere the incidence of parasitism is 1.9 percent (of 155 sets) from the eastern and midwestern states, and 0.6 percent (5 out of 779 sets) from California. In the Prairie Nest Records at the Manitoba Museum there are cards for 707 nests of the redwing, 62 of which (8.7 percent) were parasitized. An unusually high incidence of parasitism was reported from Arrowwood Refuge, North Dakota, where 13 of 17 redwing nests were so affected, with the result that only 11 redwings and 3 cowbirds fledged from 5 successful nests (Houston, 1973:885). This is almost as high an incidence of parasitism as was reported earlier (Friedmann, 1963:130) from Decatur County, Kansas, but is based on more explicit figures than was Colonel Wolfe's Kansas estimate. The data in the Cornell University files, unfortunately given to us without geographical sources, show that 176 (4.0 percent) of 4293 nests reported had cowbird eggs in them. The Ontario files, at Toronto, include 84 instances of parasitism in that province, out of a total of 3376 nests reported, an incidence of 2.5 percent.

As previously noted (Friedmann, 1963:128-130; Dappen, 1967) several observers have suggested that redwings in some areas are relatively free from parasitism because breeding in colonies results in efficient communal defense against cowbirds. Also Robertson and Norman (in press) found that redwings attack mounted cowbirds placed near their nests. While nest defense almost certainly reduces the incidence of parasitism, it would seem that some other factor must account for the virtual lack of parasitism that occurs in some parts of the redwing's range because nest defense could not forestall all cases of attempted parasitism. One way to determine whether low incidence of parasitism in some areas is due completely to nest defense by redwings or whether low preference for redwings by cowbirds is also a factor is to determine the incidence of parasitism of species nesting among redwing colonies. If nest defense is the only explanation for the low incidence of parasitism, the

other species breeding with the redwings should also experience little parasitism as the "communal defense" should exclude cowbirds from the entire area. Interestingly, Kelly Steele found that 2 of 3 yellowthroat nests in the Goleta Slough, Santa Barbara County, California, were parasitized, whereas none of at least 20 redwing nests among which the yellowthroat nests were built were affected. Similarly, Harrison (1975:249) reports "frequent" parasitism of swamp sparrow nests built among redwing nests which were "rarely" parasitized.

TRICOLORED BLACKBIRD

Agelaius tricolor (Audubon)

A set of 4 eggs of the tricolored blackbird with 1 of the brown-headed cowbird (*M. ater obscurus*) was collected in Merced County, California, 21 May 1944, by G. Brem, Jr., and is now in the collections of the Western Foundation. The record is the first one for this blackbird as a cowbird victim.

The tricolored blackbird can only be considered as a species that is parasitized extremely seldom, as vast numbers of its nests have been studied in the past by several students, and unpublished experiments (by S.I.R.) have shown it to be an acceptor species. Thus, Orians (1961) and Payne (1969) between them examined thousands of clutches of eggs of this species during the spring breeding season, and never found a cowbird egg among them. More recently Payne (1973:95) has suggested that the excessive density of nests characteristic of the tricolored blackbird colonies may act as a deterrent to the cowbird, either by intimidation or confusion, and in this way keeps the species free from parasitism. Although this density of nests does seem to prevent the red-winged and the yellow-headed blackbirds from nesting in the same marshes, it is not certain that this nest density would also totally exclude the cowbird. If the deterrent effect of the tricolor's nesting density were the only factor limiting the incidence of cowbird parasitism we might see occasional cases of parasitism, as such a deterrent could hardly provide complete protection. Yet the fact that only 1 instance of parasitism is known among the tens of thousands of nests inspected suggests that cowbirds do not often attempt to parasitize this species (although the deterrent

effect proposed by Payne may also be a factor). Interestingly, a recent survey of *A. tricolor* colonies (Dehaven, Crase, and Woronecki, 1975) finds a tendency for smaller colonies than prevailed in the past. If the deterrent effect of large numbers of tricolors is the only factor limiting cowbird parasitism, then the latter phenomenon may become more prevalent as this tendency toward smaller colonies progresses.

ORCHARD ORIOLE

Icterus spurius (Linnaeus)

The total number of actual records of this oriole as a cowbird victim was only 18 until recently (Friedmann, 1963:131), but we may now add 17 more: 1 from Illinois, 1 from Iowa, 1 from Pennsylvania, 7 from Texas, 1 from Kansas, 1 from South Dakota, and 5 from Ontario. The Pennsylvania instance and 3 of the Texas records are in the Western Foundation; another of the Texas sets is in the Santa Barbara Museum of Natural History, and still another in the Delaware Museum of Natural History; 1 was reported to us by its finder, F. F. Nyc, Jr.; and 1 was observed in the Big Bend country by Wauer (1973a). The Ontario records are in the collection or in the nest card files of the Royal Ontario Museum of Zoology. The others are observational records: South Dakota by Houston (1972:872), and Kansas by Williams (1972:874). The Texas set in Santa Barbara is unusual in that it contains 5 eggs of the cowbird (*M. ater obscurus*) and 3 of the oriole; it was taken near Henley, Brazos County, Texas, 30 May 1951. The instance reported by Nyc, found at Kingsville, Texas, contained eggs of both the brown-headed and the bronzed cowbirds, with those of the oriole. The Western Foundation has 83 sets of eggs of the orchard oriole, 6 (7.2 percent) of which are parasitized.

The South Dakota record involves the northwestern race of the cowbird, *M. ater artemisiae*, for which subspecies the orchard oriole is a "new" victim.

The incidence of parasitism reported from Ontario, 5 nests out of 31 (16.1 percent), is so high as to suggest that this oriole, like the hooded and unlike the northern oriole, may be an acceptor species.

HOODED ORIOLE

Icterus cucullatus Swainson

The status of this oriole as a cowbird host choice has become more fully documented in the past few years. In the 1963 compilation (Friedmann, pp. 131-132) the total number of actual records was only 10, to which figure we may now add 34 more. One of us (S.I.R.), in 1975, found that 15 (71.4 percent) of 21 nests found in suburban areas of Goleta and Santa Barbara were parasitized; also 1 nest (the only one found) at Carpinteria was so affected, but not the single nest seen at Refugio State Beach. These findings show the hooded oriole to be a major host in Santa Barbara County, at least in the areas altered by man.

Of the remaining new records, more than half are in the collections of the Western Foundation: 5 from California, involving the host race *I. cucullatus californicus* (from Fresno, Los Angeles and San Diego counties), a race previously reported as a cowbird host by Rowley (in Friedmann, 1963: 132) and, recently, by H. and O. Clarke (in McCaskie, 1970:718) near Glendale, Los Angeles County; 4 from Cameron County, Texas, and 1 each from Reynosa and from Matamoros, Tamaulipas, involving the host race *I. cucullatus sennetti*, and 1 from Arizona, involving the host race *I. cucullatus nelsoni*. In the collections of Oregon State University there are 2 more Cameron County sets with cowbird eggs. Wauer (1973a) noted this oriole as a cowbird victim in the Big Bend area, Texas.

In 1 of the parasitized nests from Los Angeles County, the orioles had built a new lining to the nest over the cowbird eggs and had not yet deposited any of their own. This behavior has not been noted before for the hooded oriole, but it has been described (Friedmann, 1963:132-133) in the case of the northern oriole, *I. galbula*. One other instance, from Santa Barbara County, reported to one of us by Richard Broder, was of a female hooded oriole feeding a fledged young cowbird, 13 to 20 August 1974. No other fledglings were present during the week-long observation, which suggests that no young orioles survived. Earlier in the same year, Broder saw the same individual oriole (or, at least, one breeding in the same spot) with two fledged young orioles, probably a first brood.

The Western Foundation's collections contain

148 sets of eggs of this oriole from within the area of its sympatry with the brown-headed cowbird; 12 of these (8.1 percent) are parasitized. Unpublished experiments (by S.I.R.) have shown the hooded oriole to be an acceptor species.

NORTHERN ORIOLE

Icterus galbula (Linnaeus)

Experiments involving the addition of foreign eggs to nests that contained 2 or more oriole eggs demonstrated that this oriole is a rejecter species. Artificial cowbird eggs were rejected at 18 nests. Real cowbird or house sparrow eggs (which are similar to cowbird eggs) were rejected at another 5 nests. The experiments, involving many species, indicate that while ejection is the normal type of rejection, this oriole is distinctive in that it ejects by spiking cowbird eggs. Other rejecters eject by lifting the eggs in their bills. These experiments were done in California, Manitoba, Ontario, and Connecticut and thus tested both the Bullock's and Baltimore forms of this species (Rothstein, in press (c)). Additional evidence of rejection was sent to us by R. Robertson and R. Norman, who placed real cowbird eggs in 5 nests at Delta, Manitoba. Each cowbird egg was ejected.

The least demanding explanation for the origin of rejection behavior is that it evolved in response to brood parasitism and that it decreases the deleterious effects of the parasitism. This interpretation will be supported if it can be shown that cowbird parasitism, if accepted, reduces the oriole's reproductive output. Reproductive loss due to allowing a cowbird egg to hatch is too poorly known to be measured accurately, but that it occurs is indicated in the case of every nest we know of in which a cowbird egg hatched. One cowbird, but no orioles, fledged from a nest reported by Nauman (1930). Gregg (in Friedmann 1963:133) noted a nest containing a cowbird "big enough to fly" and 2 orioles much less advanced in development. Tate (in Friedmann, 1963:133) found 2 dead oriole nestlings below a nest that contained 1 oriole and 2 cowbirds. M. R. White (unpublished 1945 MS in files of the University of Michigan Biological Station) described a nest in which a cowbird hatched 1 to 2 days before 4 orioles hatched. One of the orioles died before it was 4 days old and the cowbird was

so advanced in development that it fledged when the remaining orioles were only 6 to 7 days old. (Orioles fledge after 11 to 14 days; Bent, 1958.) Each nest demonstrates either the death of some oriole young or such a great disparity in size between cowbird and oriole nestlings that the viability of the latter was almost certainly reduced. Also, Newman (1969) reported a fledged cowbird being fed by a female oriole that appeared to have no young of her own. Thus, the rejection behavior elucidated by the experiments has adaptive value that is potentially very high, although knowledge of the actual rate of parasitism of the oriole is needed before the adaptive value can be quantified (Rothstein, 1975b).

Only a small number of additional records of natural parasitism have come to light in recent years but the oriole's rejecter status makes the paucity of records more understandable. In New York, Bull (1974:537) reported 6 instances of parasitism, 5 of which are additional to the 1963 compilation (Friedmann, pp. 132-133). T. S. Smith (1972) observed the ejection of a naturally deposited cowbird egg. This occurred in Nebraska and involved the eastern race of the cowbird, *M. ater ater*. The records reported by White and Newman (above paragraph) which occurred near Pellston, Michigan, and in Johnston County, Oklahoma, respectively, also refer to *M. a. ater*. Eight cases of parasitism by this race were reported from Ontario (Peck 1975). (Possibly some of these Ontario cases are referable to *M. ater artemisiae* since this race replaces *M. a. ater* in extreme western Ontario.) The Western Foundation has 2 sets parasitized by *M. a. ater*, 1 from Pennsylvania, the other from Ontario. There are 4 new records for the northwestern race of the parasite, *M. ater artemisiae*. One, published by Nero (1971), was the first record for Manitoba. A second Manitoba case was found by R. S. Miller in 1972 at Delta, Manitoba. The third case, now in the Delaware Museum of Natural History, was collected at Belvedere, Alberta. The fourth case, from Minnesota, is at the Western Foundation.

Except for Newman's (1969) record which may have involved a hybrid, all the above records of parasitism refer to the eastern (Baltimore) form of this oriole. There are 5 new records for the western (Bullock's) form. The Santa Barbara Museum of Natural History has a set of 4 oriole eggs and 1

cowbird egg taken at Vernon, Texas, 31 May 1966, and one of us (S.I.R.) found 3 cases of parasitism (described below) near Shandon, San Luis Obispo County, California. The Western Foundation has a parasitized set from El Centro, Imperial County, California. The Texas record is referable to *M. ater ater*, the 4 California records to *M. ater obscurus*.

While isolated reports of parasitism of the oriole are important, data on the incidence of parasitism in large series of nests have greater value. The Western Foundation has 283 sets of eggs, only 4 of which (1.4 percent) contain cowbird eggs. The 8 Ontario records reported by Peck (1975) make up 2.5 percent of the total sample of 318 nests in the Ontario Nest Record Scheme. The 3 records from Shandon, California, make up 8.8 percent of the 34 nests S.I.R. found in that area in 1974 and 1975. Of course, even these data do not accurately reflect the proportion of northern oriole nests actually parasitized because orioles may remove most cowbird eggs before the eggs are seen.

Techniques to estimate the amount of parasitism of rejecter species that goes unseen are discussed elsewhere (Rothstein, in press (b)). Two additional techniques that are especially applicable to this oriole are as follows. (1) Although these orioles usually drop ejected cowbird eggs at least several meters from their nest (Rothstein, in press (c)), some apparently drop them directly from the nest (see Friedmann, 1963:132-133; Smith, 1972). Inspection of the ground beneath oriole nests might reveal some of the cowbird eggs ejected before the inspection of the nest by an observer. Parasitism at 1 of the Shandon nests was detected in this manner when pieces of cowbird eggshell were found directly beneath an oriole nest that was not close to any other nests. (2) Experiments on the ontogeny of the northern oriole's egg recognition (S.I.R., in prep.) showed a small proportion of orioles learn to accept artificial cowbird eggs added to nests before the onset of laying. Orioles breeding for the first time apparently imprint on the first eggs that appear in their nest. The remaining orioles reject artificial cowbird eggs added before the onset of laying but most of them do not succeed in ejecting the artificial (plaster) egg because they cannot spike it. They peck at it and damage it but after several days some (perhaps all) habituate to the egg and cease their rejection attempts. The end result, whether the orioles initially accept the arti-

ficial egg or first try to eject it and then habituate, is that rejection behavior is "turned off" during part or all of the laying stage, if an artificial cowbird egg is added before laying begins. Thus, a sample of birds subjected to this experiment should reveal much of the natural parasitism that occurs, although some parasitism might still be missed if cowbirds lay before orioles have habituated and if the appearance of a naturally deposited cowbird egg is very different from that of the artificial egg to which the orioles imprinted or habituated. The presence of the artificial cowbird egg in such nests should not alter the likelihood of natural parasitism because the presence of a cowbird egg has little or no effect on the probability that a nest will receive additional cowbird eggs (Mayfield, 1965).

One nest in the ontogeny experiments at which orioles accepted the artificial cowbird egg was naturally parasitized as was another nest at which the orioles habituated to the artificial cowbird egg (nests 75-96 and 75-116, respectively). The cowbird eggs in these nests were laid between 22 and 28 May 1975. Both were accepted since they were still present and undamaged on 5 June. The cowbird egg was missing from nest 75-116 on 12 June but as the nest then contained 1 dead plus 1 live oriole nestling and an addled oriole egg, the cowbird could have hatched, then died and been removed. The cowbird egg in nest 75-96 did not hatch. It and 2 dead oriole nestlings were in the nest on 17 June.

Thus, the 3 cases of parasitism near Shandon would probably not have been detected had not special techniques been applied (checking the ground beneath nests, imprinting and habituating orioles to cowbird eggs). These special techniques were not applied at most of the other 34 nests studied near Shandon so the incidence of parasitism could have been higher than 3 of 34 (8.8 percent), since much natural parasitism would still have gone undetected. It is important to point out that cowbirds are uncommon near Shandon so the relatively high figure (8.8 percent) for the minimum incidence of parasitism was not due to an unusually large number of cowbirds. Rather, it was most likely due to the fact that the special techniques applied made it possible to detect parasitism that normally goes unseen. Application of these techniques in other areas where cowbirds are more common might reveal much higher incidences

of parasitism. As with the cedar waxwing (discussed previously) these data on cowbird parasitism near Shandon imply that cowbirds not infrequently parasitize rejecter species even though their chances for reproductive success are virtually nil.

RUSTY BLACKBIRD

Euphagus carolinus (Müller)

In the collections of the Royal Ontario Museum of Zoology is a set of 5 eggs of the rusty blackbird with one of the brown-headed cowbird (*M. ater artemisiae*) taken at Okotaks, Alberta, 24 June 1917, by E. Beaupre. Previously (Friedmann, 1963:134), there were only 3 records known to us, 2 definite and 1 indefinite, of parasitism on this blackbird, all from Alberta.

BREWER'S BLACKBIRD

Euphagus cyanocephalus (Wagler)

It was known previously (Friedmann, 1963:134) that Brewer's blackbird was a frequent host of the brown-headed cowbird in Alberta and Montana, but the actual extent to which it is imposed upon in the northwestern prairie areas could hardly be appreciated from the nonquantitative information previously available. The Prairie Nest Records Scheme has kindly sent us copies of all their cowbird data up to mid-1975, and this reveals that of 420 records of cowbird parasitism on 37 species of hosts in Alberta, Saskatchewan, and Manitoba, no fewer than 85 were on Brewer's blackbirds, the most frequently victimized of any of the resident passerine species in terms of total number of nests found to be parasitized, not in percentages. Next in order of total number of parasitized nests came the clay-colored sparrow and the red-winged blackbird, each with 65 instances in the same area. There were, in all, records of 371 nests of Brewer's blackbird in the Prairie Nests Record Scheme, so the 85 instances with cowbird eggs amount to 22.9 percent of the total, a fairly high incidence of parasitism.

