

BARCODING LIFE TAKES FLIGHT: ALL BIRDS BARCODING INITIATIVE (ABBI)

Report of Inaugural Workshop

Museum of Comparative Zoology, Harvard University
Cambridge, MA, 7-9 September 2005

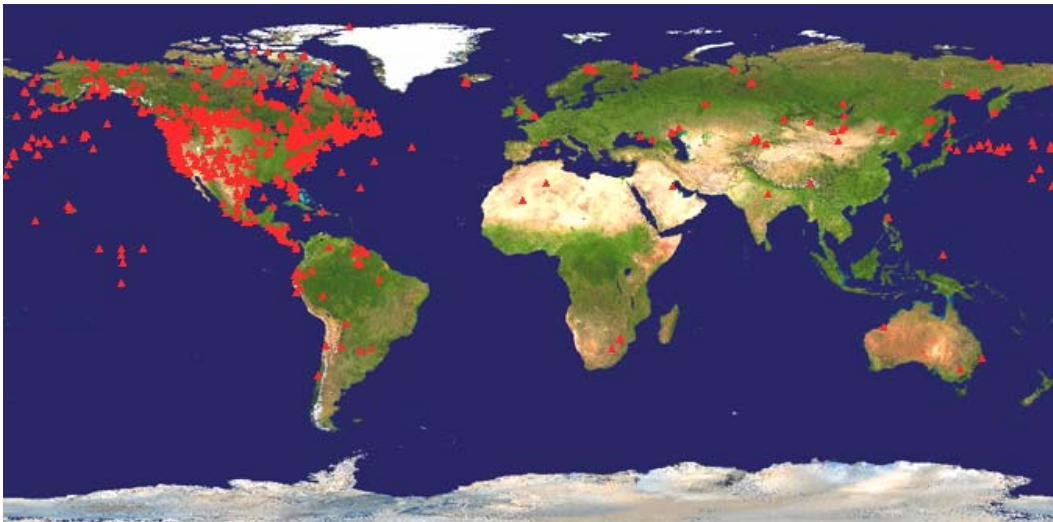
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The Consortium for the Barcode of Life

Submitted by:

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December 12, 2005



ABBI: 2698 specimens from 705 avian species analyzed as of December 2005. Map generated by Barcode of Life Database (BoLD) software.

*ALL BIRDS BARCODING INITIATIVE (ABBI)
INAUGURAL WORKSHOP REPORT¹*

Executive Summary	3
Group Photo	3
Co-Chair's Overview	4
Background	4
Meeting Structure and Content	5
1. Introductory Presentations	5
2. Logistical Issues	6
3. Regional Working Groups	10
4. Moderated Discussion	12
Appendix 1. Workshop Participants	15
Appendix 2. Meeting Agenda	16
Appendix 3. Biographical Profiles	18
Biogeographic Map	26

Acknowledgements. Special thanks to Alison Pirie for her professional and enthusiastic work arranging this meeting.

¹ Send comments to: markstoeckle@anglewing.org

EXECUTIVE SUMMARY

The Alfred P. Sloan Foundation and the Consortium for the Barcode of Life (CBOL) supported a two-day meeting at the Museum of Comparative Zoology, Harvard University, during which plans for an All Birds Barcoding Initiative (ABBI) were developed. This five-year initiative will seek to obtain gene sequence records from the barcode region of the mitochondrial gene COI, supplemented by sequences from other loci when needed, that will serve as species-level diagnostics for all bird species in the world.

