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THE IMPORTANCE, EFFECTS, AND ETHICS OF BIRD COLLECTING

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SCIENTIFIC COLLECTIONS HAVE a long history of providing important information about life on earth and the environments that humans share with other species. These benefits begin with the basic biodiversity questions upon which these collections were founded, such as which and how many species exist in a region, and their descriptions, distributions, adaptations, and evolutionary relationships. These questions form the basis for understanding the biodiversity that we aspire to manage and conserve. Scientific collections constitute a priceless, irreplaceable, yet incomplete library documenting biodiversity at particular moments in time, and the benefits that collecting specimens brings to society are expanding rapidly. The benefits of specimens often accrue in unanticipated ways. For example, collections of birds and other organisms are increasingly used to study environmental, ecological, and management-related issues such as biological responses to climate change, baseline rates of disease incidence and genetic diversity among wild hosts, organismal distributions in relation to development and environmental disturbance, sentinel species, emerging infectious diseases, genetic diversity in managed populations, food-web changes, contaminants, and parasites (see Suarez and Tsutsui 2004, Winker 2004, Moritz et al. 2008, Pergams and Lacy 2008). In addition, specimens are sometimes (although less commonly) collected for research with short-term goals that do not focus on long-term specimen preservation but nevertheless make important contributions to science. Specimen collection is also done to develop material for education, outreach, and exhibits, which contribute to education at all levels and to an appreciation of birds, science, and the world around us.

The need to collect specimens for science will continue because many questions cannot be addressed by observational or nonvouchered studies alone. However, this need must be effectively balanced with the need for conservation. Today's scientific collectors are conservationists who aim to provide new information about populations and species and their conservation status without imperiling them. Thus, scientific collecting and conservation are not incongruent activities. In ornithology, the use of bird specimens has a very strong and ongoing track record of providing important information about birds and their environments, both past and present. Collections often provide the only information we know or can infer about extinct species. However, collections of extant birds are incomplete, and adding specimens from today is critical to understanding changes over time. As an example, collections of Hawaiian honeycreepers from the 1800s provide evidence of some species that went extinct during that century (e.g., Amaui [*Myadestes woahensis*] and Lesser Koa-finch [*Rhodacanthis flaviceps*]). With appropriate care, bird populations are renewable resources, and judicious sampling through collecting will continue to improve our knowledge of birds and the ecosystems in which they live.

Birds elicit strong positive emotions from a wide variety of people, including collectors. Thus, there will always be some friction between those who support scientific bird collecting and those who oppose it. Collectors make cost–benefit decisions during the process of collecting. Yet they often face criticisms with little or no biological merit from opponents who may not appreciate (or may be overly dismissive of) the benefits of collections and specimen-based science in relation to the usually minimal costs to bird populations. Bird collecting should always be done legally and ethically. When these standards are followed, the scientific gains achieved by collecting and the potential benefits for bird

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conservation will outweigh the ecological or demographic loss of a small number of individuals in a population. Consequently, collecting should elicit minimal negative reactions from critics and the public at large. Although there are legal frameworks governing specimen collection, there is no ready checklist of actions one must undertake to ensure that collecting is always performed ethically. Situations vary tremendously, and decisions about collecting must be made on a case-by-case basis. Thus, rather than consider a series of case studies, we summarize the key factors involved in decisions on the scientific collecting of birds and consider a broader ethical landscape of the issues. We believe this focus will be useful for collectors and their institutions, for permitting agencies and institutional committees, for conservationists, and for the concerned public.

The Ethics of Specimen Collecting

Ethical responsibilities for scientific bird collecting reside with at least four groups: scientists, permitting agencies and institutional committees, concerned members of the public, and nongovernmental organizations (NGOs). All of these groups share the responsibility, but much of the burden falls to the individual collector(s). Noncollectors concerned with the potential negative effects of bird collecting should not overlook their responsibility to be informed about the benefits of collecting and collections and the small-to-insignificant costs of these actions in biological terms. Most individuals who understand the benefits and costs of collecting birds for scientific purposes support specimen collection. Scientists who collect birds should use every opportunity to inform and educate permitting personnel, the interested public, and NGOs about the value of collecting and collections. In turn, noncollectors who are concerned about collecting should be open to opportunities to learn more about the value of collections.