Even more numerous and illuminating data are provided by Furrer (1974 and personal communication) who studied this species in the "Potholes Region" (Grant and Adams counties) of eastern

Washington in 1969 and 1970. Overall parasitism on 837 nests was 32.0 percent. There was much seasonal variation in the intensity of parasitism. Cowbirds did not become common in the area until late April, and consequently early nests suffered much less parasitism than later ones. In 1969, there was 8.0 percent parasitism of 138 nests in which the first egg was laid between 10 April and 9 May, whereas 50.9 percent of 177 clutches started between 10 May and 20 June were parasitized. Similarly, in 1970, 6.5 percent of 277 clutches started in the early interval were parasitized while 59.6 percent of 245 clutches in the later interval were parasitized. The incidence of parasitism of late nests reached such a high level in 1970 that 87.5 percent of 32 clutches begun after 8 June were victimized. Parasitism at very early nests resulted in total failure for the cowbirds; the cowbird eggs laid in all 10 nests parasitized between 10 April and 3 May (1969, 1970) were laid so late in the host's nesting cycle that they could not have received sufficient incubation for hatching.

In addition to the incidence of parasitized nests, the incidence of multiply parasitized nests also increased as the season progressed. Multiple parasitism peaked between 9 and 14 June. Nests parasitized during this period received an average of 2.67 cowbird eggs. Several times 5 cowbird eggs were laid in the same nests and 1 nest (that was probably abandoned) contained 7 cowbird eggs and 1 Brewer's egg. Some nests subjected to multiple parasitism received cowbird eggs after earlier eggs had already hatched. The unusually intense parasitism of Brewer's in the Potholes Region may not be due to cowbirds in that area having an especially strong preference for parasitizing this species. Furrer points out that the area has a depauperate avifauna; there are few potential hosts besides Brewer's blackbird.

Furrer estimates that about 50 percent of the female cowbirds that parasitized Brewer's nests removed a host egg. Surprisingly, the data showed no decrease in host fledging success attributable to the presence of cowbird nestlings although Furrer suggested that post-fledging success might be reduced among host young reared with cowbirds. It is also worth pointing out that caring for a cowbird can reduce fitness even if the normal number of host young are fledged from an individual nest because the parents' chances of surviving to breed again

may be reduced. The extra care devoted to the cowbird produces an additional strain on the parents with no immediate increased output of host offspring and perhaps with a decrease in subsequent output of the breeding pair.

Furrer's work makes it evident that numerous cowbirds are reared by this species. About one-third of all cowbird eggs resulted in fledglings. The success rate of cowbird eggs in nests in bushes over land was higher than that in nests over water or on the ground. Furrer found several nests in each year of his study that fledged only cowbirds. In 1970 he found 6 nests, each of which contained 3 cowbirds that reached ages of at least 8 days and therefore probably survived long enough to fledge. That Brewer's rear large numbers of cowbirds is also shown by Gordon H. Orians' studies in the Potholes Region (pers. comm.). Despite its large size, Brewer's blackbird is evidently a good host.

We have compared Furrer's data from 1969 and 1970 with data Henry S. Horn (pers. comm.) collected in the same region in 1964, 1965, and 1966. The general trends Furrer found are also shown by Horn's data. The only major difference between the 2 bodies of information is that Horn found less parasitism. In Horn's study 2.6 percent of 234 clutches started on or before 10 May were parasitized, whereas Furrer's study showed 6.5 and 8.0 percent parasitism for the period. Similarly, 26.8 percent of 56 clutches started after 10 May were parasitized according to Horn's study whereas Furrer found 50.9 and 59.6 percent parasitism for this period. Quantitative comparisons are difficult but it is evident that the incidence of multiple parasitism was higher in Furrer's study than in Horn's. This increase in parasitism over a 7 year period, revealed by a comparison of Horn's and Furrer's studies, is almost certainly a reflection of the fact that the cowbird is a relative newcomer to the Potholes Region and that it increased in population between the two studies. We are indebted to Drs. Furrer, Horn, and Orians for making their data available to us. Dr. Furrer will publish more detailed analyses of his information elsewhere.

All the data discussed above refer to the northwestern race of the cowbird (*M. ater artemisiae*). Previously (Friedmann, 1963:134-135) there was but a single instance on record of Brewer's blackbird as a victim of the dwarf or southwestern race of the cowbird (*M. ater obscurus*). A second record,

from near Buckeye, Maricopa County, Arizona, is in the collections of the Western Foundation. During May 1975, one of us (S.I.R.) found 4 additional cases of parasitism by *M. a. obscurus*, 1 near Tupman and 3 near Shandon in Kern and San Luis Obispo counties, California, respectively. The 3 Shandon nests constituted 3.6 percent of 83 nests found in 1974 and 1975. The Tupman nest was 1 of 2 found on 20 May 1975. Cowbirds were abundant at Tupman, but uncommon near Shandon. An interesting facet of parasitism by *M. ater obscurus* is that the size differential between it and Brewer's blackbird is even greater than is the case for *M. ater artemisiae*. In marked contrast to Furrer's experience in Washington is the situation in western Ontario, where Peck (1975) reported not a single one of 171 nests recorded in the Ontario nest records files was parasitized.

Strangely enough, in earlier records, Brewer's blackbird was never mentioned as having actually reared young cowbirds. This omission has now been corrected by Furrer's and Orians' numerous observations. In a similar vein, Dr. J. B. Tatum sends us a record from Saanich, near Victoria, Vancouver Island, 23 July 1973, of a Brewer's blackbird feeding 2 fledged cowbirds. Also, 1 of the parasitized nests S.I.R. observed near Shandon produced a fledgling cowbird. Lastly, on 3 August 1975, S.I.R. observed a female Brewer's feeding a fledged cowbird near Crowley Lake, Mono County, California at an altitude of 7200 feet. This is an unusually late date and an unusually high altitude for cowbird parasitism.

COMMON GRACKLE

Quiscalus quiscula (Linnaeus)

The grackle has been reported very rarely as a cowbird victim. To the six earlier records (Friedmann, 1963:135) may be added 5 more: a parasitized nest in Greeley County, Nebraska (Bennett, 1974), 1 in Ontario (Ontario nest records files, Toronto), 1 at Seneca, Maryland, 22 April 1941 (in the Delaware Museum of Natural History); and 2 other records from New York State (Bull, 1974: 537). The record from Maryland is the first one involving the host subspecies *Q. quiscula stonoi* (all the others refer to *Q. quiscula versicolor*). The

Nebraska record is the second for the cowbird race *M. ater artemisiae*.

It should be pointed out that numerous experiments have shown the grackle to be an acceptor species (Rothstein, 1975a). Therefore, the small number of records of parasitism cannot be due to rejection behavior by the host, but must reflect an actual absence of parasitism by the cowbird. The reason for the lack of parasitism is not clearly known. The cowbird may avoid parasitizing species as large as the grackle, but the American robin and brown thrasher are nearly as large and have been found to be parasitized many more times than the grackle, even though they are rejecter species. Perhaps the grackle's colonial nesting may be a factor. It may be difficult for cowbirds to escape detection when entering grackle colonies. But many grackles do not nest in colonies, in which case other factors may be responsible for the low incidence of parasitism. In the nest card records files at Cornell University there are data on 1795 nests of the grackle, none of which contained cowbird eggs. (There were indefinite statements of 2 of them being parasitized, but nothing in the way of a reliable record). In the Ontario files at Toronto are data on 1399 nests, only 1 of which was parasitized.

WESTERN Tanager

Piranga ludoviciana (Wilson)

To the 5 previous records (Friedmann, 1963:135; 1971:246) of the western tanager as a victim of the brown-headed cowbird may be added three more, all from Mono County, California: one in the Western Foundation; one in the Santa Barbara Museum of Natural History; and one found, but not collected, by John Schmitt, along the Little Walker River, 30 June 1973. This nest contained two newly hatched tanagers, one tanager egg, and one egg of the cowbird. The western tanager is still to be looked upon as an uncommonly reported host. Whether the rarity of reported parasitism is due to a lack of observations or to a very low rate of parasitism, or even to rejection behavior, is an interesting question, since this species' eastern counterpart, the scarlet tanager, seems to be very heavily parasitized.

SCARLET Tanager

Piranga olivacea (Gmelin)

The true status of this species as a cowbird host is not well understood. Only about 50 cases were known as of the 1963 review (Friedmann, p. 136). This is not a large number for such a common and widespread species. However, the relative paucity of records may be due largely to the fact that this species has a nest that is difficult to find and to reach, since it is usually 7 or more meters above the ground. Several studies listed in 1963, and based on a series of nests, reported high rates of parasitism. The situation is further clarified by Prescott's (1965) monograph. Eleven of 14 (78.6 percent) nests of known contents found in southern Michigan from 1947 to 1949 contained cowbird eggs. An additional nest contained only an advanced cowbird nestling when found. Six nests (among the 11 parasitized ones) whose contents were known and that were successful fledged 7 cowbirds and 8 tanagers. The detrimental effects of cowbird parasitism were great and seemed to be due largely to egg removal by adult cowbirds and/or to decreased egg production by female tanagers. Prescott occasionally observed female cowbirds visiting tanager nests. Some visits even occurred while nestling cowbirds were in the nest, but no adult cowbirds were seen to feed nestlings. On one occasion Prescott watched a female cowbird lay in a tanager nest. This observation was unusual because the cowbird removed a host egg 6 seconds before laying her own egg, whereas workers who investigated other species of hosts reported that host eggs are not removed at the time the cowbird deposits her own egg. A very high incidence of parasitism is also shown by nests studied near Pellston, Michigan. A survey of unpublished reports filed (as of 1969) at the University of Michigan Biological Station shows that all 5 scarlet tanager nests studied there between 1940 and 1966 were parasitized. One nest, studied by J. K. Boon in 1966, had 2 tanager and 4 cowbird eggs.

Since a number of investigators working in diverse areas (data listed herein from Norris, 1947, and in the Friedmann, 1963, review) have reported very high rates of parasitism, it is possible that the scarlet tanager is one of the most heavily

parasitized host choices in certain areas. Bull (1974: 537) mentions 12 instances of parasitism in New York State; 9 of these are additional to our earlier compilation. In the files of the Ontario nest records, at Toronto, are 2 more cases out of 36 nests reported from that province, a much lesser frequency of parasitism.

SUMMER Tanager

Piranga rubra (Linnaeus)

In view of the infrequency with which this tanager had been reported earlier as a cowbird victim (only 18 records in Friedmann, 1963:136) we may add that in the 12 years since then, only a single further instance has come to our notice—a parasitized set of eggs from Mena, Arkansas, 25 May 1955, in the collections of the Western Foundation.

CARDINAL

Richmondia cardinalis (Linnaeus)

Previously (Friedmann, 1963:137-138; 1966:5) a large number of records had been noted, with an unusually wide disparity in the incidence of parasitism in various areas (from "rarely parasitized" to over 60 percent). This lack of uniformity made it desirable to seek further quantitative data. Toward this end we may note that in the Ontario nest records files at Toronto there are 35 instances of parasitism (19.0 percent) of a total of 184 Ontario nests reported. The files at Cornell University, unfortunately given us without localities, show 49 parasitized nests out of a total of 1018 reported (4.8 percent).

PYRRHULOXIA

Pyrrhuloxia sinuata (Bonaparte)

To the 9 records of this bird as a cowbird victim previously reported (Friedmann, 1963:138; 1971:246-247) may be added 2 more: 1 in the collections of the Western Foundation, taken at Corpus Christi, Texas, 30 May 1912; and 1 in the Delaware Museum of Natural History, from Lytle, Texas, 20 July 1932.

ROSE-BREADED GROSBEEK

Pheucticus ludovicianus (Linnaeus)

A new northwesternmost record of this bird as a victim of the brown-headed cowbird is a parasitized nest found at Leduc, Alberta (Prairie Nest Records, Manitoba Museum); previously (Friedmann, 1963:138) Saskatchewan and North Dakota were the only areas where this grosbeak was known to be parasitized by the northwestern race of the cowbird (*M. ater atemisiae*). In the files of the Ontario nest records, Toronto, are data on 193 nests, 12 of which (6.2 percent) were parasitized (by *M. ater ater*).

BLACK-HEADED GROSBEEK

Pheucticus melanocephalus (Swainson)

A parasitized nest of the black-headed grosbeak reported from Butte County, California, by Dembosz, Fickett, and Manoles (1972:979) refers to the host race *P. melanocephalus maculatus*, a subspecies not hitherto recorded as a cowbird victim. A second instance, from San Luis Obispo County, California, 1 May 1937, is in the Lawrence Stevens Collection in the Santa Barbara Museum of Natural History. The cowbirds involved in these 2 cases are of the race *M. ater obscurus*, a subspecies not previously reported as a parasite on any race of this grosbeak.

The nominate race of the grosbeak has been reported as a cowbird host a number of times in British Columbia (Friedmann, 1971:247), and in Montana, Utah, Colorado, Nebraska, and Kansas (Friedmann, 1963:139). Still, on the whole, the black-headed grosbeak appears to be parasitized much less frequently than the rose-breasted species. In the holdings of the Western Foundation are 271 sets of eggs of *P. melanocephalus*, none of which are parasitized, while of *P. ludovicianus* there are 59 sets, 5 of which (8.1 percent) have cowbird eggs.

BLUE GROSBEEK

Guiraca caerulea (Linnaeus)

The Western Foundation's collections contain 10 parasitized sets of eggs of this bird, about a fifth as many as the total number of records known earlier (Friedmann, 1963:140; 1971:247). These add con-

siderably to the documentation of the blue grosbeak-brown-headed cowbird relationship. If we consider them according to the subspecies of the host and in relation to the total number of sets of eggs of each in the Western Foundation, we get the following: *G. caerulea caerulea*, 23 sets, 4 of which (17.4 percent) are parasitized; *G. caerulea interfusa*, 9 sets, 2 of which (22.2 percent) are parasitized; *G. caerulea salicaria*, 37 sets, 4 of which (10.8 percent) have cowbird eggs.

LAZULI BUNTING

Passerina amoena (Say)

A few years ago (Friedmann, 1971:247) it was erroneously stated that the lazuli bunting had been listed many times as a victim of the brown-headed cowbird. Actually, including the data therein presented, there were then available only 13 records of parasitism on it. To these we may now add 10 more: 2 from California (Madera and Calaveras counties), 3 from Oregon (Wasco County), all in the collections of the Western Foundation; 3 from Utah (1 from Springdale, in the collections of the Western Foundation, and 2 from Washington and Provo counties in the collections of Brigham Young University); another from San Luis Obispo County, California, in the Santa Barbara Museum of Natural History; and 1 from Maricopa County, Arizona, in the Western Foundation's collections. This remarkable increase in the number of records suggests that the lazuli bunting may yet uphold the statement made prematurely (not proleptically) in 1971. The Western Foundation has a total of 107 sets of eggs of this bunting; 7 of these (6.5 percent) have cowbird eggs.

The closely related indigo bunting has a much higher incidence of parasitism, 9 of 63 sets (14.3 percent) in the Western Foundation. In sizeable data brought together in 1963 (Friedmann, pp. 140-141) the indigo bunting was found to show a still higher rate of parasitism, 40 to 42 percent in Ohio. Peck (1975) notes that 19 of 88 (21.6 percent) Ontario nests were parasitized.

PAINTED BUNTING

Passerina ciris (Linnaeus)

A set of 2 eggs of this bunting with 1 of the brown-headed cowbird, taken 2 miles north of

Royse City, Washington County, Texas, on 23 May 1939, and now in the Western Foundation, is the first for the host-parasite combination *P. ciris pallidior* and *M. ater ater*, although the area is fairly close to where the ranges of *M. ater ater* and *M. ater obscurus* meet. The latter race of the cowbird has long been known to parasitize this subspecies of the bunting, while *M. ater ater* has been known to victimize *P. ciris ciris*.

DICKCISSEL

Spiza americana (Gmelin)

P. F. Elliott has informed us that parasitism of this species is very frequent in Kansas. Working in Riley County during 1974 and 1975, he found that 18 (94.7 percent) of 19 nests were parasitized, whereas the previous "high" for parasitism of this species was 78.2 percent (Zimmerman, 1966), also in Kansas.

PURPLE FINCH

Carpodacus purpureus (Gmelin)

Dr. J. B. Tatum informs us of an observation of an adult purple finch feeding and attending a recently fledged brown-headed cowbird near Victoria, southern Vancouver Island, British Columbia, in 1969, and of a second, similar instance at North Saanich, southern Vancouver Island, observed by Stuart Johnston, 9 June 1973. Crowell and Nehls (1973:911) noted still another case in the same general area. Aside from the relative rarity of records for the purple finch as a cowbird host, these are the first ones reported for the western race of the finch (*C. purpureus californicus*). There had been only 1 previous record of the purple finch's rearing the young cowbirds.