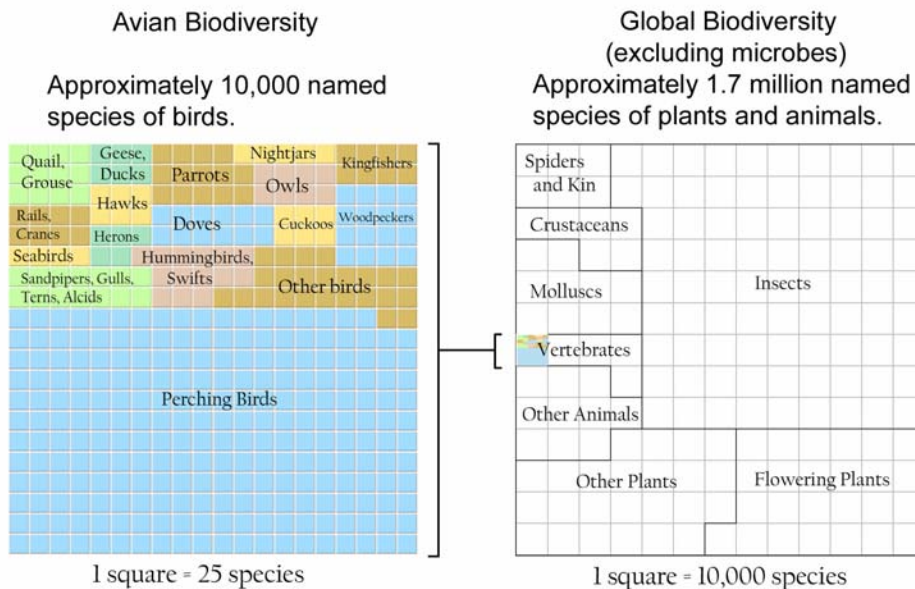
ABBI will be organized and managed through seven regional working groups and overseen and coordinated by a central Steering Committee. CBOL will assist with the initial organization of these structures. A minimum of five sequences per record will be sought, and each sequence must be associated with an acceptable voucher specimen, one of which must be a study skin. Data will be assembled and managed on the Barcode of Life Database (BoLD) at the University of Guelph. Individual participants will maintain ownership and control of the data records they submit to BoLD and will share their data with others in their geographic working group and with other groups on a case-by-case basis. Barcode data that are not associated with a specific research publication will be made public as soon as possible. CBOL and ABBI will promote training and capacity-building in developing countries, with emphasis on the Afrotropical and Indomalayan regions.



ABBI Workshop participants (left to right, starting at bottom) David Schindel, Mikhail Kalyakin, Allan Baker, Scott Edwards, Alison Pirie, James Hanken, Biff Bermingham, Fumin Lei, Navjot Sodhi, Cristina Miyaki, Les Christidis, Muchane Muchai, Timothy Crowe, Cristiane Bastos-Silveira, Dario Lijtmaer, Tshifhiwa Mandiwana, Sharon Birks, Robert Prys-Jones, Raurie Bowie, Paul Hebert, Juan Diego Palacio Mejia, Maria Paula Cruz Schneider, Julie Feinstein, Sri Sulandari, Shannon Hackett, Rob Fleischer, Kevin Kerr, David Mindell, Carla Cicero, Shou-Hsien Li, Linda Ford, Richard Prum, Isao Nishiumi, Nate Rice, Kevin Omland, Ettore Randi, Michael Sorenson, David Lambert, Mark Stoeckle, Per Ericson, Jon Fjeldsa, Rene Dekker, Sergei Drovetski, Carla Dove, Lee Weigt. Not in photo: Jesse Ausubel, James Beach, Joel Cracraft, Noam Leader, Rasmus Nielsen. Photo by Jeremiah Trimble.

CO-CHAIRS' OVERVIEW

At the close of the meeting Allan Baker provided a synthesis which drew a comparison with the Human Genome Project. There was early resistance to and skepticism of the Genome Project that gave way to collaboration and success. He recounted his own initial doubts of the effectiveness of COI and the notion of a DNA barcode, and his subsequent discovery that it worked well in his group of interest. He went on to describe the early success of barcoding in other taxonomic groups, such as fishes, insects and decapods. Based on his experience and research results to date, Baker predicted that the ornithological community would come to accept and support barcoding and that ABBI would be highly successful. Scott Edwards addressed worries about DNA barcoding, emphasizing that ABBI is an exploration of barcoding for species-level identification and is distinct from investigations into higher-level avian taxonomy.



BACKGROUND

The DNA Barcode Initiative began with a proposal by [Hebert et al. \(2003\)](#) that the mitochondrial gene cytochrome c oxidase 1 (COI) could be used as a diagnostic tool for identifying species of animals, analogous to the Universal Product Codes on commercial products. Studies of North American birds were among the first tests of this proposition ([Hebert et al., 2004](#)) and the results were uniformly positive. COI proved to be effective in distinguishing species of North American birds and even uncovered several potentially new species. DNA barcodes have been recovered from frozen tissue samples, feathers, and even from the residue of birdstrikes with aircraft engines ([FAA-US Airforce birdstrike program](#)).