The ethics of collecting is not restricted to biological considerations, but also extends into social concerns. In addition, there are philosophical issues surrounding the taking of life of other sentient beings (e.g., Vucetich and Nelson 2007). These philosophical aspects of bird collecting are important and require individual reflection on the part of collectors. With respect to these philosophical issues, we make three observations. First, in a society and world in which the taking of sentient life for sustenance is the norm, it is also legitimate to do so for science—especially because science uses (and usually reuses) the animal's remains to enhance our knowledge about the individuals and populations being sampled, often providing information that enables successful conservation. Second, many who hold particularly strong views on these philosophical and even spiritual aspects have a different value system in which collecting specimens for science has no merit, and there is no argument that can justify the practice within such a value system. Finally, the creation of Institutional Animal Care and Use Committees (IACUCs) and equivalents has brought increased dialogue, education, and focus to bear on all aspects of animal research (including bird collecting) to ensure that it meets societal ethical standards (despite concerns expressed by Vucetich and Nelson 2007; cf. Nisbet and Paul 2004). This process is done in a nonformulaic manner by a diverse group (including at a minimum a veterinarian, a research scientist who uses animals in research, a nonscientist, and a layperson not affiliated with the institution) that carefully weighs ethics, costs, regulations, alternatives, and benefits in determining whether a specific project can and should be undertaken (Office of Laboratory Animal Welfare 2002).

In general, public sensitivities about specimen collection are disproportionately large in relation to the biological effects of collecting. These two seemingly disparate issues—social and biological concerns—both influence bird collecting, and they can be tightly intertwined. For example, a collector can be legally right and ethically wrong. Such a collector might have a legally valid collecting permit for a location and a species, but if that scientist collects a particular specimen in front of a group of birdwatchers who are there to enjoy that bird, the collector excessively impinges upon their rights and does more damage to specimen-based science and its public relations than the gains from that specimen are likely to warrant. Excessively bold or aggressive collecting of a high-profile or very visible bird should be avoided. For similar reasons, a collector should not use rare-bird alerts for tips on where to go and what to collect.

Biological versus Social Effects of Collecting

Decisions about collecting must weigh the benefits gained from the specimen (and accompanying data) against the effect of collecting on populations and species and the potential public reaction. Scientists collect only a minuscule—statistically and, in most cases, biologically insignificant—proportion of the birds that die each year of all causes. Yet opposition to collecting can sometimes stop one of the only sources of avian mortality that can benefit the populations being sampled. Responses from concerned members of the public can vary between the extremes of the uninformed and reactionary (e.g., "collecting birds should be illegal") to contributing important information (e.g., "I can show you where there are a lot of those"). Members of the public are often eager to assist in the processes of specimen-based science. It is the responsibility of collectors and their institutions to explain and work within the relevant legal framework to find ways to enable interested people of all walks of life to participate in efforts to understand natural populations.

Disagreements over scientific bird collecting often focus on perception and opinion rather than biological data. The magnitude of the danger to populations of collecting—not what it might be, but what it actually is—needs to be understood. The likelihood that scientific bird collecting will cause substantial harm to bird populations is minuscule given current legal and ethical standards. Too few of today's scientists are collecting too few birds for this to be otherwise, especially given that it is generally a tightly regulated activity. When scientific collecting is likely to impose a genuine risk to a population or species, it should not occur. Bird collectors and permitting agencies need to balance the job of specimen-based biological documentation with that of conservation and recognize the shared goal of understanding birds and their biology. We also need to recognize that there are much more significant dangers to birds and society (e.g., habitat loss and climate change) than scientific collecting.