Data on the nominate race of the purple finch from Cheboygan and Emmet counties, Michigan, in the area around the University of Michigan Biological Station, indicate that this species is, in at least this one region, a common host. In the files of the station are student reports on 14 nests studied between 1926 and 1968. Eight (57.1 percent) of these were parasitized. This species is a cardueline finch and since this group feeds its young on a type of food—regurgitated plant seeds—unusual for a passerine its members may be among the few pas-

serines whose diet is unsuitable for cowbirds. Thus, it is of interest to determine what proportion of cowbird nestlings are able to survive under this feeding regime. Four of the 8 parasitized nests are irrelevant to this question because of nest predation, or insufficient data, or because the observers removed the cowbird eggs. At 1 of the remaining 4 nests (studied by C. V. Davis in 1941) a cowbird egg disappeared about the time the finch egg hatched. Possibly the cowbird hatched, but soon died, and was then removed by the finches. At another nest (studied by W. F. Sell in 1962) a cowbird nestling disappeared when it was 2 to 3 days old. But at the last 2 nests (studied by W. F. Sell in 1965 and by A. P. Sibole and S. I. Rothstein in 1968) a cowbird nestling fledged. In assessing the potential threat that the parasitism poses to the finch's reproductive output, it is important to note that the cowbird hatched 1 to 3 days earlier than the finches at each of 3 nests at which investigators reported hatching times. It is also important to note that the high rate of parasitism in this Michigan area is not a transitory phenomenon. The 2 oldest nests in the sample, studied in 1926 and 1941, were parasitized as were the 2 most recent nests, studied in 1968.

Apparently the situation described for Michigan applies also to New York, from which state Bull (1974:537) mentions 15 instances of parasitism. Of these, 10 are additional to the earlier compilation (Friedmann, 1963:144). In Ontario, as well, the purple finch is a frequent host; in the nest records files at Toronto, 27 out of 70 nests reported (38.6 percent) were parasitized, a higher incidence of parasitism than for any other host species of which at least 20 nests were reported. All these new data provide a great change in our knowledge since the 1963 compendium.

HOUSE FINCH

Carpodacus mexicanus (Müller)

The house finch has been reported as a victim of the brown-headed cowbird relatively seldom (11 records, Friedmann, 1963:145; 1966:6). It may therefore be worth noting 7 more records: a set of 4 eggs of the finch and 1 of the cowbird, taken in San Luis Obispo County, California, 21 May 1933, now in the Santa Barbara Museum of Natural History; an observation in southern Vancouver Island (Vic-

toria area), 15 July 1970; a parasitized set collected at Mesa, Maricopa County, Arizona, 29 June 1922, now in the Delaware Museum of Natural History; another found at Fresno, California, 14 May 1975; a parasitized set taken at Hunter, Salt Lake County, Utah, 15 June 1916, by J. W. Sugden, now in the Western Foundation; a cowbird egg from a nest of a house finch at Carlsbad, Eddy County, New Mexico, 10 July 1922, in the Thomas Burke Memorial Museum, University of Washington; and a record from Premont, Jim Wells County, Texas (Cornell University files). The record from Carlsbad, New Mexico, involves the nominate, eastern race of the parasite, for which it is the second case reported. All of the present records involve the host race *C. mexicanus frontalis*.

In the early 1940's the house finch was introduced on Long Island, New York, and has become established there. According to Bull (1974:537) it has been found to be parasitized there in at least 3 instances. Here the parasite is nominate, *M. ater ater*. Bull has kindly supplied the data for 2 of these cases: Bellport, Suffolk County, 3 May 1965, with 1 finch egg and 2 cowbird eggs; Lloyd's Harbor, Suffolk County, 29 May 1966, nest in a hanging flower pot on a house porch, 5 eggs of the finch and 1 of the parasite.

COMMON REDPOLL

Acanthis flammea (Linnaeus)

This far northern finch was previously known as a victim of the brown-headed cowbird on the basis of a single record, a parasitized nest found at Castor, Alberta, 25 June 1959 (Friedmann, 1963:146). The Prairie Nest Records Scheme includes 2 such cases, both found on the same day in the same place; 1 of them is most probably the same as the record previously mentioned.

PINE SISKIN

Spinus pinus (Wilson)

To the 11 earlier records of parasitism on this bird (Friedmann, 1963:146-147) may be added 3 more. One of these, from Manitoba (Prairie Nest Records, Winnipeg) is the third case known to us

involving the cowbird race *M. ater artemisiae*. The other 2, from Ontario, out of 11 nests reported to the nest records files at Toronto, refer to the nominate race of the parasite.

AMERICAN GOLDFINCH

Spinus tristis (Linnaeus)

Lemon (1969) reported a goldfinch parasitized by a brown-headed cowbird near Victoria, southern Vancouver Island. This record must refer to the host subspecies *S. tristis jewetti*, which is an addition to the host catalog. Of the subspecies *S. tristis salicamans*, no fewer than 13 parasitized sets of eggs, all from California (Merced, San Benito, Ventura, Los Angeles, and San Diego counties) are in the collections of the Western Foundation. These 13 constitute 6.8 percent of 191 sets of that subspecies in that collection; the host frequency is about the same for the Foundation's material of eastern *S. tristis tristis*—3 parasitized sets (6.6 percent) of 45 sets there. However, in 4 "source studies" of the eastern goldfinch population from Quebec and Michigan (Friedmann, 1963:147-148) there were only 19 parasitized nests out of 1484 reported, an incidence of only about 1.3 percent. Of 49 nests from Saskatchewan, Manitoba, and Alberta reported to the Prairie Nest Cards files at Winnipeg, only 2 (4.0 percent) were parasitized; of 439 nests in Ontario, 18 (4.1 percent) were parasitized (Ontario Nest Records, Toronto); the files at Cornell University show 12 (3.1 percent) of 390 nests were so affected.

During 1968 and 1969, one of us (S.I.R.) found 12 nests of this species in Cheboygan and Emmet counties, Michigan. One of these nests was parasitized. The cowbird egg hatched 2 to 4 days before the 5 goldfinch eggs began to hatch. However, the cowbird showed little weight gain. On 22 July 1968, the day it probably hatched, the cowbird weighed 2.8 g. On 23 July, it was 3.5 g, and on 24 July it was dead and weighed 2.5 g. Evidently, the cowbird was not adequately nourished by the diet of regurgitated seeds this cardueline finch normally feeds to its young. Interestingly, on 24 July, the dead cowbird was draped over the nest rim in a manner similar to that in which cardueline finches drape fecal sacs around the sides of their nest.

LESSER GOLDFINCH

Spinus psaltria (Say)

To the few (7) records of this goldfinch as a cowbird victim in California (Friedmann, 1963:148) may be added 6 more, 5 of which are among a total of 8 parasitized sets of eggs in the collections of the Western Foundation, an incidence of parasitism of 5.2 percent out of 153 sets there; the other 3 of these 8 were included in the 1963 statement. The sixth record, observed by D. A. Schroeder at Three Pines Campground, Ventura County, is the first case in which a cowbird was successfully reared by this species of host. When first found, on 12 May 1972, the nest contained 3 goldfinch eggs and 1 cowbird egg. Between 12 and 21 May, 2 of the goldfinch eggs fell from the nest when a late snowstorm caused the branches supporting the nest to tilt over. The cowbird hatched on 21 or 22 May and fledged on 31 May. The 1 remaining goldfinch egg hatched on 24 May, but the nestling disappeared 2 days later.

GREEN-TAILED TOWHEE

Chlorura chlorura (Audubon)

Previously (Friedmann, 1963:150) we knew but a single record of this towhee as a victim of the northwestern race of the brown-headed cowbird, *M. ater artemisiae*. We may now add 3 more instances, 2 from Mono County and 1 from Tuolumne County, California, all in the collections of the Western Foundation. There still are only a small number of reports of parasitism on the green-tailed towhee by the nominate race of the cowbird, although it has been said to be a favorite host choice in Mesa County, Colorado, and in San Miguel County, New Mexico (Friedmann, 1963:150).

RUFOUS-SIDED TOWHEE

Pipilo erythrophthalmus (Linnaeus)

In the last general survey of the brown-headed cowbird's hosts (Friedmann, 1963:150-151), it was noted that few instances of parasitism on this towhee had been reported from California, but that the recent spread and increase of the parasite in the southern parts of that state would probably result

in further records. Three such instances have come to light: 1, collected in San Luis Obispo County, 2 June 1934, is now in the Santa Barbara Museum of Natural History, and 2 more—1 from near Mendota, Fresno County, 1 June 1935, and 1 from near Stockton, 21 June 1942—are in the collections of the Western Foundation. The San Luis Obispo record involves the host subspecies *P. erythrophthalmus megalonyx*; the other 2 have to do with the race *P. erythrophthalmus falcinellus*. The last mentioned subspecies is new to the host catalog of the parasite.

The Western Foundation's collections contain 393 sets of eggs of this towhee (all races), 11 of which (2.8 percent) are parasitized. A list of only those races of the host known to be victimized by the cowbird, yields the following data: *P. erythrophthalmus erythrophthalmus*, 55 sets, 9 (16.3 percent) parasitized; *P. erythrophthalmus falcinellus*, 8 sets, 2 (25.0 percent) parasitized; *P. erythrophthalmus canaster*, 3 sets, none parasitized; *P. erythrophthalmus arcticus*, 7 sets, none parasitized; *P. erythrophthalmus montanus*, 14 sets, none parasitized; *P. erythrophthalmus curtatus*, 1 set, not parasitized; *P. erythrophthalmus oregonus*, 37 sets, none parasitized; *P. erythrophthalmus falcifer*, 57 sets, none parasitized; and *P. erythrophthalmus megalonyx*, 173 sets, none parasitized.

The Ontario nest records files at Toronto have data on 70 nests, 14 of which (20.0 percent) were parasitized.

BROWN TOWHEE

Pipilo fuscus Swainson

McCaskie (1970:718) reported that H. and O. Clarke found a young brown-headed cowbird reared by a brown towhee in 1970, near Glendale, Los Angeles County, California, where the breeding race of the host is *P. fuscus senicula*, according to the fifth edition of the A. O. U. Check-List (1957:583). A little further to the north, in Santa Barbara and San Luis Obispo counties, one of us (S.I.R.) found 7 nests of the subspecies *P. fuscus crissalis* in 1974. Two of these nests were parasitized, constituting the first records for that race of the brown towhee as a cowbird victim. Aside from this, they give an indication that the brown towhee may be a more common host than was indicated

by previously available data. One nest was already abandoned when found and the other was destroyed by a predator before the cowbird egg hatched. It is possible that cowbird parasitism of this towhee is increasing in southern California, with the increase of the cowbird population. No parasitism was found in 6 towhee clutches collected in previous years in Santa Barbara and San Luis Obispo counties and now at the Santa Barbara Museum of Natural History. Otherwise the brown towhee is known as a very occasional victim of the cowbird in New Mexico (3 records) and Arizona (several records); these instances all relate to the host race *P. fuscus mesoleucus*.

A parasitized nest found east of Stone Corral, California, 4 May 1941, by W. B. Sampson, and now in the Western Foundation, is the first record of parasitism on the subspecies *P. fuscus carolae*.

The Glendale record is the first one of the host species rearing the young parasite; all the other records were of eggs only.

ABERT'S TOWHEE

Pipilo aberti Baird

To the 10 times this towhee had been previously noted (Friedmann, 1963:152) as a cowbird victim may be added 11 more instances, 10 of them in the collections of the Western Foundation, and 1 in the Delaware Museum of Natural History. The records in the Western Foundation are as follows: of nominate *P. aberti aberti* there are 34 sets, 7 of which (20.6 percent) are parasitized, all 7 from Maricopa County, Arizona (as is the set in the Delaware Museum); of *P. aberti dumeticolus* there are 69 sets, 3 (4.3 percent) are parasitized, all from California—near El Centro, near Blythe, Riverside County, and from Bard, Imperial County.

LARK BUNTING

Calamospiza melanocorys (Stejneger)

A set of eggs of the lark bunting containing an egg of the brown-headed cowbird, now in the Western Foundation, taken at Seven Persons, Alberta, adds a new northwestern limit to the range over which this species has been found to be parasitized. The earlier records (Friedmann, 1963:153; 1971:247–248) were from North Dakota, Montana,

and Saskatchewan. The Prairie Nest Records files at the Manitoba Museum contain records of 6 parasitized nests of this bird. A record from Nebraska, reported by Bennett (1974), is the southernmost record of parasitism on the lark bunting.

SAVANNAH SPARROW

Passerculus sandwichensis (Gmelin)

This sparrow has recently been reported as a cowbird victim in southern Alberta by Kondla and Pinel (1971). This refers to the host race *P. sandwichensis nevadensis*, for which there were previously only 3 records from Alberta. Information received from the Prairie Nest Records Scheme adds no fewer than 18 more records of parasitism on this bird in Alberta, Saskatchewan, and Manitoba, out of a total of 111 nests reported, an incidence of parasitism of 16.2 percent. It follows that in the prairie provinces of Canada the savannah sparrow can be looked upon as a regular victim of the parasite, quite a different situation than could have been visualized from the few earlier data. A record from Utah (Brighton, 3 May 1906), not hitherto reported, is in the Western Foundation's collections; 1 from Jefferson, Colorado, is reported by Kingery (1974:932). Of the host race *P. sandwichensis oblitus* the following may be recorded: in Ontario, out of 240 nests reported to the Ontario nest records at Toronto, 32 (13.3 percent) were parasitized; the Delaware Museum of Natural History has a parasitized set of eggs from Illinois; Potter (1974:58) in southeastern Michigan, noted 1 parasitized nest out of 54 nests observed by him. Of the host race *P. sandwichensis savanna* we may add 3 more records, from Cape Cod, Massachusetts (Hill, 1965:280), and New York (Bull, 1974:537). The total number of records for the species known to us is now 84, as compared with 28 in 1963.

GRASSHOPPER SPARROW

Ammodramus savannarum (Gmelin)

In view of the fact that there still are but a relatively small number of records of this secretive sparrow as a cowbird victim (18 records known in Friedmann, 1971:248), we may note that in Ontario (Peck, 1975), 6 (11.7 percent) of 51 nests reported were parasitized. P. F. Elliott informs us that he found an even higher rate of parasitism in Riley

County, Kansas, where 9 out of 18 nests (50 percent) were so affected. He also found the grasshopper sparrow successfully raises cowbird nestlings, the first evidence for this on record. Peck's and Elliott's data indicate that this sparrow and the cowbird are, at least in their regions, quite important in each other's economy. The Prairie nest records at Winnipeg show a parasitized nest found at Woodlands, Manitoba, 2 July 1962. These Ontario, Kansas, and Manitoba records involve the host race, *A. savannarum perpallidus*. The eastern race, *A. savannarum pratensis*, has recently been noted as a cowbird victim on Cape Cod, Massachusetts (Hill, 1965:280).

HENSLOW'S SPARROW

Ammodramus henslowii (Audubon)

To the small number of cases of parasitism on this sparrow previously known to us (Friedmann, 1963:156) may be added one more, from near Augusta, Michigan, reported by Robins (1971). This record involves the nominate races of the host and of the parasite. Although the total number of records is still small, it is significant in proportion to the number of nests, parasitized or not, reported of this unobtrusive species. In Maryland, from whence 5 records of parasitism are known, the Henslow's sparrow must be a regular and a fairly common host choice.

VESPER SPARROW

Poocetes grammineus (Gmelin)

A new concept of the frequency with which the vesper sparrow is imposed upon by the brown-headed cowbird in the western prairie provinces of Canada is afforded by the files of the Prairie Nest Records Scheme which include no fewer than 23 instances (11.8 percent) of parasitism in Alberta, Saskatchewan, and Manitoba, out of a total of 195 nests reported. The Ontario nest records files, at Toronto, have data on 242 nests, 35 of which (14.5 percent) were parasitized. These figures reflect a higher incidence of parasitism than either of two sizeable "lots" of data reported earlier (Friedmann, 1963:157), where it was noted that 9 nests (8.0 percent) were parasitized out of 112 found in Ohio by Hicks, and 3 out of 74 nests examined in south-

ern Quebec by Terrill (4.0 percent). The experience of Harrison (1975:249) in Pennsylvania and Wisconsin suggests that such parasitism is not always the case. He found 18 nests, none of which held any cowbird eggs.

Low frequency of parasitism is shown in the material in the Western Foundation's collections. Out of 107 sets of eggs, only 3 have cowbird eggs (only 2.8 percent). All these are of the nominate race of the host where they constitute 5.7 percent of 53 sets; completely unparasitized are 29 sets of *P. grammineus confinis* and 25 sets of *P. grammineus affinis*.