As barcode data on the 690 species of North American birds accumulated during 2004 and early 2005, other components of the Barcode Initiative were gathering momentum. The Consortium for the Barcode of Life (CBOL) was established in May 2004 through a grant from the Alfred P. Sloan Foundation and the CBOL Secretariat Office opened at the Smithsonian Institution in September 2004. The first analysis of DNA barcodes among North American birds was published in September 2004 and its publication attracted considerable media coverage ([New York Times 14Dec2004](#)). Ornithologists began to consider the potential for a global inventory of bird barcodes. CBOL held the First International Barcode Conference at The Natural History Museum, London in February 2005, and an All Birds Barcoding Initiative (ABBI) was announced at that time ([Natural History Museum press release 10February2005](#)). An ABBI Steering Committee² was formed and met at Harvard in April 2005 to plan an inaugural ABBI workshop. The Steering Committee's proposal was submitted to the Sloan Foundation and an award was made in May 2005 for a workshop to be held at Harvard in September 2005. This is the report of that workshop.

MEETING STRUCTURE AND CONTENT

The ABBI Inaugural Workshop was hosted by the Museum of Comparative Zoology, Harvard University, on 7-9 September 2005. The meeting was held in the Harvard University Center for the Environment (HUCE) and was attended by 48 participants from 23 countries (Appendix 1, participant list; Appendix 3, biographical sketches). The meeting was divided into four sequential components (Appendix 2, meeting agenda):

1. *Introductory presentations on:*

- DNA barcoding;
- the proposed data standards for barcode data;
- the Barcode of Life Database (BoLD) at the University of Guelph;
- prior results on North American birds, penguins and extinct moas; and
- other biodiversity initiatives in ornithology with relevance to ABBI, such as the Tree of Life project and the ORNIS database;

2. ***Presentations on the logistical issues*** related to a global inventory of DNA barcodes for bird species. Ten logistical issues had been identified by the Steering Committee and these provided the framework for discussing logistics;

3. ***Discussions in seven break-out groups*** organized by biogeographic regions; and

4. ***Moderated discussions*** of strategy and tactics for the initiative, aimed at mapping the action plan for ABBI.

1. *Introductory Presentations*

Members of the ABBI Steering Committee explained the history leading up to the ABBI workshop. Scott Edwards (local host) described the place of ABBI in the larger Barcode Initiative. David Schindel (CBOL's Executive Secretary) presented the goals of the meeting.

Kevin Kerr (Univ. of Guelph) provided an introduction to DNA barcoding and presented the results of a study of barcodes of North American birds (north of Mexico). DNA barcodes have been obtained for 640 of the 690 bird species of North America. Intraspecific variation in

² A. Baker, Royal Ontario Museum; C. Dove, Smithsonian Division of Birds; S. Edwards, Museum of Comparative Zoology, Harvard Univ.; P. Hebert, Univ. of Guelph; D. Schindel, CBOL; M. Stoeckle, Rockefeller Univ.; and L. Weigt, Smithsonian Laboratory for Analytical Biology

barcode sequences averaged 0.3% within species and 6.4% among congeneric species, based on 2390 sequences (average of 3.7 sequences per species, ranging from 1 to 22 samples per species). The analysis revealed ten splits within described species that suggest the existence of incipient or cryptic species. Carla Dove (Smithsonian) described her application of barcode data to the problem of identifying birds after collisions with aircraft, a project supported by several US government agencies. Allan Baker (Royal Ontario Museum) explained that he had been skeptical toward DNA barcoding until it proved effective in his research on various bird clades. David Lambert (Allan Wilson Center, New Zealand) presented his research on extinct moas using molecular markers.



Avian strikes cost civil aviation an estimated \$1.2 billion annually, including \$500 million in damage to aircraft and 500,000 hours of civil aircraft downtime. Identification of bird species involved in airstrikes enables targeted interventions that reduce presence of these species near airfields and helps manufacturers improve aircraft design. Photos provided by Carla Dove.

Several presentations were devoted to data management and analysis issues. David Schindel outlined the draft barcode data standards that have been developed by CBOL's Database Working Group. Paul Hebert (Univ. of Guelph) introduced the workshop participants to the Barcode of Life Database (BoLD) and how it can be used to manage the data produced by a large distributed research initiative such as ABBI. Rasmus Nielsen (Univ. Copenhagen) discussed the roles of intraspecific variability and lineage sorting in the analysis of barcode data and described the potential use of Bayesian approaches. Carla Cicero (Univ. California Berkeley) gave an overview of the ORNIS database, an NSF-supported project that is creating seamless access to bird biodiversity information from multiple sources. She explained that ORNIS could be used to locate samples of interest to ABBI participants and to link specimen data to barcode sequence data in GenBank.