There is no clear evidence that scientific collecting has ever been responsible for a species' extinction (see Collar 2000). However, because bird collecting is often the only source of documentation for some extinct taxa, collection may provide the last evidence of a taxon and, thus, imply guilt by association. But such cases are very few, and generally it is clear that extinction occurred because of other factors. By today's standards, human players in past extinction events, sometimes including specimen collectors (Snyder 2004, Jackson 2006), showed a disregard for the future of species that would not be acceptable today. It is important, however, to continue to recognize a distinction between commercial (e.g., bird trade) and scientific collectors (e.g., Dutcher et al. 1905), and here we are dealing with the latter. Unfortunately, today there are large-scale anthropogenic factors pushing populations and species into decline, rarity, and extinction. Scientific collecting is not one of these, and in today's society we work to ensure that it does not become so. However, when scientific collecting is scrutinized and rescrutinized, we risk losing track of the things that actually matter, including human population expansion, habitat loss, pollution, the pet trade, feral cats, exotic invasive species, and collisions with communication towers, buildings, and vehicles. Unlike these factors, which can cause major declines in species diversity and population abundance, the costs of scientific collecting over most of the abundance spectrum (Fig. 1) are far less than the benefits it brings to conservation, management, and science. Such potential costs increase and become nonlinear as abundance nears zero and mortality from collecting could become increasingly additive rather than compensatory—that is, when more animals might be collected each year than would have died through other factors, such as predation, disease, or starvation (Fig. 1). Legal restrictions on collecting are justifiably at their highest when taxa reach such low numbers.

Biological concerns about a taxon can be negative for exotic invasive or other pest species (for which presence alone can be considered high abundance), and eradication efforts may be made under such conditions. Social concerns are more variable than biological ones and can span much of the space in Figure 1 (e.g., the area between the two dashed-line social-concern vectors). Historical examples such as Gray Wolves (*Canis lupus*) and Grizzly Bears (*Ursus arctos*) in the contiguous United States suggest that negative social concerns can persist through the eradication of some taxa, particularly those deemed a scourge (e.g., Fig. 1, lower dashed line); in these cases, negative feeling toward the species was expressed in outright, formal extermination efforts. Dodos (*Raphus cucullatus*) and Passenger Pigeons (*Ectopistes migratorius*) are examples in which there were positive feelings about the affected taxa (e.g., as food); but at the societal level, concern about the species' well-being was effectively negative (i.e., it was insufficiently positive for successful conservation). At the other end of the social-concern spectrum (Fig. 1, upper dashed line), high concern for even relatively abundant species can be seen in game-bird management and landscape-level management efforts for long-distance migratory nongame birds. Yet when a species' abundance is very high, social concerns, like biological ones, can become negative (e.g., control programs for species such as the Double-crested Cormorant [*Phalacrocorax auritus*]).

Modern scientific bird collecting is effectively a minor sampling event with no lasting effect when considered over most of the space in Figure 1, and this sampling can help diagnose or monitor the health of a population, species, or ecosystem. In most cases, excessive attention focused on the minor effects of collecting could leave involved parties feeling that something positive was accomplished, leading to the neglect of genuine threats, or, worse, the polarization of natural allies. Information derived through both collecting and conservation must be integrated and mobilized to protect birds from the real causes of decline.