LARK SPARROW

Chondestes grammacus (Say)

The recent work of Newman (1970) reveals again the difficulty of properly evaluating the frequency of host selection by the brown-headed cowbird. At the time of the 1963 compilation (Friedmann, p. 158) only 30 instances were on record, and the only valid conclusion then seemed to be that this bird was a relatively seldom chosen victim. Newman's paper not only adds half as many more records, but shows that in his study area, Marshall County, Oklahoma, the lark sparrow was heavily parasitized; 15 (45.5 percent) of 33 nests under observation were so affected. Newman's data reveal that only 3 of the parasitized nests actually fledged young cowbirds, while the fledging success of the host was 20.0 percent of the eggs laid in parasitized nests as compared with 55.2 percent in non-parasitized nests. Analysis of Newman's data shows, interestingly, that parasitized nests were much less successful in producing young of either species than were unparasitized nests (28.6 percent of the former and 58.8 percent of the latter produced young). This difference, while not statistically significant, suggests that parasitized nests may have a higher predation rate than unparasitized ones. If this is indeed the case, one wonders if the former are relatively easier for predators to find, perhaps because of the louder and more persistent begging of the nestling cowbirds.

To Newman's cases we may now add 25 more, a total of 70, or over twice the number known to us in 1963. Four of these additions are from Oklahoma (Wiens, 1963); 1 from Texas is in the collec-

tions of the Delaware Museum of Natural History; 3 parasitized nests out of 15 from Saskatchewan, Manitoba, and Alberta are in the Prairie Nest Records; 17 others, including sets from Texas, California, and Oklahoma, are in the Western Foundation's collections. These 17 sets constitute 7.4 percent of the 228 sets of lark sparrow eggs in that large collection, or 8.7 percent of 195 sets of the host race *C. grammacus strigatus*. Of the nominate, eastern race of the lark sparrow there are 33 sets of eggs, not one of which contains cowbird eggs. Lest it seem that this low percentage of parasitism in this extensive series is at odds with Newman's findings, discussed above, it should be said that this may reflect the bias some of the early egg collectors had against parasitized sets, many of whose eggs are now in the Western Foundation. It cannot be merely assumed that the frequency of parasitism on the lark sparrow has increased in recent years.

RUFIOUS-WINGED SPARROW

Aimophila carpalis (Coues)

To the little known of this sparrow as a victim of the brown-headed cowbird (*M. ater obscurus*) may be added 2 instances, both from near Tucson, Arizona: a parasitized set of eggs taken on 7 May 1897, now in the holdings of the Western Foundation, and an observation reported to us by D. W. Lamm, who found a parasitized nest, 15 August 1971, at Santa Rita Experimental Range, south of Tucson. Apparently in that part of Arizona the rufous-winged sparrow is not infrequently imposed upon by the parasite.

CASSIN'S SPARROW

Aimophila cassinii (Woodhouse)

To the few previous records of this sparrow as a victim of the brown-headed cowbird (Friedmann, 1963:159) may be added one more. Kingery and Julian (1971:439) found a parasitized nest in the Comanche National Grassland, 11 miles southeast of Campo, Baca County, extreme southeastern Colorado. This record refers to the nominate race of the parasite, for which subspecies there was earlier but a single record, an instance reported by Strecker (1927:47) from McLennon County, Texas.

BLACK-THROATED SPARROW

Amphispiza bilineata (Cassin)

To the total number of instances of cowbird parasitism on this sparrow previously known (Friedmann, 1963:160) we may now add the following additional cases: 5 from the Texas counties Cameron, Tom Green, and Webb, distributed among the Western Foundation, the Delaware Natural History Museum, and the collections of Oregon State University; a "few nests" all of which were parasitized, found in southern Texas (Webster, 1972:878); one from southwestern Texas—Big Bend National Park (Wauer, 1973:178); and one from the Malheur National Wildlife Refuge, southeastern Oregon, reported to us by T. W. Haislip, Jr. This last record, the first authenticated breeding record for the black-throated sparrow in Oregon (*A. bilineata deserticola*), is also the first record for this species as a host of the northwestern race of the parasite (*M. ater artemisiae*).

DARK-EYED JUNCO

Junco hyemalis (Linnaeus)

The dark-eyed junco, as presently understood, includes the races of the previously separated "Oregon" junco as well as those of the "slate-colored" junco.

Of the race *J. hyemalis cismontanus*, previously (Friedmann, 1963:161) known as a cowbird victim in British Columbia, we may note a parasitized set from the Fort Assiniboine District, Alberta, 8 June 1946, now in the collections of the Western Foundation. Of the "Oregon" junco portion of the species we may add the first records of cowbird parasitism on the subspecies *J. hyemalis shufeldti*—from near Victoria, southern Vancouver Island (Lemon, 1969), and from near Portland, Oregon, a set now in the collections of the Western Foundation. The small number of previous records for the races of the "Oregon" junco were of the subspecies *J. h. montanus*, *J. h. thurberi*, and *J. h. pinosus*. Three additional instances of parasitism on *J. h. thurberi* are mentioned by Rogers (1971:881) and 11 more by White (1974) out of a total of 40 nests studied by her in meadow sites in the Sierra Nevadas, Nevada County, California. Fur-

ther south in the Sierras (Mono County) one of us (S.I.R.) found a parasitized nest with 2 cowbird eggs laid during the first 3 days of August, a very late date.

In New York, from whence we previously knew of only 2 records, Bull (1974:537) has added 6 more cases.

CHIPPING SPARROW

Spizella passerina (Bechstein)

At the time of the 1963 compendium (Friedmann, p. 162) but a single instance was known of parasitism on the subspecies *S. passerina arizonae* by the dwarf cowbird *M. ater obscurus*. A second case may be added, a set of 4 eggs of the sparrow and 1 of the parasite, taken in San Luis Obispo County, California, 28 April 1939, now in the Santa Barbara Museum of Natural History.

The collections of the Western Foundation contain 267 sets of eggs of the chipping sparrow, only 8 of which (3.0 percent) are parasitized. This is to some extent a reflection of the bias against sets with cowbird eggs of some of the early collectors whose materials are now incorporated in the Western Foundation, and may also suggest a geographical difference in the incidence of parasitism on this sparrow in the west as compared with the east. We may recall (Friedmann, 1963:162) that in Ohio, Hicks had found that 60 out of 115 nests examined (over 50 percent) were parasitized, and that in southern Quebec, Terrill had found cowbird eggs or young in 16 out of 138 nests (11.6 percent). One of us (S.I.R.) studied 83 nests in Cheboygan and Emmet counties, Michigan, in 1968 and 1969, and found that 30 (36.2 percent) of them were parasitized. Of 155 nests found in Manitoba, Saskatchewan, and Alberta, reported to the Prairie Nest Cards files at the Manitoba Museum, 20 (12.9 percent) were parasitized. Of 733 nests in Ontario reported to the files at Toronto, 216 (29.5 percent) were parasitized. On the other side of the picture is the experience in Pennsylvania of Harrison (1975:244) who found cowbird eggs in only 2 out of 29 nests examined, a very low incidence of 6.9 percent.

CLAY-COLORED SPARROW

Spizella pallida (Swainson)

This sparrow was previously known (Friedmann, 1963:163) to be parasitized by the brown-headed cowbird frequently in Alberta, but there were only scattered records from elsewhere, e.g., only 1 such case from North Dakota. Now there is evidence that this sparrow is frequently imposed upon in that state. Dr. R. E. Stewart informs us that he has data on 14 North Dakota instances of parasitism, including the 1 referred to above. The 13 additional cases represent 39.4 percent of 33 active nests examined, a high rate of parasitism, a rate exceeded in North Dakota only by the yellow warbler (44 percent) in Dr. Stewart's state files. In the files of the Prairie Nest Records Scheme are 65 instances of cowbird parasitism on this sparrow in Alberta, Saskatchewan, and Manitoba. In these prairie provinces the clay-colored sparrow is a very common victim, second in frequency only to Brewer's blackbird. The 65 Prairie records more than equal in number all the records from the entire range of the sparrow known a decade earlier. These 65 records constitute 23.6 percent of a total of 275 clay-colored sparrow nests reported to the Scheme up to mid-1975. In Ontario, 3 nests out of 13 reported to the Toronto files were parasitized. What degree of biological success for the cowbird is involved in this excessive host selection is, however, uncertain, in view of Salt's (1966) conclusion that in his area of Alberta the clay-colored sparrow did not tolerate, or, at least, did not incubate, the eggs of the parasite. Salt's conclusion needs to be corroborated by experiments as he does not state how many parasitized nests served as the basis for his statement, and the intolerance he noted consisted largely of nest desertion. Inasmuch as birds may desert their nests for various reasons, the mere fact of desertion cannot be rigidly connected with cowbird parasitism however much the two may seem to have a cause-and-effect relationship.

BREWER'S SPARROW

Spizella breweri Cassin

To the little that was previously known of Brewer's sparrow (n nominate subspecies) as a host of the brown-headed cowbird (Friedmann, 1963:163-

164) may be added 2 more records; a set of 3 eggs of the host and 1 of the parasite, taken in Mono County, California, 15 June 1940, and now in the Santa Barbara Museum of Natural History (Lawrence Stevens Collection); and a parasitized nest found in North Dakota, reported to us by Dr. R. E. Stewart.

FIELD SPARROW

Spizella pusilla (Wilson)

Kondla and Pinel (1971) have recorded the field sparrow (subspecies *S. pusilla arenacea*) as a victim of the brown-headed cowbird (*M. ater artemisiae*) in southern Alberta, the northwesternmost area yet reported for this victim. Actually Alberta is just north of the range of the host as given in the 1957 A. O. U. Check-List (pp. 616-617). Either the sparrow is extending its range or the paucity of local observers has limited our knowledge of its occurrence in southern Alberta before now. While the field sparrow is a frequent victim of the cowbird, with over 125 records of parasitism (Friedmann, 1963:164-165), there were only 2 earlier records for the race *S. pusilla arenacea*, both from South Dakota.

Mr. F. F. Nyc, Jr. has informed us that he found a parasitized nest of the field sparrow in Caldwell County, Texas. The brown-headed cowbird in that area is of the race *M. ater obscurus*, a subspecies of the parasite not previously noted as affecting this sparrow.

Since the 1963 compilation some 66 additional instances of parasitism on the nominate race of the sparrow have come to our notice. In the collections of the Western Foundation there are 122 sets of eggs of the field sparrow, 9 of which (7.4 percent) were parasitized. In Ontario, of 179 nests reported to the files at Toronto, 36 (20.1 percent) were parasitized.

WHITE-CROWNED SPARROW

Zonotrichia leucophrys (Forster)

The white-crowned sparrow has long been known as an infrequent victim of the brown-headed cowbird. The few instances on record (Friedmann, 1971:249) pertained to 3 races of the host—*Z. l. leucophrys*, *Z. l. oriantha*, and *Z. l. gambelii* (now

shown to refer to *Z. l. pugetensis*). To these may be added the race *Z. leucophrys nuttalli*, which was so reported by Baptista (1972) in the San Francisco Bay area. Baptista also suggested that the records previously assigned to *Z. l. gambelii* were more accurately referable to *Z. l. pugetensis* in the light of Banks's detailed study (1964) of the geographic variations of this sparrow, a decision here accepted. Lemon (1969) found *Z. l. pugetensis* to be parasitized near Victoria, Vancouver Island, where still additional instances were reported later in the annual bird reports for southern Vancouver Island (Tatum, 1970: [unpaged]; 1971:51; and 1973:62), and by Crowell and Nehls (1973:911). Still more recently, Lewis (1973) and Lavers (1974) found this race of the sparrow to be parasitized on Camano and on Samish Islands, western Washington (1 instance out of over 100 active nests found on Camano Island, 3 instances on Samish Island). A record of a parasitized nest from Skull Creek, Saskatchewan, 2 July 1961, (files of the Prairie Nest Records Scheme) may be noted as well as the mention of 3 fledged young cowbirds attended by white-crowned sparrows in the "Great Basin-Central Rocky Mountain Region" (Kingery, 1972:886). It is not clear from Kingery's note whether these were 3 separate observations or 1 instance involving 3 young cowbirds. Dr. James R. King informs us that in his studies of this sparrow, race *Z. leucophrys oriantha*, in Hart Mountain National Antelope Refuge, Lake County, Oregon, in June 1975, he found that 6 (14.3 percent) of 42 nests observed were parasitized. It appears from all these recent records that the white-crowned sparrow is becoming a regular host of the parasite in the recent extension of range of the latter in Oregon and Washington.

WHITE-THROATED SPARROW

Zonotrichia albicollis (Gmelin)

Of 236 nests of this bird found in Ontario and reported to the nest record files at Toronto, 17 (7.2 percent) were parasitized, a higher incidence than the 4.0 percent (20 out of 507 nests) found in southern Quebec (Friedmann, 1963:166). Of these 17 records, 12 are additional to those listed in the earlier compilation, increasing the total from 36 to 48 instances.

FOX SPARROW

Passerella iliaca (Merrem)

The fox sparrow is infrequently reported as a cowbird victim. To the single previous record for the subspecies *P. iliaca monoensis* (Friedmann, 1963:167) as a victim of the brown-headed cowbird, may be added 2 more from Mono County, California, now in the collections of the Western Foundation.

A first instance of cowbird parasitism on the race *P. iliaca stephensi* was found by E. M. Hall at Barton Flat, San Bernardino County, California, on 21 July 1973, a late breeding date. In this case the cowbird egg was found at one side of the nest and possibly was not being incubated by the sparrow.

LINCOLN'S SPARROW

Melospiza lincolnii (Audubon)

Kingery (1974:932) listed the Lincoln's sparrow as a cowbird host at Jefferson, Colorado; one of us (S.I.R.) noted another instance of parasitism on it in Mono County, California, 4 August 1975, a nest with 2 young cowbirds and 2 young sparrows, all ready to fledge. These are the first records of the host subspecies *M. lincolnii alticola* as a victim of the cowbird, and also the first report of Lincoln's sparrow's rearing the young of the parasite to the fledging stage. In both cases, the parasite was of the race *M. ater artemisiae*. The nominate race of the sparrow was previously known (Friedmann, 1963:167-168) as a host on the basis of only 10 records, occurring over more than half a century, ranging from northern New York State to Saskatchewan, Manitoba, and Alberta. To these may be added 1 more, from Ontario, in the nest record files at Toronto (the only instance out of 15 nests reported to the files).

SWAMP SPARROW

Melospiza georgiana (Latham)

To the data previously compiled (Friedmann, 1963:168) may be added 20 more records of parasitism on the swamp sparrow: 1 from near Chicago, Illinois, 3 from Wisconsin (Dana and Oconto counties), and 1 from New York (Monroe County), all

in the collections of the Western Foundation; 1 from South Dakota in the Delaware Museum of Natural History, and 14 records from Ontario. The Ontario nest records show 18 parasitized nests out of 112 nests reported (of these, 4 were included in the earlier compilation). This is an incidence of 16.0 percent, a high frequency of parasitism. Harrison (1975:249) noted that the swamp sparrow was a "frequent" victim in marshy areas in Pennsylvania and Wisconsin, in spots where nearby red-winged blackbird nests were rarely affected by the cowbirds. It becomes obvious that the incidence of parasitism on this sparrow varies in different areas; in most places it is an uncommon host choice.

SONG SPARROW

Melospiza melodia (Wilson)

The song sparrow may be discussed here chiefly to put on record the greatly increased number of known instances of cowbird parasitism on some of the sparrow's less well-known western subspecies, including one, *M. melodia mailliardi*, that had not been reported as a cowbird victim until now. In the vast collections of the Western Foundation are the following parasitized sets of eggs: *M. melodia montana*, 2 sets from Utah (Hunter and Ft. Douglas Creek, Salt Lake County); *M. melodia fallax*, 1 set from near Phoenix, Arizona; *M. melodia cooperi*, 16 sets from Los Angeles, San Diego, and San Luis Obispo counties, California; *M. melodia saltonis*, 5 sets from Yuma and Maricopa counties, Arizona, and near Bard, Imperial County, California; *M. melodia heermanni*, 4 sets from Los Banos, Merced County, Fresno, Fresno County, and Buena Vista Lake, Kern County, California. *M. melodia gouldii*, 5 sets from Alameda and Santa Clara counties, California; *M. melodia fisherella*, 2 sets from Mono County, California, and 2 sets from Oregon; *M. melodia morphna*, 2 sets from Oregon; and *M. melodia mailliardi*, 2 sets taken near Stockton, California.

In the collections of the University of Puget Sound there is a parasitized set of eggs of the rarely reported subspecies *M. melodia merrilli*, taken at Satus, Washington, 17 June 1928. For this subspecies there was previously a single record from British Columbia.

Aside from being a very commonly selected host,

the song sparrow is also a remarkably good one from the standpoint of the parasite (McGeen, 1972:379).