Shannon Hackett (Field Museum) described NSF's Assembling the Tree of Life (AToL) initiative and the avian AToL project. This multi-institution effort is devoted to reconstructing the higher-level phylogeny of birds and their archosaurian ancestors. She described the differences between the top-down multi-gene AToL approach and the bottom-up single-gene ABBI approach. Large collections such as the Field Museum's are being asked to provide tissue samples for both initiatives. She stated that ABBI could place a significant strain on museum resources and stressed the need for ABBI to bring new support into taxonomy, and to work closely with curators responsible for collections.

2. Logistical Issues

Mark Stoeckle, ABBI's Interim Coordinator (Rockefeller University) and David Schindel presented ten needs that the initiative would have to meet for a successful outcome. Their presentations introduced the issues that would be discussed in the geographic break-out groups and during the moderated discussion. The ten needs they described were:

Need 1. Establish a list of target species. There are several world checklists of bird species that could provide a taxonomic framework for sampling. The ABBI Steering Committee proposes to use Clements 2005 as ABBI's "master list". Mark Stoeckle proposed a system for centralized tracking of progress against this checklist.

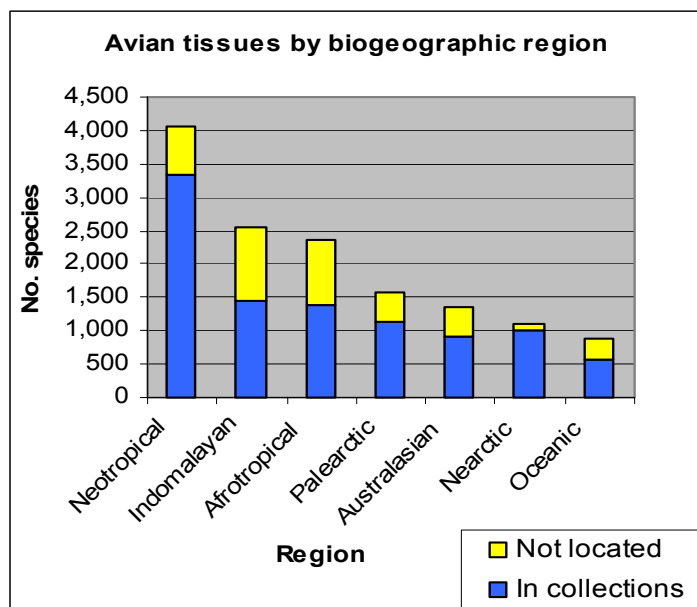
Need 2. Locate specimens. Mark Stoeckle has compiled data on the frozen tissue collections at 15 major repositories and is in the process of integrating other such collection lists into the Clements checklist. This compilation shows that:

Collection	Tissue specimens	Species represented
Australian Museum	1,433	340
Burke Museum	21,699	1,873
Field Museum	20,485	2,056
Indonesian Museum	1,037	258
Louisiana State University	34,766	3,282
Museo Argentino	376	114
Museum of Comparative Zoology	1,660	456
Museum of Vertebrate Zoology	8,945	441
Philadelphia Academy of Natural Sciences	13,000	2,102
Royal Ontario Museum	27,470	960
Smithsonian Institution	20,000	1,902
Smithsonian Tropical Research Institute	9,033	764
Swedish Museum of Natural History	12,140	912
University of Kansas	10,000	1,730
Zoological Museum of Copenhagen	24,000	2,646
Totals	206,044	6,320

- A very high percentage of the world's bird species (over 65%) are represented in frozen tissue collections. This means that new collecting or recovery of DNA from study skins, alcohol-preserved specimens or other sources will be needed for a minority of species;
- Of the species represented in frozen tissue collections, 70% are represented in more than one collection and 68% are represented by five or more specimens. This

bodes very well for the assessment of geographic variation within species;

- Approximately 10% of the species names in the lists of collection holdings did not match species names in the Clements checklist;



- The taxonomy in the Clements list is more up-to-date than are the lists from collections, making it difficult to know exactly which species on the Clements list are represented. Expert taxonomic oversight will be needed as barcode sequences are obtained and species on the master list are "checked off";
- Not all curators in charge of collections are willing to provide more than the minimal information on their holdings (undisclosed data included geographic locations, gender, number of specimens per species).

Participants discussed other possible sources of specimens, especially for those not represented in tissue collections. Good results are being obtained from feathers and banding programs could provide these. However, these sequences would only have the feather and perhaps a digital

image of the specimen as a voucher for the species identification. Participants discussed whether or not a feather and a digital image represent an adequate voucher for the species name. As a last resort, compromised DNA can be recovered from study skins and a barcode record can usually be obtained if enough time and effort is invested.