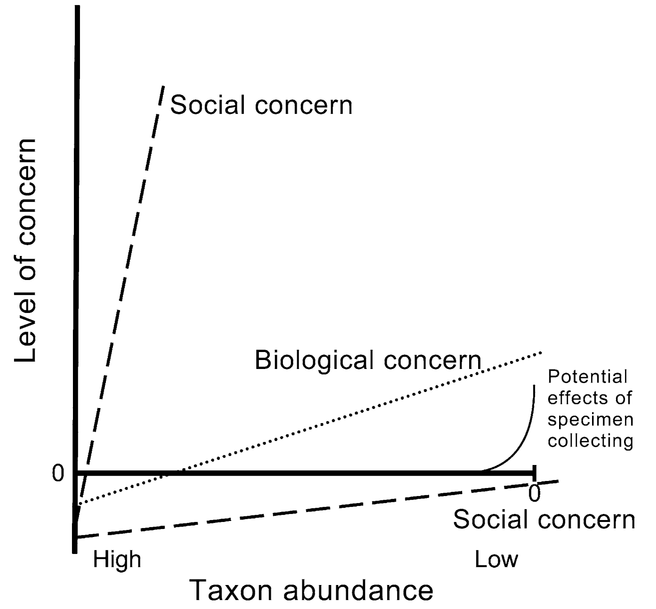

FIG. 1. The interaction space in which taxon abundance, the magnitude of biological and social concerns, and specimen collecting play out in conservation and management (note that the taxon-abundance axis is reversed, going from high to low). The taxon-abundance axis in North America might be considered as a House Sparrow (*Passer domesticus*; invasive species in high abundance) to Passenger Pigeon (*Ectopistes migratorius*; extinct and at zero abundance) continuum. Biological concerns (dotted line) usually increase to drive conservation efforts at very low levels of abundance and, frequently, management efforts at high abundance levels as well. Biological and social concerns increase as taxon abundance decreases, but social concerns are more variable and can span much of this space (e.g., area between the two dashed-line social-concern vectors). The potential effects of specimen collecting (curved line labeled "Potential effects of specimen collecting") are considered in a biological sense; they become nonzero and highly nonlinear when active collecting ceases to result in compensatory mortality and becomes increasingly additive (see text). Time is not meant to be a variable here, but adding that dimension by considering changes in abundance through time helps us understand how declines or increases in a specific taxon's abundance (or perceptions thereof) can also cause social and biological concerns to change.

RARITY AND PERCEIVED RARITY

Rarity can range from taxa widely distributed at low densities, to taxa locally common within a narrow geographic range, to taxa with occasional movements into regions outside their normal distribution (Rabinowitz 1981). Thus, rarity alone does not necessarily preclude collecting. Rarity is often attributable to extralimital occurrences of a species or inadequate information about its abundance (perceived rarity). In such cases, collecting may be warranted, but care should be taken. Important contributions to ornithology have been made by collecting vagrant individuals from outside a species' known breeding range (American Ornithologists' Union [AOU] 1957, 1998). Although this particular function of extralimital documentation has been replaced across much of the world by observational, photographic, and acoustic records from birdwatchers, collecting specimens for documentation remains an important activity (e.g., Jehl and Johnson 1994, AOU 1998, Roberts et al. 2010). The biological effects of collecting such rarities are insignificant in most cases, but negative social effects are potentially large (e.g., if a specific bird has been staked out by birdwatchers). Because of the benefits that such specimens bring (e.g., subspecies identification, information on reproductive condition and age, evidence of range shifts, etc.), collection is justified when potential biological and social effects are minimal.

Collar (2000) focused on the collection of rare birds and provided several examples to show that we tend to underestimate bird population sizes. We do not have space to address in detail his proposed set of procedures for considering the collecting of rare birds. However, he gave insufficient attention to two important considerations: life-history characteristics of species and the ultimate lack of power that a global, top-down approach to collecting limits will have with national and local permitting officials. These considerations shift the ethical burden back to the level of collectors and permitting officials and shift the discussion to biologically based considerations of population status and species' life histories. These areas are our focus here.

The common terms "vulnerable," "threatened," and "endangered" are often applied when birds are rare, are perceived to be rare, or may soon become rare (even if they are currently common). We recognize that some may be frustrated that we have not made stronger statements about collecting specimens from populations to which these labels have been applied. In our global experience, these terms are often misapplied (i.e., in cases of perceived rarity), so encompassing statements are inapplicable. We note, however, that populations that receive these labels also have added legal protections and, thus, additional scrutiny during permit negotiations, and that collectors should pay close attention in the field to whatever data they might obtain (most of which might be obtained through nonlethal means, even if limited collecting occurs) on these populations. The IUCN (International Union for Conservation of Nature) has the most widely accepted criteria for categorizing a species' status (see www.iucnredlist.org), and permit applications to collect bird species that they list as endangered (EN) or critically endangered (CR) should be closely scrutinized (these listings are not as reliable for nonavian taxa; e.g., Godfrey and Godley 2008). The former category (EN) includes some bird species with healthy populations from which small numbers of specimens might be collected, with good justification and careful scrutiny by management agencies. The latter category (CR) represents the world's most imperiled bird populations, and we expect that scientific collecting of these taxa would be permitted only after some highly compelling reasons were given and accepted, and only then after rigorous scrutiny, preferably including an independent scientific authority with an appropriate research background. So, for bird species that are not categorized by the IUCN as EN or CR (i.e., for most of the world's bird species and populations), we suggest that collecting should be considered carefully by permitting agencies and collectors on a case-by-case basis.