The great number of instances on record of the song sparrow as a cowbird host choice gives the impression that it is very heavily parasitized. If we add together the figures from all studies where the total number of song sparrow nests found is given, as well as the number that were parasitized, the resulting figure comes to 385 nests parasitized out of 1286 active nests observed, or a parasitism incidence of 29.9 percent. As might be expected, the percentage varies in different sets of data (see Friedmann, 1963:170), with a high of 62.7 percent (37 out of 59 nests) in Michigan and a low of 12.7 percent (62 out of 486 nests) in southern Quebec. At its most intense local rate, the cowbird parasitism on the song sparrow comes about up to the level experienced on the whole population of the Kirtland's warbler. Mayfield (1973) found that the warbler had from 60 to 70 percent of its nests parasitized, with heavy loss of host young. In the collections of the Western Foundation there are 847 sets of eggs of the song sparrow (all races, but not including eggs taken in Baja California, or Alaska, or off-shore islands, localities outside the cowbird's breeding range). Out of these, 44 (5.19 percent) have cowbird eggs in them. Regionally these figures break down as follows: eastern races, 131 sets, 9 (6.9 percent) parasitized; California races, 582 sets, 24 (4.1 percent) parasitized; Pacific Northwest races, 86 sets, 4 (4.7 percent) parasitized; Rocky Mountain

races, 38 sets, 3 (7.9 percent) parasitized; and southwest races, 10 sets, 4 (40.0 percent) parasitized.

Of 152 nests found in Saskatchewan, Manitoba, and Alberta reported to the Prairie Nest Card files, at the Manitoba Museum, 30 (19.7 percent) were parasitized. These 30 records refer to the host race *M. melodia juddi* and the parasite race *M. ater artemisiae*. Of 773 nests of the song sparrow (all races) listed in the data bank at Cornell University, 74 (10 percent) were parasitized; of 1002 nests found in Ontario and reported to the files at Toronto, 251 (25.1 percent) were parasitized.

CHESTNUT-COLLARED LONGSPUR

Calcarius ornatus (Townsend)

Previously known as a victim of the brown-headed cowbird in North Dakota and Saskatchewan, this longspur has recently been found to be imposed upon in southern Alberta as well (Kondla and Pinel, 1971). In North Dakota, where most of the older records were noted, the incidence of parasitism may be higher than was hitherto assumed. Dr. R. E. Stewart informs us that out of 37 nests examined there, 8 were parasitized, a rate of 21.6 percent. Until now there were only a dozen or so records in all. To these may be added two more from Moose Jaw, Saskatchewan (Prairie Nest Records Scheme), and one from near Esmond, North Dakota, in the collections of the Western Foundation.

Shiny Cowbird

Molothrus bonariensis

Discussion

The small number of bird students throughout much of South America is reflected in the slow accretion of new published information on this species of cowbird. Inexplicably, Sick's important paper of 1958 was overlooked in the 1963 compilation, but was subsequently assumed to have been included in it. The information it contains, together with what we have been able to learn from extensive correspondence with many generous and cooperative observers, who have very kindly made their unpublished notes available to us for the

present report, has enabled us to appraise and to review some 262 more instances of the parasitism of the shiny cowbird since the 1971 paper.

NEW HOSTS.—These records add 33 new hosts (27 species, plus 6 subspecies) to those previously reported. Four races of the parasite are involved in these records, as listed below. In addition to these 33 new hosts, a few species previously known to be among the victims of one race of the shiny cowbird have been found to be parasitized by another subspecies as well. The additions to the host catalogs for each of the 4 cowbird subspecies are listed below; those that are new to the total

host list of the species are marked with an asterisk. No new information has come to us concerning the other races of the shiny cowbird.

New hosts for *Molothrus bonariensis bonariensis*: **Zenaida auriculata chrysochenia*, **Pseudoseisura cristata*, **Phacellodomus striaticeps*, **Phacellodomus rufifrons*, **Phacellodomus sibilatrix*, **Phleocryptes melanops*, **Tityra cayana braziliensis*, **Alectruris tricolor*, **Arundinicola leucocephala*, **Serpophaga subcristata*, **Myiarchus tyrannulus tyrannulus*, **Phytotoma rutila angustirostris*, **Anthus furcatus*, **Psarocolius decumanus*, **Schistoclamys melanopsis olivina*, **Ramphocelus carbo centralis*, **Donacospiza albifrons*, **Arremon flavirostris d'orbignii*, **Sporophila lineola*, and **Spinus magellanicus tucumanus*.

New hosts for *Molothrus bonariensis melanogyna*: *Anumbius annumbi*, *Passer domesticus domesticus*, **Icterus icterus jamacaii*, **Hemithraupis guira guira*, and *Thlypopsis sordida sordida*.

New hosts for *Molothrus bonariensis venezuelensis*: **Machetornis rixosus flavigularis*, **Campylorhynchus nuchalis brevipennis*, *Thryothorus rutilus*, **Catharus aurantirostris aurantirostris*, **Turdus nudigenis nudigenis*, **Turdus serranus atrosericeus*, *Vireo olivaceus vividior*, **Basileuterus flaveolus*, *Agelaius icterocephalus icterocephalus*, **Rhodinocichla rosea rosea*, *Sicalis flaveola flaveola*, **Atlappetes semirufus denisei*, and **Arremonops conirostris conirostris*.

New hosts for *Molothrus bonariensis cabanisi*: **Troglodytes aedon striatulus*, *Agelaius icterocephalus icterocephalus*, and **Zonotrichia capensis costaricensis*.

These additions bring the total host catalog of the shiny cowbird up to 176 species, or 240 species and subspecies of birds. Future field studies in the many parts of South America that are still imperfectly known, should increase the numbers. However, more important than mere additions to this catalog will be quantitative data establishing the relative frequency of host choice in different areas. We know, for example, that the house wren is seldom parasitized in Argentina, but is a primary host in Trinidad and in parts of northern South America. The rufous-collared sparrow is clearly the most frequently selected victim in Argentina, Uruguay, parts of Brazil (east and southeast), and of Venezuela (Caracas area), but its role is assumed by a grackle, *Quiscalus lugubris*, in Anzoategui

Province, northeastern Venezuela. In Chile, where the parasite is considered to be a relatively recent addition to the fauna, a very considerable portion of the burden of its reproduction has fallen on the diuca finch, *Diuca diuca*, while in the Lesser Antilles the spread of the shiny cowbird has caused critically great damage to the golden warbler, *Dendroica petechia*. On the other side of the picture, in many parts of South America we still have insufficient data to suggest the relative frequency of specific host choices by the parasite.

Among the records here brought together are observations adding 9 species to the list of those that have been reported as rearing the young shiny cowbirds. Previously (Friedmann, 1963:197; 1971:250) 27 species had been found to do so, i.e., to be true fosterers, not merely victims. The additions are: *Tityra cayana*, *Campylorhynchus nuchalis*, *Thryothorus rutilus*, *Thraupis sayaca*, *Ramphocelus carbo*, *Donacospiza albifrons*, *Atlappetes semirufus*, *Spinus magellanicus*, and *Poospiza nigrorufa*.

In some of the following accounts we state that a species has been found to be parasitized, but give no details other than the name of our informer. This means that we do not have any more explicit data.

Data on Individual Host Species

EARED DOVE

Zenaida auriculata (Des Murs)

Gunnar Hoy informs us that in December 1972, he found a nest of this dove containing an egg of the shiny cowbird in Oran, northern Salta, Argentina. This is the first time this species has been found to be victimized by the cowbird; it cannot be looked upon as anything but an accidental host choice, since pigeons are not suitable as fosterers for the parasite. The pigeon involved is of the subspecies *Z. auriculata chrysauchenia*; the parasite is the nominate race of *Molothrus bonariensis*.

RUFIOUS CACHOLOTE

Pseudoseisura cristata (Spix)

Dr. Helmut Sick informs us that this furnariid has been noted as a victim of the shiny cowbird

(*M. bonariensis bonariensis*) near Bahia, Brazil. This is the first such instance to have come to our notice.

RUFOUS-CAPPED ANTBIRD

Thamnophilus ruficapillus (Vieillot)

Previously (Friedmann, 1929:94) known as a cowbird host in Uruguay, this species is now the subject of a record from Gualeduaychu, Entre Rios, eastern Argentina, where, on 21 December 1970, Señor S. Narosky found a nest with 2 eggs of the antbird and 4 of the shiny cowbird. The record involves the nominate races of the host and the parasite.

RUFOUS OVENBIRD

Furnarius rufus (Gmelin)

Previously known (Friedmann, 1929:94-97; 1931:54) to be a frequent host in Argentina and in southeastern Brazil, the rufous ovenbird is similarly commonly parasitized in Uruguay, according to E. Gerzenstein, and in Mato Grosso, Brazil, according to J. Hidasi.

STRIPE-CROWNED SPINETAIL

Cranioleuca pyrrhophia (Vieillot)

Hoy (1971:160) found a parasitized nest of this spinetail at Volle Lerma, Salta, Argentina. This is the second record of this host-parasite combination; the previous one (Friedmann, 1963:204) was also found by Hoy in the same area. The records involve the nominate races of both the host and the parasite.

WREN-LIKE RUSHBIRD

Phleocryptes melanops (Vieillot)

The Delaware Museum of Natural History has a set of 2 eggs of this rushbird with 1 of the shiny cowbird, taken at Buena Esperanza, San Luis Province, Argentina, 14 December 1912, by J. Goodall. This is the first record known to us of this species as a victim of the parasite (nominate races of both *P. melanops* and *M. bonariensis* are involved).

FIREWOOD-GATHERER

Anumbius annumbi (Vieillot)

Previously known as a victim of the shiny cowbird in Argentina on the basis of a single record, this bird has now been found to be parasitized in southeastern Brazil as well, according to Dr. Helmut Sick. The Brazilian record involves the cowbird race *M. bonariensis melanogyna*; the Argentine one, the nominate race.

RED THORNBIRD

Phacellodomus ruber (Vieillot)

This bird was previously known as a victim of the shiny cowbird on the basis of a single instance in Uruguay (Friedmann, 1934:342). Recently, Hidasi informed us that he has observed a second case near the Rio Pixaim, Mato Grosso, Brazil.

STREAK-FRONTED THORNBIRD

Phacellodomus striaticeps (d'Orbigny and Lafresnaye)

Dr. C. C. Olrog informs us that he has found this thornbird to be a victim of the shiny cowbird in Tucumán, Argentina. It was not previously reported as a host. The nominate races of both the victim and the parasite are here involved.

RUFOUS-FRONTED THORNBIRD

Phacellodomus rufifrons (Wied)

This is an addition to the known victims of the shiny cowbird. Dr. C. C. Olrog informs us that he has found it to be parasitized in Tucumán, Argentina. The record involves the nominate race of the cowbird and the host subspecies *P. rufifrons sincipitalis*.

LITTLE THORNBIRD

Phacellodomus sibilatrix (Sclater)

Señor S. Narosky writes us that at Zarate, Buenos Aires Province, Argentina, on 14 January 1967, he found a parasitized nest of this thornbird. It is the first time this species has been reported as a cowbird victim.

BLACK-TAILED TITYRA

Tityra cayana (Linnaeus)

This cotinga was added to the known victims of the shiny cowbird by Jose Hidasi, who informed us that some years ago he observed a young of the parasite being attended and fed by a pair of the tityra near Goiania, Mato Grosso, Brazil. This record involves the nominate race of the parasite and the host subspecies *T. cayana braziliensis*.

COCK-TAILED TYRANT

Alectruris tricolor (Vieillot)

Dr. R. D. Etchecopar informs us that he has in his collection a set containing 1 egg of this flycatcher and 2 of the shiny cowbird, taken in Tucumán, Argentina by Luis Dinelli over 70 years ago. The record somehow never was published until now; it adds the present species to the parasite's host catalog.

WHITE-HEADED MARSH TYRANT

Arundinicola leucocephala (Linnaeus)

This flycatcher has long been known as a fairly frequent host choice of the shiny cowbird in Guyana and in Trinidad. Sick informs us that it has been found to be parasitized in Brazil as well. While the exact locality of the Brazilian record is not known to us, the probabilities are that the case involves the nominate race of the cowbird; in the Guyana and Trinidad records the race *M. bonariensis minimus* is involved.

CATTLE TYRANT

Machetornis rixosus (Vieillot)

The southern, nominate race of this flycatcher has long been known to be parasitized by the shiny cowbird in Argentina (13 records from Tucumán alone) and in Paraguay. We have been informed by Mr. Paul Schwartz that he has found the northern subspecies, *M. rixosus flavigularis*, to be victimized in the Caracas area, Venezuela, by the local race of the parasite, *M. bonariensis venezuelensis*.

TROPICAL KINGBIRD

Tyrannus melancholicus Vieillot

The tropical kingbird was previously known (Friedmann, 1929:105-106; 1931:55; 1934:343) to be parasitized in western Argentina, Paraguay, and Brazil. We may now add 2 records from eastern Argentina, kindly sent us by S. Narosky: one from Atalaya, and one from San Vicente, both in Buenos Aires Province.

FORK-TAILED FLYCATCHER

Muscivora tyrannus (Linnaeus)

This flycatcher has been known, since Hudson's early work (1874:154; cited in Friedmann, 1929:106), to be a frequently selected host of the shiny cowbird in Argentina. Since most of the Argentine records were from the eastern part of that country—provinces of Buenos Aires and Entre Ríos—it may be noted that a similar incidence of parasitism also obtains in Cordoba Province, central Argentina, where, in 1907, Goodall collected no fewer than 10 parasitized sets of eggs, and, in 1912, 2 such sets in San Luis Province, all currently in the Delaware Museum of Natural History and not previously reported in print.

WHITE-CRESTED TYRANNULET

Serpophaga subcristata (Vieillot)

This little flycatcher was added to the known victims of the shiny cowbird when Eugene Gerzenstein found a parasitized nest on 6 November 1960, southwest of Paso Real, on the Solis Chico River, Departamento de Canelones, Uruguay.

CROWNED SLATY-FLYCATCHER

Empidonomus aurantioatrocristatus
(d'Orbigny and Lafresnaye)

To the 2 records of this flycatcher as a victim of the shiny cowbird known to us earlier (Friedmann, 1929:105) may be added 3 more: 2 from Manchalá, Tucumán, northwestern Argentina, 20 October 1925 and 10 October 1930, taken by Pablo Girard,

and both now in the collections of the Museo de La Plata; and 1 found in Entre Rios, 23 December 1970, by S. Narosky.

BROWN-CRESTED FLYCATCHER

Myiarchus tyrannulus (Müller)

The Museo de La Plata has a set of 4 eggs of this flycatcher with 1 of the shiny cowbird, collected at Manchalá, Tucumán, Argentina, 10 November 1930, by Pablo Girard. No previous record for this host species is known to us; the record involves the nominate races of both the host and the parasite.

SUIRIRI FLYCATCHER

Suiriri suiriri (Vieillot)

Señor S. Narosky writes us that he found a parasitized nest of this flycatcher at Pronunciamento, Entre Rios Province, eastern Argentina, on 15 October 1968. Previously (Friedmann, 1929:103) we knew of but 1 other record, from Mendoza, western Argentina.

WHITE-TIPPED PLANTCUTTER

Phytotoma rutila Vieillot

This interesting bird was added to the known host list of the shiny cowbird by Gunnar Hoy, in January 1968, when he found a parasitized nest near a small mountain settlement, 2800 meters elevation, in the province of Salta, northwestern Argentina. We are much indebted to Dr. Hoy for this information, which it is expected he will amplify in a forthcoming description of the previously unknown eggs of the plantcutter (*P. rutila angustirostris*); the parasite involved in this record is *M. bonariensis bonariensis*.

Dr. C. C. Olrog has since informed us that he has also found this species to be victimized, apparently in the province of Tucumán, some distance south of Salta.

STRIPE-BACKED WREN

Campylorhynchus nuchalis Cabanis

We have recently learned from Dr. R. H. Wiley that he observed a fledged young cowbird (*M.*

bonariensis venezuelensis) cared for and repeatedly fed by 2 stripe-backed wrens (*C. nuchalis brevipennis*) in Venezuela. This wren is an addition to the shiny cowbird's host catalog.

RUFIOUS-BREASTED WREN

Thryothorus rutilus Vieillot

As outlined in an earlier paper (Friedmann, 1931:56) this wren is frequently parasitized by the shiny cowbird (*M. bonariensis minimus*) in Trinidad. All the records then available were of eggs only, but recently R. P. French has informed us that he has found the young parasites to be reared successfully by this host. In Tobago, Dr. D. W. Snow observed a recently fledged young cowbird attended and fed by an adult rufous-breasted wren.

Mr. Paul Schwartz informs us that he has observed this wren to be victimized in the Caracas area of Venezuela by the local subspecies of the cowbird (*M. bonariensis venezuelensis*) as well.

HOUSE WREN

Troglodytes aedon Vieillot

Miller (1963:47) found this wren to be a host of the shiny cowbird at San Antonio, western Andes, Colombia. The local race of the wren is *T. aedon striatulus*, which has not otherwise been reported as a cowbird victim. Dr. J. I. Borero and Father Antonio Olivares have informed us of numerous observations they have made of parasitism on the house wren in the region of Cali, Colombia, as well. Previously seven other subspecies, *T. a. albicans*, *T. a. tobagensis*, *T. a. musculus*, *T. a. rex*, *T. a. audax*, *T. a. chilensis*, and *T. a. bonariae*, had been known to be parasitized. The present record refers to the cowbird race *M. bonariensis cabanisii*, a subspecies not hitherto reported as including this wren among its victims.