There was in-depth discussion of the financial and operational burdens that large tissue requests from ABBI would place on museum collections. Scott Edwards pointed out that the distribution of tissues among museum collections meant that cooperation would be required and that no one institution would be unduly burdened. Paul Hebert's lab has included funds to cover the costs of loan transactions in their grant proposals and they have paid per specimen fees for tissue loans. Participants discussed whether collections were entitled to the cost of the loan transaction or the value of the specimens. On one hand, loan traffic is a critical factor in proposals for support of collections because loans are an important indicator of a collection's importance. On the other hand, curators have a responsibility to preserve the collection for future researchers. Their responses to each loan request must balance the scientific value of the study proposed by the borrower against the long-term impact of the loan on the collection. Some participants were not convinced that curators would or should honor loan requests from barcoding projects, because loans must be tied to specific scientific uses and research questions. In their view, barcoding is data gathering without a specific research question in mind. Others argued that barcoding has a specific scientific purpose (creating diagnostic characters for species and searching for new variation) that also contributes to the long-term research infrastructure of ornithology.

Participants agreed that a follow-on meeting of curators from major bird collections should be convened to discuss the issues of the costs of loan transactions and the justification for ABBI loan requests. Allan Baker agreed to convene the meeting at the Royal Ontario Museum.

Need 3. Establish an organizational framework. The ABBI Steering Committee proposed a distributed organizational framework, with a small central Steering Committee and an ABBI Coordinator. Most of the work will be accomplished through seven regional working groups (see map, Section 3; also back cover). The coordinators of the regional working groups would be members of the Steering Committee.

Need 4. Establish sampling strategies within species. Barcode studies of birds have tried to obtain at least five specimens per species in order to assess intraspecific variability. This has not always been possible. Because birds migrate widely, it can be difficult to ensure that sampling strategies capture variation across the geographic range of species. CBOL's Data Analysis Working Group is developing guidelines for adequate sample sizes which will vary depending on effective population size and gene flow among local populations.

Need 5. Identify permit issues. In some cases, new collections will be needed in order to obtain DNA for species not represented in collections. Collecting permits will be needed and are very hard to obtain in many countries. Local researchers will need to take the lead in these cases. It is therefore critical that each regional working group is led by a local researcher. In those countries and regions without laboratory capabilities, specimens and/or PCR amplification products will have to be shipped internationally. Permits to export biological material can be very difficult to obtain. Participants agreed that violations committed by one or a few ABBI members could undermine the credibility and effectiveness of the entire initiative. Special efforts should be taken to maintain awareness of and adherence to all permitting regulations.

Need 6. Steer specimens to sequencing facilities. High-throughput barcoding labs have been established at the University of Guelph and the Smithsonian's Laboratory for Analytical Biology. Regional working groups may want to approach them with requests to process samples and/or PCR products (assuming that international transfer permits can be arranged). Biomedical research institutes may be another source of sequencing capacity in countries where museums and biodiversity research institutes lack these capabilities.

Need 7. Establish a shared software platform and standards for data submission and access. Mark Stoeckle and Paul Hebert provided information on the University of Guelph's Barcode of Life Database (BoLD). BoLD has modules that support (1) laboratory workflow processes during DNA extraction, amplification and sequencing, (2) a repository for barcode data and their analyses; and (3) identification of unknown specimens based on barcode sequences. BoLD can

submit sequences to GenBank and will manage the GenBank acquisition numbers provided after submission. The new version of BoLD will support barcoding campaigns in which geographic regions will work independently, and at the same time allow their progress against a master species list to be monitored centrally if this is desired.

Need 8. Identify funding strategies. CBOL and its Secretariat Office are supported by a grant from the Sloan Foundation. This grant is for administrative costs, meetings, conferences, outreach, and for partial support of the activities of CBOL's Working Groups. The Sloan grant can be used to offset some of the administration of ABBI but it cannot support barcoding projects or other research activities. These will require funding from national research councils, other government agencies, NGOs and private sources.