The biological data to be gained must be weighed against the loss of individuals when collecting is proposed or undertaken from populations designated as vulnerable, threatened, or endangered. Limited collecting from such populations can occur at times with no substantial risk to the population. Collecting is not warranted when it imperils distinct populations as defined in biological (and frequently legal) terms. As biologists, we have often seen political and social definitions of populations that do not match biological populations, and we restrict consideration here to the latter. For example, in North America, four designators are often used to define populations in terms of conservation and evolutionary importance. (1) The evolutionarily significant unit (ESU) denotes a population that is distinct from other populations, usually on the basis of more than one type of data and often including genetic data or distinct adaptive variation (Ryder 1986, Waples 1991, Moritz 1994). (2) The management unit (MU) denotes a population with significant genetic divergence (Moritz 1994) and, at times, a geographically isolated population. (3) The distinct population segment (DPS) denotes a population that is morphologically or genetically distinct (U.S. Department of the Interior and U.S. Department of Commerce 1996). And (4) designatable units (DUs) below the species level can be defined as a named subspecies or variety, a genetically distinct unit, a major range disjunction with no gene flow, or a biogeographically distinct unit that inhabits a different ecogeographic region (Committee on the Status of Endangered Wildlife in Canada 2005, Green 2005).

Field realities.—All parties should recognize the relationship between the collector and the population(s) being sampled. Whether background data on populations are strong or weak, collectors sample on a local scale to which those data may or may not apply. Abundance varies spatially, and a collector obtains data on abundance as soon as he or she steps into the field; encounter rates decrease with increasing scarcity. Population assessment is a natural part of a collector's activities. The most common result is that the collector moves to other sites when it becomes overly difficult to find and obtain the desired specimens. Because collectors do not have total access to all areas within the distribution of a taxon or population, the risk of overharvesting is tiny in the great majority of cases. Nevertheless, as a population becomes small and true rarity increases, or as a collector's ability to cover a substantial fraction of an entire habitat patch increases, additional care should be taken to ensure that taxa are sufficiently represented in the wild and are not imperiled by collecting. Collectors should be sensible about their activities and recognize that rarity is a stochastic phenomenon in many respects. An individual or flock of one species might be seen in the first few minutes of a field effort and never again during subsequent days or weeks of work in the same place. How a collector reacts to a first encounter with a species of interest should take all of these factors into consideration. Furthermore, if the object of collecting is a large, long-lived species, collectors should make a greater effort to assess population status before collecting than would be necessary for small, short-lived animals. Decisions on whether to take one, a second, or a series of 20 individuals will come after more time has been spent in a place and the stochasticity inherent in interpreting the degree of rarity is ameliorated by more data. We emphasize that this must all be within the bounds of permitted activities. But given imperfect knowledge and population fluctuations, permits can be overly restrictive for some taxa and overly generous for others. Collectors' field experiences should be used to tailor both ongoing collecting activities and future permits to improve the balance between science and robust populations.

Conclusions

Considering the above, we can make some general and specific recommendations. First, when investment in specimen collecting (e.g., preparation and archival care) is scientifically worthwhile, a bird should be collected only when available information provides reasonable assurance that doing so will not imperil the species, considering the life-history characteristics of that species or (in the absence of such knowledge) a predicted life history based on closely related species. This guideline also applies to the population level when biological criteria have been used to define populations (e.g., subspecies, ESUs; see above). Second, insofar as specimen collecting provides myriad scientific benefits to the successful management and conservation of populations and species (AOU 1957, 1998) and even ecosystems, it should be supported whenever possible by permitting agencies, institutional committees, the public, and NGOs. Third, we should all be doing more to facilitate specimen salvage. If greater collective effort were made to salvage birds that die of other causes, lower levels of active collecting would be required for some taxa, and we would all benefit. Although specimen salvage cannot totally replace active collecting, salvage may be the only way to preserve specimens of some species for science (e.g., the rarest); it can also provide large series useful for studies that would not be undertaken if active collecting were required; and it is often used to build or maintain collections used for teaching and public education. Scientific collecting extends to exploiting opportunities to put useful dead birds into collections, and this is most effectively done through partnerships among collectors, institutions housing scientific collections, the general public, and, perhaps most importantly and often overlooked, the agencies responsible for the management and conservation of species.