From Trinidad there were earlier (Friedmann, 1963:207) a number of records of parasitism on this wren (race *T. aedon albicans*, of which *T. a. clarus* is a synonym). To these may be added 17 more such instances, demonstrating beyond question that the house wren, in spite of its small size, is the most frequently reported host of the shiny cowbird in that island that has many potential (and ac-

tual) hosts. Of these additional cases, 10 have come to us through the kindness of Dr. D. W. Snow, and the other 7 were reported to us by R. P. French. In 1 of the latter's instances there were 4 eggs of the wren and 9 of the cowbird, a nest that could hardly have been successful. In 9 of the 10 cases observed by Snow, the parasite's eggs were accepted and incubated and the young cowbirds were reared; in only a single case were the "eggs thrown out after cowbird visit."

From the combined evidence supplied by French and Snow, it becomes apparent that the cowbird parasitizes other hosts in localities where the house wren is absent, but that the parasite prefers the wren when it is available. (See the note on *Agelaius icterocephalus* in the present paper).

The house wren has also been found, by Paul Schwartz, to be a victim of the shiny cowbird (race *M. bonariensis venezuelensis*) in the vicinity of Caracas, Venezuela.

This wren is of more than usual interest, since in Argentina and Uruguay it is seldom imposed upon (by *M. bonariensis bonariensis*) while in Guyana and Trinidad it is a favorite host choice of *M. bonariensis minimus* (Friedmann, 1963:207). By way of contrast, it may be mentioned that in North America the house wren is extremely infrequently parasitized; thus in Ontario, only 1 out of 709 nests reported was parasitized by *M. ater*.

PATAGONIAN MOCKINGBIRD

Mimus patagonicus (Lafresnaye and d'Orbigny)

A fourth instance of parasitism on this mockingbird is a set of 2 eggs of the host and 1 of the parasite, collected at Maquinehao, Rio Negro, Argentina, 26 October 1911, by J. R. Pemberton, now in the collections of the Western Foundation. A fifth instance was found near Patagones, Buenos Aires Province, 15 December 1972, by S. Narosky.

CHILEAN MOCKINGBIRD

Mimus thenca (Molina)

To the 3 earlier recorded instances (Friedmann, 1929:110; 1934:544) of parasitism on this host in Chile, may be added 3 more from that country, all presently in the collections of the Western Founda-

tion, all collected by J. D. Goodall, near Santiago (2 at Manquehue, 1 and 2 December 1967, and 1 at Fundo La Montaña on the road between Santiago and Colina, 20 October 1968).

CHALK-BROWED MOCKINGBIRD

Mimus saturninus (Lichtenstein)

The race *M. saturninus modulator*, previously (Friedmann, 1929:109-110) noted as a common host of the shiny cowbird in Argentina, has been found by Gerzenstein to be equally imposed upon in Uruguay. Recently S. Narosky has informed us of 3 more instances of cowbird parasitism on this mockingbird in Buenos Aires Province: in one of these nests there were 11 cowbird eggs, in the others 1 and 5, respectively.

ORANGE-BILLED NIGHTINGALE-THRUSH

Catharus aurantiirostris (Hartlaub)

This thrush (n nominate race) is now added to the known hosts of the shiny cowbird (*M. bonariensis venezuelensis*) on the strength of information received from Paul Schwartz, who has found it to be parasitized near Caracas, Venezuela.

BARE-EYED THRUSH

Turdus nudigenis Lafresnaye

Mr. Paul Schwartz informs us that he has found this thrush to be parasitized near Caracas, Venezuela. The local race of the cowbird is *M. bonariensis venezuelensis*, the local host is of its nominate subspecies, and is new to the known host list of the parasite.

GLOSSY-BLACK THRUSH

Turdus serranus Tschudi

A nest of this thrush containing 1 egg of its own, 1 egg and 1 young of the shiny cowbird (subspecies *M. bonariensis venezuelensis*) was found 17 October 1974 in the mountains (1600 to 1700 meters altitude) near Caracas, Venezuela, by W. H. Phelps, Jr., to whom we are indebted for this information. This constitutes an addition to the host catalog of the shiny cowbird.

CREAMY-BELLIED THRUSH

Turdus amaurochalinus (Cabanis)

This thrush was previously reported (Friedmann, 1929:109; 1938:43) as a victim of the shiny cowbird in the provinces of Tucumán and Cordoba, western Argentina, where a total of 6 instances of parasitism were known to us. Recently, R. D. Etchecopar has informed us that in his collection are 4 more parasitized sets of eggs, taken in 1903 or 1904 in Tucumán by Luis Dinelli. Two additional Tucumán records, collected by Pablo Girard, are in the Museo de La Plata. The total number of Tucumán records is sufficient to show that the creamy-bellied thrush is a frequent host choice of the parasite in that area. Señor S. Narosky informs us that he found a parasitized nest of this thrush at Pronunciamento, Entre Rios Province, eastern Argentina, 26 December 1970.

RUFIOUS-BELLIED THRUSH

Turdus rufiventris (Vieillot)

Although this thrush has been reported (Friedmann, 1929:107; 1938:43) as a cowbird victim in a few places in Argentina, Uruguay, and Brazil, the number of records is small enough to warrant adding one more. Señor S. Narosky writes us that he found a nest of this species with 1 egg of its own and 8 of the shiny cowbird at Pronunciamento, Entre Rios, eastern Argentina, 24 December 1970.

YELLOWISH PIPIT

Anthus lutescens Pucheran

The yellowish pipit was formerly known as a victim of the shiny cowbird on the basis of 1 record in Tucumán Province, northwestern Argentina (Friedmann, 1929:110). Recently, Sick has informed us that it has been found to be parasitized in southeastern Brazil. In that region the cowbird is of the race *M. bonariensis melanogyna*, for which the pipit is a "new" host.

SHORT-BILLED PIPIT

Anthus furcatus Lafresnaye and d'Orbigny

Eugene Gerzenstein informs us that on 4 December 1966 he found a nest of this pipit containing

2 eggs of the shiny cowbird as well as several of the host, near A° Dulce, Polanes, Departamento de Lavalleja, Uruguay. This is the first record for this bird as a victim of the parasite.

RED-EYED VIREO

Vireo olivaceus (Linnaeus)

The South American populations of the red-eyed vireo, formerly separated as *Vireo chivi*, have at least 3 subspecies that are known to be parasitized by the shiny cowbird, but apparently the species is not parasitized nearly so frequently in South America as is its North American nominate race by the brown-headed cowbird. The southernmost subspecies, *V. olivaceus chivi*, was known as a victim of *M. bonariensis bonariensis* in Argentina (Friedmann, 1929:110; 1938:43) and of *M. bonariensis melanogyna* in southeastern Brazil (Friedmann, 1934:344); the race *V. olivaceus griseobarbatus* is parasitized in southwestern Ecuador by *M. bonariensis aequatorialis* (Friedmann, 1963:209), and *V. olivaceus vividior* has been found to be parasitized by *M. bonariensis minimus* in Trinidad (Friedmann, 1949:156) and may be now stated to be similarly affected by *M. bonariensis venezuelensis* near Caracas, Venezuela, according to information received from Paul Schwartz.

RUFIOUS-BROWED PEPPERSHRIKE

Cyclarhis gujanensis Gmelin

Previously known as a cowbird victim in Tucumán, Argentina (Friedmann, 1929:110), this bird has been found by S. Narosky to be victimized at Embalse, Cordoba, 20 January 1969. The nest contained 3 eggs of the host and 2 of the parasite. The record involves the host race *C. gujanensis viridis* and the nominate race of the shiny cowbird.

BICOLORED HONEY-CREEPER

Conirostrum bicolor (Vieillot)

Previously (Friedmann, 1963:209) this bird was known to be victimized by the small race of the shiny cowbird (*M. bonariensis minimus*) on the basis of 1 record from Trinidad and one from Surinam. Recently, French (1973:396-397) listed 3

records from Trinidad, including the one previously mentioned. There had been some uncertainty about the earlier Trinidad record since that particular nest was described as domed, whereas all other nests of this species found are open, cup-like structures. In 2 of French's 3 records, the young cowbirds were reared successfully by their hosts. Still another record from Trinidad comes to us from D. W. Snow, who saw a pair of these honey-creepers feeding a recently fledged young cowbird.

WHITE-STRIPED WARBLER

Basileuterus leucophrys Pelzeln

The white-striped warbler is an addition to the known victims of the shiny cowbird. Sick has informed us that it has been found to be parasitized in the Distrito Federal (Brasilia), eastern Goias, Brazil. The cowbird in that area is the nominate subspecies.

FLAVESCENT WARBLER

Basileuterus flaveolus (Baird)

The flavescent warbler may be added to the known victims of the shiny cowbird. Mr. Paul Schwartz informs us he has found this species to be parasitized by the local race of the cowbird, *M. bonariensis venezuelensis*, in the vicinity of Caracas, Venezuela.

HOUSE SPARROW

Passer domesticus (Linnaeus)

This introduced, but now widely distributed, species was previously known to have been parasitized once in Chile by the shiny cowbird. Sick informs us of a similar record from São Paulo, Brazil. In an earlier paper (1957:16-17) Dr. Sick reported that around Rio de Janeiro he found house sparrows and shiny cowbirds congregating in mixed flocks and sleeping together in small roosts, but at that time he wrote that the house sparrow had not been known to be used as a host by the parasite. Judging by the more extensive data on this bird in North America, the house sparrow seems unlikely to become a regular host choice. Its pugnacity alone would be a deterrent to the

would-be intruder. The Brazilian record involves the cowbird race *M. bonariensis melanogyna*; the earlier Chilean one had to do with *M. bonariensis bonariensis*.

CRESTED OROPENDOLA

Psarocolius decumanus Pallas

We learn from the Museo de La Plata that there is in that collection a set of 3 eggs of this oropendola with 1 of the shiny cowbird, taken at Atahona, Tucumán, Argentina, 19 November 1928, by Pablo Girard. This is the only record known to us for this host.

TROUPIAL

Icterus icterus (Linnaeus)

The race *jamacaii* of this oriole has been found to be parasitized by the shiny cowbird (subspecies *M. bonariensis melanogyna*) at Pirapora, Minas Gerais, Brazil (H. Sick). This is a "first" record, both for the race of the host and for the race of the parasite. There was a single earlier record in Guyana involving the host race *I. icterus croconotus* and the parasite race *M. bonariensis minimus* (Friedmann, 1963:211).

YELLOW-WINGED BLACKBIRD

Agelaius thilius (Molina)

To the 10 earlier records (Friedmann, 1929:120; 1931:58; 1934:344-345) of this blackbird as a victim of the shiny cowbird may be added 8 more. One of these, taken at Lampa, north of Santiago, Chile, 12 October 1956, by P. P. de Leon, is now in the holdings of the Western Foundation. Another was found by S. Narosky, at Lobos, Buenos Aires Province, Argentina, 8 January 1967. Dr. Gordon H. Orians informs us that in October-November 1973, in the province of Buenos Aires, he found 20 nests of this blackbird, 6 of which had 1 cowbird egg each, and in every instance these were the unspotted, pure white morph. In the same study sites, which consisted of wet areas along a 16 kilometer stretch of road near Pinamar, Orians also found the following nests of two other icterids: 51 of *Pseudoleistes virescens* and 9 of *Ambly-*

rhamphus holosericeus. None of the latter contained cowbird eggs but 10 *Pseudoleistes* nests had 1 cowbird egg and 2 others had 2 cowbird eggs. Unlike the case in the *Agelaius* nests, 13 of the 14 cowbird eggs in the *Pseudoleistes* nests were of the speckled morph; only 1 was unmarked white. The association between *A. thilius* and white cowbird eggs and between *P. virescens* and speckled cowbird eggs is highly significant statistically. The zero incidence of parasitism on *A. holosericeus* is not significantly different from the incidences of parasitism on *A. thilius* and *P. virescens* but is suggestive of a real difference.

The differential occurrences of white and speckled cowbird eggs cannot be due to differences in microgeographical distribution. *Agelaius* nests were mixed in with *Pseudoleistes* nests, sometimes within a few meters of each other. Possibly individual cowbirds that laid each egg type parasitized the different hosts preferentially. Or it is possible that the two types of cowbird eggs are placed randomly and that *Agelaius* selectively removes speckled eggs and *Pseudoleistes* removes white ones. Conceivably, some process combining selective egg placement by the cowbirds and selective removal by the hosts is responsible for Dr. Orians' observations. Interestingly, Hudson (1920:124-125; cited by Friedmann, 1929:120-121) suggested that *Pseudoleistes* ejects white cowbird eggs but retains speckled ones. He often found cowbird eggs on the ground under nests. Also, Dr. Orians informs us that of the two cowbird egg morphs, the white one most closely resembles eggs of *A. thilius*, the speckled one most closely resembles eggs of *P. virescens*, and neither resembles eggs of *A. holosericeus*. Conceivably the last mentioned species ejects both types of cowbird eggs or, as Dr. Orians suggests, it may have escaped parasitism because its nests were further out in extensive stands of marsh vegetation than were nests of the other two icterids, and cowbirds may rarely enter such areas. Dr. Orians also notes that *Amblyramphus* is much more territorial than the other two species and the fact that either the male or female usually perches near the nest may also deter cowbird parasitism. We are indebted to Dr. Orians for informing us of his observations and for the additional information he has so generously provided. We have discussed this information at length because it is the first evidence known to us that shows that both white and speckled cowbird

eggs occur, in one area, at different frequencies, with different hosts. This information poses significant biological questions concerning the factors responsible for the differential occurrence of the two types of cowbird eggs and it is hoped that these will be dealt with in the near future. The situation is especially intriguing because Dr. Orians' experience with *A. thilius* differs from that of Bullock who studied this host at Angol, Chile (Friedmann, 1934:345-346). One of the nests Bullock studied contained five cowbird eggs, each patterned so differently that he concluded 5 different hens were involved. Obviously, these could not all have been unmarked white eggs.

It may be recalled that there is 1 previous record of a parasitized nest of *Amblyramphus holosericeus* near Buenos Aires (Friedmann, 1931:58).

YELLOW-HOODED BLACKBIRD

Agelaius icterocephalus (Linnaeus)

First added to the list of victims of the shiny cowbird (*M. bonariensis minimus*) in Trinidad (Friedmann, 1931:58) on the basis of G. M. Snooker's observations, this marshbird's status as a frequently selected host in that island, is now corroborated by R. P. French, who informs us that out of 10 nests found there by R. H. Wiley, 7 contained cowbird eggs. This host lives in marshy areas where the house wren does not occur, and in such situations it is the commonest host choice. Dr. Wiley writes us that he found this blackbird to be parasitized, not only in Trinidad, but also in Guarico, Venezuela, and in Surinam. In Venezuela the parasite is of the subspecies *M. bonariensis venezuelensis*, for which race this is a "new" host record. In the region of Popayan, Colombia, Humberto Granados Diaz informs us he has twice noted this marshbird as a victim of the parasite, the local race of which is *M. bonariensis cabanisi*, for which this is also a new host record.

CHESTNUT-CAPPED BLACKBIRD

Agelaius ruficapillus Vieillot

While there were some 50 or more records of this blackbird as a cowbird host in earlier reports (Friedmann, 1929:120; 1931:58) all were from Tu-

cumán, western Argentina. An instance from eastern Argentina comes to us from Señor S. Narosky, who found a parasitized nest at Lobos, Buenos Aires Province, 8 January 1967.

CHOPÍ BLACKBIRD

Gnorimopsar chopi (Vieillot)

Many years ago (Friedmann, 1934:346) it was noted that Azara, in the opening years of the nineteenth century, had written that his Indian assistant, Nosedá, had found this bird to be parasitized by the shiny cowbird, but he gave no definite records. Nosedá's observations were probably made in southern Paraguay. Later, Sobrino made an observation similar to Nosedá's in the province of Minas Gerais, Brazil, but, again, mentioned no specific instances (Friedmann, 1938:45). The first definite specimen record seems to be a set of 3 eggs of the host and 2 of the parasite (*M. bonariensis melanogyna*), taken in Arcos, Minas Gerais, October 1925, now in the Delaware Museum of Natural History. We are indebted to Mr. John E. du Pont for information about this set.

BROWN-AND-YELLOW MARSHBIRD

Pseudoleistes virescens (Vieillot)

Previously (Friedmann, 1929:120-121) this species was known to be a very frequent host choice in Argentina, and that there it often had excessive numbers of shiny cowbird eggs in its nests. Hudson was quoted to the effect that he found as many as 14, and, in one case, 16 of the parasitic eggs in single nests. "In some seasons all the nests . . . found and watched were eventually abandoned by the birds on account of the number of parasitical eggs dropped in them." Similarly, in the province of Entre Ríos, Smyth (1925) found nests of this host with 8, 10, 11, 12, 15, and 17 cowbird eggs apiece! Very different was the experience of Dr. Gordon H. Orians in the province of Buenos Aires, in October-November 1973, discussed more fully under *Agelaius thilius* herein. He found 51 nests of this marshbird and 10 of these contained a single cowbird egg apiece in addition to those of the host, 2 of the nests had 2 cowbird eggs each. Dr. Orians informs us that 13 of the 14 cowbird eggs were of

the usual speckled coloration and 1 was unmarked white. Hudson, the first man to study these birds, thought that the *Pseudoleistes* may eject pure white, unspotted cowbird eggs, but retain and incubate mottled ones. He often found cowbird eggs on the ground under the nests.

Santos (1940:271) found this bird to be victimized in southeastern Brazil, and recently we have been informed by Eugene Gerzenstein that it is often parasitized in Uruguay as well.

RED-BREASTED BLACKBIRD

Leistes militaris (Linnaeus)

The southern race of this species, *L. militaris superciliaris*, has been known earlier (Friedmann, 1963:211-212) as a fairly frequent host choice of the shiny cowbird in Argentina. According to information received from Dr. Sick it is also parasitized in southern Brazil.

GREATER RED-BREASTED MEADOWLARK

Pezites militaris (Linnaeus)

The little that was previously reported (Friedmann, 1929:121) of this bird as a victim of the shiny cowbird made it seem a relatively infrequently selected host. The picture is now changed by the observations of Dr. Michael Gochfeld. In his study of this bird in 1970 and 1971 near Saavedra, in the pampas 90 kilometers north of Bahía Blanca, Argentina, he found it to be very heavily parasitized. Out of 23 active nests that came under his notice, no fewer than 22 were parasitized. In the same area and in the same years, 11 nests of the related *Pezites defilippii* were found, none of which contained eggs or young of the cowbird. Dr. Gochfeld writes us that this striking difference in the incidence of parasitism may be a reflection of the differential nest site selection by the two species. *P. defilippii* tended to nest in open fields away from elevated perches, while *P. militaris* tended to nest in fence-row vegetation, which may have afforded elevated perches for the cowbird. Dr. Gochfeld's studies should be of much interest, and it is hoped his report will provide further data to clarify the situation more explicitly.

Another instance of parasitism on the greater

red-breasted meadowlark, from farther south and west, was collected at Rio Limay, Rio Negro, Argentina, 28 December 1912, by C. L. Nelson; this set of eggs is now in the collections of the Western Foundation.

It may be recalled that there are still only 2 records of parasitized nests of *P. defilippii*, both found as long ago as the 1880's, at Lomas de Zamora, Buenos Aires Province (Friedmann, 1929:121). In the light of Dr. Gochfeld's experience these records may be looked upon with some suspicion as to their identification, but without other evidence they cannot be dismissed.

SAYACA Tanager

Thraupis sayaca (Linnaeus)

Previously (Friedmann, 1929:111; 1931:56) there were 3 records of this tanager as a victim of the shiny cowbird, both involving parasitic eggs found in nests, 2 in Tucumán, Argentina, and 1 near Rio de Janeiro, Brazil. That the sayaca tanager is a true fosterer and not merely a victim is now made definite by an observation of a fledged young cowbird attended by this species in Tucumán, 8 January 1970, by J. R. King, to whom we are indebted for this record. Still another Tucumán record, a parasitized set of eggs taken at Manchalá, 28 October 1929, is now in the Museo de La Plata.

GUIRA Tanager

Hemithraupis guira (Linnaeus)

This tanager is a newcomer to the host catalog of the shiny cowbird. Dr. Sick has informed us that it has been found to be parasitized in Minas Gerais, southeastern Brazil, on at least 1 occasion. The record involves the nominate race of the host, *H. guira guira*, and the subspecies *M. bonariensis melanogyna* of the parasite.

BLACK-FACED Tanager

Schistoclamys melanopsis (Latham)

The black-faced tanager was added to the known victims of the shiny cowbird in Brazil, according to information sent to us by Dr. Sick. The parasitism was noted near Brasilia, eastern Goias. The

host race there is the subspecies *S. melanopsis olivina*, the parasite is *M. bonariensis bonariensis*.

SILVER-BEAKED Tanager

Ramphocelus carbo (Pallas)

To the single earlier record (Friedmann, 1938:44) from Trinidad, of this tanager as a victim of the shiny cowbird may be added a second from that island, communicated to us by D. W. Snow. This was of a fledged young cowbird attended by one of these tanagers. A third record, from Brazil, comes to us from Dr. H. Sick. The Brazilian record involves the host race *R. carbo centralis* and the parasite race *M. bonariensis bonariensis*; the Trinidad instances involve *R. carbo magnirostris* and *M. bonariensis minimus*.

WHITE-LINED Tanager

Tachyphonus rufus (Boddaert)

Previously (Friedmann, 1963:212) we knew of 3 records of this tanager as a victim of the shiny cowbird, 2 from Venezuela and 1 from Colombia. An additional instance from the vicinity of Caracas, Venezuela may be mentioned, a case reported to us by Paul Schwartz.

ORANGE-HEADED Tanager

Thlypopsis sordida (Lafresnaye and d'Orbigny)

Previously known as a host of the shiny cowbird on the basis of a single record from Tucumán, northwestern Argentina, this tanager has been reported as a victim of the parasite in Brazil, as well, by Dr. Sick. The instance he reported is from near Rio de Janeiro, and involves the cowbird subspecies *M. bonariensis melanogyna*; both records refer to the nominate race of the tanager.

ROSE-BREASTED THRUSH-Tanager

Rhodinocichla rosea (Lesson)

This tanager is now added to the host catalog of the shiny cowbird on the basis of information received from Mr. Paul Schwartz, who found it to

be parasitized near Caracas, Venezuela. The record involves the nominate race of the host and the cowbird race *M. bonariensis venezuelensis*.

GOLDEN-BILLED SALTATOR

Saltator aurantiirostris (Vieillot)

Inasmuch as the total number of records of this saltator as a victim of the shiny cowbird is still small (Friedmann, 1929:112) it may be added that the Museo de La Plata has 2 parasitized sets of eggs, from Manchalá, Tucumán, 18 and 28 November 1930.

ULTRAMARINE GROSBEAK

Cyanocopsa cyanea (Linnaeus)

The earlier (Friedmann, 1929:112) statement to the effect that the grosbeak had been found to be parasitized in Tucumán, northwestern Argentina, may be extended by the information that it is there a frequent host choice. There were no fewer than 8 parasitized sets of eggs from that province in the J. P. Norris Collection, and another is in the Museo de La Plata.

LONG-TAILED REED-FINCH

Donacospiza albifrons (Vieillot)

This species was added to the known victims of the shiny cowbird in Uruguay by Eugene Gerzenstein. He found parasitized nests more than once in Bañado de Carrasco (Montevideo-West) and near Playa Penino (east of Sta. Lucia Bridge), and he also has seen these reed finches feeding a fledged young shiny cowbird.

OCHRE-BREASTED BRUSH-FINCH

Atlapetes semirufus (Boissonneau)

Mr. William H. Phelps, Jr., informs us that in the mountains near Caracas, Venezuela, at about 1600 to 1700 meters, he observed young shiny cowbirds (*M. bonariensis venezuelensis*) attended and fed by this species (race *A. semirufus denisei*). Paul Schwartz also reports this bird as a victim of the shiny cowbird at Caracas. These records add this finch to the known hosts of the parasite.

SAFFRON-BILLED SPARROW

Arremon flavirostris Swainson

This finch was added to the known victims of the shiny cowbird by Gunnar Hoy, who informs us that he found a nest containing 2 eggs of the host and 1 of the shiny cowbird at Lesser, Salta, Argentina, 22 December 1974. The record involves the host subspecies *A. flavirostris d'orbignii*, and the nominate race of the parasite.

BLACK-STRIPED SPARROW

Arremonops conirostris (Bonaparte)

Mr. Paul Schwartz informs us that he has a record of this sparrow being victimized by the shiny cowbird near Caracas, Venezuela. The record, which is the first one for this bird, involves the nominate race of the victim and the race *M. bonariensis venezuelensis* of the parasite.

LINED SEEDEATER

Sporophila lineola (Linnaeus)

Gunnar Hoy informs us that in December 1972, at Oran, Salta Province, Argentina, he found many nests of this seedeater, 2 of which contained eggs of the shiny cowbird. This species is an addition to the known hosts of the parasite.

HOODED SISKIN

Spinus magellanicus (Vieillot)

This species of siskin was previously known (Friedmann, 1929:113) as a victim of the shiny cowbird solely on its having been so reported by Gibson, in the Cape San Antonio region in the province of Buenos Aires, eastern Argentina. We are now informed by Dr. J. R. King that he saw a recently fledged young shiny cowbird attended by a hooded siskin in Tucumán, northwestern Argentina, 30 November 1969. The siskin in Tucumán is of the subspecies *C. magellanicus tucumanus*, which is an addition to the known hosts of the parasite. The Cape San Antonio record, previously considered as referring to *C. magellanicus ictericus*, is now relegated to the nominate race of the hooded siskin.

SAFFRON FINCH

Sicalis flaveola (Linnaeus)

To the relatively few earlier records (Friedmann, 1929:111; 1934:345) of this finch (subspecies *S. flaveola pelzelni*) as a victim of the shiny cowbird in Argentina and Uruguay, the following may be added. The Museo de La Plata has 2 parasitized sets of eggs, 1 from Manchalá, Tucumán, Argentina, 2 December 1930, and 1 from General Lavalle, Buenos Aires, 9 January 1933. In Uruguay E. Gerzenstein informs us that he found it to be among the frequent hosts of the parasite. The nominate race of the saffron finch has also been found to be victimized near Caracas, Venezuela, by the local form of the shiny cowbird, *M. bonariensis venezuelensis*, according to Paul Schwartz.

GRASSLAND YELLOW FINCH

Sicalis luteola (Sparrman)

In the 1963 compendium (Friedmann, p. 213) it was noted that this finch had been listed as a victim of the shiny cowbird in Argentina and in Uruguay. It was then stated that, "inasmuch as neither the finch nor the cowbird are local or rare, and inasmuch as the nest of the former seems in every way suitable, it is difficult to see why the misto (grassland yellow) finch is not parasitized more frequently." Now Eugene Gerzenstein has informed us that in Uruguay he found it to be a fairly frequent host choice of the parasite. An additional Argentine record comes to us from Señor S. Narosky, who found a parasitized nest at Atalaya, Buenos Aires, 26 November 1967.

COMMON DIUCA FINCH

Diuca diuca (Molina)

Previously (Friedmann, 1929:117; 1949:157) known as a victim of the shiny cowbird in western Argentina and in Chile, we may add that it is also parasitized in eastern Argentina. Señor S. Narosky informs us of a parasitized nest found at Patagones, Buenos Aires, 14 December 1972.

PILEATED FINCH

Coryphospingus pileatus (Wied)

The pileated finch (nominate subspecies) was first reported as a victim of the shiny cowbird in Minas Gerais, Brazil, by Skinner (1928:64) who recorded several sets of eggs taken by Goodall near Arcos, every one of which was parasitized with from 1 to 3 cowbird eggs apiece. Nothing further has been reported, but the degree to which the pileated finch is victimized could not be realized from Skinner's brief statement. However, the Delaware Museum of Natural History acquired Goodall's egg collection, and in it are no fewer than 8 parasitized sets of eggs, all taken near Arcos in 1922, 1923, and 1924. It follows that this species must indeed be one of the major supports of the shiny cowbird in southeastern Brazil, possibly as much so as the chingolo sparrow, *Zonotrichia capensis*.

CHINGOLO, OR RUFIOUS-COLLARED SPARROW

Zonotrichia capensis (P. L. S. Müller)

The wide-ranging chingolo sparrow is perhaps the commonest victim of the shiny cowbird, especially in Argentina and in eastern Brazil. Recently Eugene Gerzenstein has informed us that it is also the most frequent host in Uruguay, although no specific instances from that country have so far appeared in the literature. The Uruguayan records involve the host race *Z. capensis hypoleuca*.

The northeasternmost subspecies of the sparrow, *Z. capensis costaricensis*, may now be added to the 10 others of its geographic races previously known to be parasitized. A. H. Miller (1963:47) reported it as a victim of *M. bonariensis cabanisi* in Colombia (San Antonio, western Andes). Dr. J. I. Borrero informs us that he has observed similar cases near Cali, Colombia. The fact that in Chile the chingolo (*Z. capensis chilensis*) is frequently victimized by the shiny cowbird is evidenced by 5 parasitized sets of eggs, all collected by J. D. Goodall near Santiago, and currently in the collections of the Western Foundation.

The Venezuelan race of this sparrow (*Z. capensis venezuelae*) was previously (Friedmann, 1949:157) noted as a victim of the shiny cowbird on the basis of a single record near Caracas. Recently, Mr. W. H. Phelps, Jr., has informed us that in the past

few years he has noted many such cases in that area. This is in keeping with the situation elsewhere in South America; where the rufous-collared sparrow and the shiny cowbird occur together, the former seems usually to be a favorite host choice of the latter. In areas where the sparrow does not occur, as in parts of the states of Monagas and Anzoategui, in northeastern Venezuela, the shiny cowbird seems to concentrate its parasitism on the grackle *Quiscalus lugubris*, as in the field experience of Foster D. Smith (Friedmann and Smith, 1955:514). In Trinidad, the wren, *Troglodytes musculus*, is the favorite host choice, but in northeastern Venezuela Foster Smith did not find the wren to be parasitized, although it breeds there.

King's study of the rufous-collared sparrow in Tucumán, northwestern Argentina (1973) has corroborated, even extended, the almost incredibly high incidence of parasitism previously noted for it in that area (Friedmann, 1929:113-114)—66.0 percent of all the nests for the entire breeding season (33 out of 50 nests under observation) contained 1 or more eggs of the shiny cowbird, and at the peak of the sparrow's breeding season, 100 percent were so affected!

BLACK-CAPPED WARBLING-FINCH

Poospiza melanoleuca (d'Orbigny and Lafresnaye)

Previously known (Friedmann, 1929:115) as a shiny cowbird host in Tucumán Province, northwestern Argentina, on the basis of 2 parasitized sets of eggs taken at Manchalá, by Pablo Girard, in 1925, there is now a third record from the same locality, by the same collector, 24 November 1930, in the collections of the Museo de La Plata.

Bronzed Cowbird *Molothrus aeneus*

Discussion

Additional information on this cowbird is geographically "spotty," as much as the range of the bird has few or no resident, local observers. The data here brought together are dependent on specimen records (of eggs) in collections, on the kind

RINGED WARBLING-FINCH

Poospiza torquata (d'Orbigny and Lafresnaye)

To the single earlier record of this finch as a victim of the shiny cowbird (Friedmann, 1971:251), may be added a second, a nest with a well developed young cowbird, found in December 1967, in the Lerma Valley, Salta Province, Argentina, by Gunnar Hoy. The race *P. torquata pectoralis* is the subspecies of the host involved in Salta, as in the earlier record from San Luis, Argentina.

BLACK-AND-RUFIOUS WARBLING-FINCH

Poospiza nigrorufa (d'Orbigny and Lafresnaye)

Previously (Friedmann, 1929:117) this warbling-finch was known as a victim of the shiny cowbird in the Cape San Antonio region, Buenos Aires Province, Argentina, where Gibson had so recorded it. We now learn of a later record from the same area, taken 15 January 1933, by Col. R. Runnacles, and now in the Museo de La Plata, and of another parasitized nest found 26 November 1967 at Atalaya, Buenos Aires, by S. Narosky.

GREAT PAMPA-FINCH

Embernagra platensis (Gmelin)

To the few records previously reported (Friedmann, 1929:117; 1931:58) of this finch as a cowbird victim in Argentina and Paraguay, may be added one more Argentine instance. Señor S. Narosky informs us that he found a parasitized nest at Tapalque, Buenos Aires, on 7 December 1971.

cooperation of a small number of collector-observers, and on the literature.

NEW HOSTS.—Recently one of us (Kiff, 1973) reported 3 new hosts for this cowbird in Costa Rica: *Catharus gracilirostris*, *Amblycercus holosericeus*, and *Ramphocelus passerinii*. We now add 7 more (6 species and 1 subspecies) from Arizona, Mexico,

and Guatemala. Since all are new to the total host list of *Molothrus aeneus*, there is no need to mark them with an asterisk.

New hosts for *Molothrus aeneus aeneus*: *Turdus grayi grayi*, *Zarhynchus wagleri wagleri*, *Icterus wagleri wagleri*, *Habia fuscicauda salvini*, and *Melospiza biarcuatum biarcuatum*.

New host for *Molothrus aeneus lloyei*: *Setophaga picta*.

New host for *Molothrus aeneus assimilis*: *Piranga flava dextra*.