Collectors should:

- Follow all relevant laws and regulations.
- Work with permitting agencies to enhance the collective knowledge about these biological resources.
- Use the utmost care, working with permitting officials, if it is mutually considered necessary to collect specimens of species deemed by world standards to be exceptionally rare, such as those listed as EN or CR by the IUCN; such taxa, and the latter in particular, should be documented through nonlethal means and specimen salvage whenever possible.
- Limit collecting of individuals so as not to imperil distinct biological populations.
- Consider the nonlinear effects of collecting when populations reach very small numbers (Fig. 1) and take care not to make excessive collections when this is so; discuss these cases with permitting officials to promote mutual awareness and additional data.
- Be aware of the sensibilities of other individuals and conduct activities as though they are being observed by members of the public.
- Use humane methods to prevent pain and suffering and follow other formal professional guidelines (e.g., Fair et al. 2010).
- Use techniques that maximize quick and focused collection to minimize injuries and the possible loss of a harmed or collected bird.
- Make sure that a collected bird is used and/or is available for science or education, and, within practical limits, preserve parts of specimens and deposit them in an institutional scientific collection. For truly rare taxa, greater effort must be made to preserve more parts and data and to deposit specimens into institutional scientific collections where other researchers will have access to them.
- Continue to educate the public, government officials, and NGOs on the value of scientific collecting and collections and on the research, education, and conservation benefits that they bring.
- Coordinate collecting efforts to prevent excessive duplication, both to reduce societal and biological effects and to increase the effectiveness of scarce funding for science.
- Exploit opportunities to salvage specimens useful to science whenever practical.

The concerned public and NGOs should:

- Follow all relevant laws and regulations. This includes refraining from destroying property, such as mist nets set legally to capture birds. Avoid interfering with the legal and valid scientific collection of specimens.
- Engage in dialogue with scientific collectors about the goals and reasons for their research when concerned about their methods.
- Understand the fundamentals of biological populations; every individual dies, and the mortality caused by scientific collecting is typically biologically insignificant at population scales.
- Be honest and accurate in reporting about birds and bird collecting, and correct statements that are subsequently found to be erroneous.
- Understand that cars, communication towers, cats, and buildings kill far more birds than scientists; criticism regarding avian mortality should be focused on major threats to birds.
- Volunteer to retrieve and prepare salvaged specimens—birds that have died from causes other than scientific collecting—so that the need for active collecting of specimens will be reduced.

Permitting agencies and committees should:

- Be aware of the benefits that specimens bring to resource management, and support specimen collection whenever it is appropriate.
- Review each collecting-permit application on its own merits. Applications based on nonlethal sampling should not be used as a measure by which to evaluate applications based on sound justification for taking specimens.
- Focus on key scientific issues of population status and life history in setting limits on take, putting aside unwarranted social concerns whenever possible.
- Understand the basic biology underlying population demographics and issue collecting permits with neither overly generous nor overly restrictive limits.
- Understand that neither a lack of knowledge nor a category of "conservation concern" (in the absence of higher levels of categorization or protection) justifies denial of collecting. Judicious permits, partnerships with scientific collectors and their institutions (e.g., in data sharing), and flexibility as knowledge improves can bring important gains to all of us and to the birds we are all concerned about.
- Use terms such as "rare," "vulnerable," "threatened," and "endangered" only when they are truly applicable, and focus attention on the taxa and populations for which conservation efforts are most important. Moreover, do not allow misapplication of labels to thwart collecting or to dilute conservation support by applying them where they are not needed.

- Do not hesitate (beyond caveats above regarding species imperilment) to issue collecting permits that allow whole avian communities to be sampled, in addition to single-species or project-driven permits. The data-rich specimens that come from broader sampling bolster the numbers of specimens available in museum collections and bring a broad range of benefits. Recognize that the numbers of species and individuals actually collected on these multispecies permits are nearly always substantially less than the numbers authorized. One cannot accurately gauge the impact of the permitted field activities by simply adding up all of the species possible and their individual limits, because this would almost always be a gross overestimate.
- Recognize that judicious collecting can coexist with and may even enhance birdwatching and ecotourism activities.
- Monitor collecting activities through annual reports to remain informed about geographic and taxonomic patterns of take.
- Promote, facilitate, and fund specimen salvage.

In summary, the specimens and associated data that result from bird collecting benefit a wide variety of scientific studies and often serve as the basis for successful management and conservation of populations, species, and ecosystems. Thus, bird collecting should be supported whenever possible by permitting agencies, institutional committees, the public, and nongovernmental organizations. However, a bird should be collected only when available information provides reasonable assurance that doing so will not imperil the species or biologically defined population, considering the life-history characteristics of that species or closely related ones.

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