These bring the known host catalog of the bronzed cowbird up to a total of 71 species, or 86 species and subspecies of birds. One report of a species previously recorded (Friedmann, 1971:252) as a victim, the brown-throated wren, *Troglodytes brunneicollis*, has since been found to have been erroneous, due to a confusion in the record, which really refers to *Thryothorus sinaloa*, a species otherwise reported as a victim of the bronzed cowbird.

In the 1963 compendium (Friedmann, p. 175) 15 species of hosts were noted as having been found to rear the young bronzed cowbirds. Only 5 others have since been observed to do so; they are: *Cyanocorax yncas*, *Thryomanes bewickii*, *Mimus polyglottos*, *Piranga bidentata*, and *Ramphocelus passerinii*.

DUMP NESTS AND MULTIPLE PARASITISM.—Before proceeding to the comments on individual species of hosts, it should be mentioned that there is a slowly growing mass of evidence suggesting that the bronzed cowbird occasionally makes use of what may be termed dump nests, in which excessive numbers of eggs of multiple hens are deposited. Since these nests are either old ones, already deserted by their builders, or since the unacceptably large numbers of parasitic eggs cause the hosts to desert, these eggs are wasted. A case in point, recently described to us by F. F. Nyc, Jr., is a dump nest he found at Brownsville, Texas—a small platform-like nest in a crotch about 7 feet up in a tree, containing 14 eggs of the bronzed cowbird and no eggs, or any other sign, of a host. It may be recalled that the South American shiny cowbird, *Molothrus bonariensis*, is even more addicted to the use of such dump nests, in which from 15, 17, 20, 25, 26, to, in one instance, an incredible maximum of 37 of its eggs have been reported, and as many as 13 female cowbirds have been found to lay their eggs in one of these nests (Friedmann, 1929:86–87).

In these instances the circumstantial evidence suggests that the eggs, dissimilar enough to suggest they were laid by 13 hens, were those of year-old hens still living in loose flocks late in the season and without individual breeding territories. It now appears that a similar situation may be present in the case of the bronzed cowbird. Aside from Nyc's record of 14 eggs of this species in a deserted nest, we may call attention to a record, given in our account of the green jay, below, also in southern Texas, of a nest containing 10 of the parasitic eggs together with 2 eggs of the host.

It is true there have been some records of excessive, multiple parasitism by the brown-headed cowbird as well, but the number of such cases is extremely small compared with the many thousands of records of more limited, "normal" degrees of parasitism. The number of these cases is so insignificant statistically that it is not possible to look upon them as evidence for the dump nest habit in that cowbird species—a total of only 21 nests with 5 or more (in one case up to 12) eggs of the brown-headed cowbird, against nearly a thousand times that many "normal" nests, each with 1 or 2 eggs of the parasite (Friedmann, 1963:12–13).

Another aspect of the matter of host selection by the bronzed and the brown-headed cowbirds that is becoming even more clearly discernable from the total mass of records is that there are significant differences between the two parasites that serve to divide the available host species in a way to lessen competition for victims in areas where the two cowbirds are sympatric and numerous. Vireos and wood warblers are reported as victims far more often for the brown-headed cowbird than for the bronzed species. This does not mean that the overlapping of the host choices of the two is insignificant; more than half of all the species known to be parasitized by *M. aeneus* are also molested by *M. ater*. For that matter, it is not at all uncommon to find individual nests containing eggs of both species of cowbirds. However, most of these hosts are used significantly more frequently by one than by the other of the two species of brood parasites. The trends are not as pronounced as they are in the sympatric species of parasitic *Cuculus* in Africa, for which the term "alloxenia" was proposed to describe the situation where related species of parasites affect different species of hosts (Friedmann, 1967a; 1967b).

Data on Individual Host Species**GREEN JAY***Cyanocorax yncas* (Boddaert)

To the 3 records previously known to us (Friedmann, 1963:177) of this unusually large victim may be added 3 more: a nest with 2 eggs of the jay and 1 of the bronzed cowbird, found at El Zapotal, Tuxtla Gutiérrez, Chiapas, 10 June 1959, by Miguel Alvarez del Toro, and one found in the Santa Ana Refuge area, southern Texas (Webster, 1971:878), containing 2 eggs of the host and 10 of the parasite. It is this second instance that is discussed as a case of a dump nest in the paragraph above. Two years later, Webster (1973:892) reported a pair of green jays feeding a fledged young bronzed cowbird, the first record of this jay's actually rearing the young parasite.

MOCKINGBIRD*Mimus polyglottos* Linnaeus

The mockingbird was known previously (Friedmann, 1963:178; 1966:8) as a rarely imposed upon victim of the bronzed cowbird, with only 2 records, both from southern Texas. Recent observations have since necessitated a change in our estimate of this host species. Four additional instances of parasitism, also from southern Texas, are now known to us, and 3 of them were successful to the point of rearing the young parasite to the fledging stage. The 4 new records are: a parasitized set of eggs found near Santa Maria, Cameron County, Texas, 29 June 1971, now in the collections of the Western Foundation; and 3 separate records of fledged young bronzed cowbirds attended and repeatedly fed by mockingbirds, near Corpus Christi, late June and August 1972, and August 1974, all observed by Sheriton Burr to whom and to R. McCracken we are indebted for the information. The 3 cases observed by Burr were all fairly late in the mockingbirds' breeding season (they begin nesting in March); it may be that their first broods of the season escape the intrusion of the parasite.

The fact that 3 cases of parasitism were noted in one limited locality during a 3 year period is of interest in a comparative way. The brown-headed cowbird has been noted as using mockingbirds as

hosts quite infrequently, and as the mockingbird is an "accepter species" the scarcity of records is meaningful. By contrast, the neotropical shiny cowbird makes extensive use of the several species of mockingbirds in South America. Inasmuch as all 3 species of cowbirds seem potentially similar in what they require of a host, their relations with mockingbirds should be more alike than they seem to be.

LONG-BILLED THRASHER*Toxostoma longirostre* (Lafresnaye)

Previously (Friedmann, 1963:179) this thrasher had been reported as a victim of the bronzed cowbird only 3 times. To these may be added a fourth record, observed in 1971, in the Santa Ana Refuge area of southern Texas (Webster, 1971:878).

CLAY-COLORED ROBIN*Turdus grayi* Bonaparte

This thrush is an addition to the known victims of the bronzed cowbird. Two instances of its parasitism were found in Chiapas—El Zapotal, Tuxtla Gutiérrez, 20 May, and Meyapac, Ocozocoautla, 29 May—by Miguel Alvarez del Toro, to whom we are indebted for this information. The records involve the nominate races of both the host and the parasite.

YELLOW-BREASTED CHAT*Icteria virens* (Linnaeus)

To the 2 earlier records of this warbler as a victim of the bronzed cowbird (Friedmann, 1963:180–181) may be added 3 more. A set of 3 eggs of the host and 1 of the parasite, found at Rio Grande City, Texas, 1 May 1943, by F. F. Nyc, Jr., is now in the collections of the Western Foundation. Another instance, found by E. M. Hall at Sonoita Creek, near Patagonia, Arizona, 9 June 1967, contained 3 eggs of the chat, 1 of the bronzed cowbird, and 1 of the brown-headed cowbird. Such instances of dual parasitism of this host in southeastern Arizona may not be infrequent, as the same observer found another nest of this species in the same locality on 3 June 1974, with 1 chat egg, 1 of the bronzed cowbird, and 1 of the brown-headed cowbird.

The yellow-breasted chat seems to be less frequently victimized by the bronzed than by the brown-headed cowbird, but the reason for this difference is not yet understood.

PAINTED REDSTART

Setophaga picta Swainson

On 11 June 1967, E. M. Hall found a nest of the painted redstart containing 3 eggs of the warbler and 1 of the bronzed cowbird at Madera Canyon, Pima County, Arizona. This is the first time this species has been noted as a victim of the bronzed cowbird. It would seem that there cannot be many areas where the breeding ranges of the two species overlap, but they have both been noted (aside from the present record) at Madera Canyon. The painted redstart is one of the few ground-nesting birds affected by the bronzed cowbird.

CHESTNUT-HEADED OROPENDOLA

Zarhynchus wagleri (Gray and Mitchell)

A parasitized nest of this oropendola, found at Kilometer 25, Ocozocoautla—Mal Paso road, Chiapas, 28 April 1972, by Miguel Alvarez del Toro, is the first record for the species as a victim of the bronzed cowbird. The record involves the nominate race of the host and of the parasite.

YELLOW-BILLED CACIQUE

Amblycercus holosericeus (Deppe)

Miguel Alvarez del Toro informs us that he found a nest of this cacique parasitized by the bronzed cowbird at Isla La Concepción, Acapetahua, Chiapas, 20 May 1968. Previously the species had been reported as victimized in Costa Rica (Kiff, 1973:241). In both the Mexican and the Costa Rican instances the nominate races of the host and of the parasite are involved.

RED-WINGED BLACKBIRD

Agelaius phoeniceus (Linnaeus)

In 1971 (Friedmann, p. 253) only 6 instances were known to us of parasitism on the red-winged black-

bird (subspecies *A. phoeniceus megalotamus*) by the bronzed cowbird. To these may be added 2 more, both from the Brownsville, Texas, area, now in the collections of the Western Foundation. It appears that in extreme southern Texas the blackbird is parasitized fairly regularly.

ORCHARD ORIOLE

Icterus spurius (Linnaeus)

To the few earlier records (Friedmann, 1963:181) may be added 1 more, a nest in southern Texas, containing 5 eggs of the oriole and 4 of the bronzed cowbird (Webster, 1972:878).

SCOTT'S ORIOLE

Icterus parisorum (Bonaparte)

W. J. Sheffler found a parasitized nest of this oriole at Rancho Guirocoba, Sonora, 15 May 1949, now in the collections of the Western Foundation. This is the second known instance of this species' being victimized by the bronzed cowbird. The earlier record was from southern Arizona (Friedmann, 1963:182).

BLACK-VENTED ORIOLE

Icterus wagleri Sclater

This oriole has been found to be victimized by the bronzed cowbird in Chiapas—at El Sumidero, Tuxtla Gutiérrez, and at Meyapac, Ocozocoautla. These occurrences were noted by Miguel Alvarez del Toro, who has kindly informed us of his observations. The records involve the nominate races of both the host and the parasite.

SPOTTED-BREASTED ORIOLE

Icterus pectoralis (Wagler)

This oriole was previously (Friedmann, 1963:182) known to be victimized in the lowlands of El Salvador. Two recent records from Chiapas—La Encrucijada, Acapetahua, and El Carmen, Pijijiápam—are the first from Mexico. We are indebted to their

observer, Señor Miguel Alvarez del Toro, for these records. The nominate races of the host and the parasite are here involved.

LICHTENSTEIN'S ORIOLE

Icterus gularis (Wagler)

To the few earlier records of this oriole as a victim of the bronzed cowbird (Friedmann, 1963:183; 1971:253) may be added three more from Tuxtla Gutiérrez, Chiapas, all found and reported to us by Miguel Alvarez del Toro.

SCARLET-HEADED ORIOLE

Icterus pustulatus (Wagler)

While 4 races of this oriole have been known to be parasitized by the bronzed cowbird, there was until now but a single record involving the southern subspecies (*I. pustulatus formosus*). This was from Oaxaca. We may now add 1 more from that state (El Zapilote) in the collections of the Western Foundation, and 4 records from Chiapas (Terán and Tuxtla Gutiérrez) reported to us by Miguel Alvarez del Toro.

HEPATIC TANAGER

Piranga flava (Vieillot)

One record, erroneously allocated to the host subspecies *P. flava hepatica* (Friedmann, 1971:253) collected at Rancho Vicente, Cerro Baul, Oaxaca, really refers to *P. flava dextra*, which is an addition to the host catalog of the bronzed cowbird. There are 2 other earlier records for *P. flava hepatica* (Friedmann, 1963:184).

RED-THROATED ANT-TANAGER

Habia fuscicauda (Cabanis)

This tanager was added to the known victims of the bronzed cowbird by Miguel Alvarez del Toro, when he found a parasitized nest at Meyapac, Ocozocoautla, Chiapas, 30 May 1962. The record involves the host race *H. fuscicauda salvini* and the nominate race of the parasite.

PYRRHULOXIA

Pyrrhuloxia sinuata (Bonaparte)

Previously (Friedmann, 1971:253) there were 3 records known to us of this bird as a victim of the bronzed cowbird. A fourth instance has been reported to us by its finder, Mr. F. F. Nyc, Jr., who found a parasitized nest near Falcón Lake, Starr County, Texas, 20 May 1970.

PAINTED BUNTING

Passerina ciris (Linnaeus)

The Western Foundation has in its collections an egg of the bronzed cowbird taken from a nest of a painted bunting, at Brownsville, Texas, 15 April 1900, by F. B. Armstrong. This is only the second instance known to us of parasitism on this host by the bronzed cowbird. The bunting is frequently imposed upon by the brown-headed cowbird, recalling the case of the yellow-breasted chat, which shows similarly a differential in its role as a victim of the 2 species of parasites.

WHITE-THROATED TOWHEE

Pipilo albicollis Sclater

To the 6 earlier records of this host (Friedmann, 1963:187; 1966:10) may be added 4 more, all similarly from Oaxaca, and all in the collections of the Western Foundation. It is apparent that in that part of Mexico, Sclater's towhee is a frequent host choice of the bronzed cowbird.

PREVOST GROUND SPARROW

Melospiza biarcuatum (Prevost and Des Murs)

One of us (L.F.K.) added this sparrow to the known hosts of the bronzed cowbird when he collected a fledgling of the parasite being fed by two of these sparrows, 16 August 1969, at Finca La Morena, 15 miles south of Guilapa, Department of Santa Rosa, Guatemala. The cowbird was observed flying from tree to tree with the two sparrows, and the situation looked like a true family party, not an "accidental feeding" due to response to the feeding call of a strange fledgling.

Depositories of Unpublished Data

Egg Collections

Brigham Young University, Provo, Utah
British Columbia Provincial Museum, Vancouver, British Columbia
Delaware Museum of Natural History, Greenville, Delaware
J. P. Norris Collection, dispersed: part at the San Bernardino County Museum of Natural History, San Bernardino, California; part at Western Foundation; part at Nelson Hoy Collection, Media, Pennsylvania
Museo de La Plata, La Plata, Argentina
Oregon State University, Corvallis, Oregon
Royal Ontario Museum of Zoology, Toronto, Ontario
Santa Barbara Museum of Natural History, Santa Barbara, California
Thomas Burke Memorial Museum, University of Washington, Seattle, Washington

University of Puget Sound, Tacoma, Washington
Western Foundation of Vertebrate Zoology, Los Angeles, California

Record Files

British Columbia Nest Records, University of British Columbia, Vancouver, British Columbia
Cornell University Nest Records, Cornell University, Ithaca, New York
Ontario Nest Records, Royal Ontario Museum of Zoology, Toronto, Ontario
Prairie Nest Records, Manitoba Museum of Man and Nature, Winnipeg, Manitoba
University of Michigan Biological Station (files, student reports, unpublished manuscripts), Pellston, Michigan

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Bibliography, depending upon use, is termed "References," "Selected References," or "Literature Cited." Spell out book, journal, and article titles, using initial caps in all major words. For capitalization of titles in foreign languages, follow the national practice of each language. Underline (for italics) book and journal titles. Use the colon-parentheses system for volume/number/page citations: "10(2):5-9." For alignment and arrangement of elements, follow the format of the series for which the manuscript is intended.

Legends for illustrations must not be attached to the art nor included within the text but must be submitted at the end of the manuscript—with as many legends typed, double-spaced, to a page as convenient.

Illustrations must not be included within the manuscript but must be submitted separately as original art (not copies). All illustrations (photographs, line drawings, maps, etc.) can be intermixed throughout the printed text. They should be termed **Figures** and should be numbered consecutively. If several "figures" are treated as components of a single larger figure, they should be designated by lowercase italic letters (underlined in copy) on the illustration, in the legend, and in text references: "Figure 9_a." If illustrations are intended to be printed separately on coated stock following the text, they should be termed **Plates** and any components should be lettered as in figures: "Plate 9_b." Keys to any symbols within an illustration should appear on the art and not in the legend.

A few points of style: (1) Do not use periods after such abbreviations as "mm, ft, yds, USNM, NNE, AM, BC." (2) Use hyphens in spelled out fractions: "two-thirds." (3) Spell out numbers "one" through "nine" in expository text, but use numerals in all other cases if possible. (4) Use the metric system of measurement, where possible, instead of the English system. (5) Use the decimal system, where possible, in place of fractions. (6) Use day/month/year sequence for dates: "9 April 1976." (7) For months in tabular listings or data sections, use three-letter abbreviations with no periods: "Jan, Mar, Jun," etc.

Arrange and paginate sequentially EVERY sheet of manuscript—including ALL front matter and ALL legends, etc., at the back of the text—in the following order: (1) title page, (2) abstract, (3) table of contents, (4) foreword and/or preface, (5) text, (6) appendixes, (7) notes, (8) glossary, (9) bibliography, (10) index, (11) legends.