Need 9. Publication strategy. ABBI, like other barcoding projects, will produce voluminous data that should, eventually, be placed in the public domain through GenBank or other public data repositories. Participants engaged in a wide-ranging discussion of the ways that ABBI-produced barcode data should be made public. Some data that will be collected under ABBI will be tied closely to specific research projects (e.g., avifaunal surveys of a geographic region, revisionary studies, biogeographic research). In these cases, participants agreed that a researcher in an ABBI regional working group should be able to keep the data private until publication of the study. Some attendees felt that barcode data might contribute to research being conducted by people not associated with ABBI, and for this reason data should be released as soon as possible (unless embargoed by an ABBI participant planning to publish on the data).

Other participants in the discussion disagreed with the notion of releasing barcode data, except in connection with specific research publications. In their view, releasing large volumes of barcode data could undermine the efforts of researchers who were amassing diverse gene sequences for phylogenetic studies. Attendees at the meeting agreed that barcode data, by themselves, are inadequate for phylogenetic analyses. Nevertheless, some participants expressed concern that

“quick and dirty” studies could be published using only barcode data, thereby pre-empting more careful studies based on multiple gene regions.

Need 10. Create a Timeline. Stoeckle and Schindel stressed the need for specific milestones and for constant monitoring of progress within and among regional working groups. Setting and achieving annual goals will help to build momentum and attract participants and support.

3. Perspectives of the Regional Working Groups

Participants divided themselves into seven groups that correspond to their biogeographic regions of interest: Palearctic, Nearctic, Afrotropics, Neotropics, Indomalayan, Australasia/Antarctica,



and Oceania. Following their discussions in breakout groups, the seven regional working groups reported their responses to the logistical challenges posed by the workshop organizers.

Palearctic. Jon Fjeldsa (Denmark), Ettore Randi (Italy), Sergei Drovetski (USA), Mikhail Kalyakin (Russia), Noam Leader (Israel), Rene Dekker (Netherlands), Robert Prys-Jones (UK), Shou-Hsein Li (Taiwan). There are several large tissue collections with good geographic

representation for most of the region. The area of maximum species-richness is in the transition zone between the Palearctic and Oriental regions. There is no official list for the whole region because of a dispute about where to draw the border towards the Oriental region. However, Kees Roselaar (Amsterdam) is about to finish a distributional database for all Palearctic birds (expected to come soon as a book) and it may be possible to get permission to use this list. This follows a phylogenetic species concept which would be very relevant for ABBI. Within the EU there are well-established organizations and cooperative arrangements that link natural history museums which should help the organizational side of the project.

Nearctic. Allan Baker, Paul Hebert, Kevin Kerr (Canada); Mark Stoeckle, Lee Weigt, Carla Dove (USA) The North American bird project (north of Mexico) is nearing completion of a “first draft” with 5 or more specimens per species. There may be divergent populations within some species, particularly in the western US and Canada, that will merit additional study. The next steps are to expand coverage to Mexico and the Bahamas. There are no plans to include Greenland, Hawaii or the Caribbean in the Nearctic region. About 90 species will be added to the regional master list, mostly from Mexico. DNA for these species will probably have to come from study skins, or perhaps from frozen tissue deposited in smaller museums. National barcoding networks are developing in the US and Canada, and outreach efforts to Mexico, including possible training opportunities, are the next step. The Biodiversity Institute of Ontario (at the Univ. of Guelph), Royal Ontario Museum and the Smithsonian all have lab capabilities for DNA barcoding and are the natural lead institutions in the region. International transfer of non-US specimens might present a permitting problem.

Afrotropical. Timothy Crowe, Rauri Bowie, Tshifhiwa Mandiwna (South Africa) Muchane Muchai (Kenya). Although about 60% of the named species of Afrotropical birds are represented

in frozen tissue collections, it is likely there are many currently undescribed splits within species; in these cases wide geographic sampling is imperative. New collecting will be required and researchers in most regions of Africa either have permits or are awaiting final approval of permits. Southern Africa (South Africa, Namibia, Zimbabwe) and Kenya have the best-developed museum and collection infrastructure. Most of these holdings have been entered into a database and can be integrated into a master list of collections. Sequencing facilities are available in South Africa (automated) and National Museums of Kenya and Makerere University of Uganda (manual sequencers). As a result, out-of-country sequencing will be required and export/import regulations must be considered and followed. Networking is good in some parts of Africa. Training for all stages of the barcoding process will be needed - collecting, preparation, museum science, systematics, and molecular biology.

Neotropical. Cristina Mayaki and Maria Paula Cruz Schneider (Brazil); Juan Diego Palacio Mejia and Carolina Villafane Palau (Colombia); Eldredge Bermingham (Panama); Dario Lijtmaer (Argentina); Per Ericson (Sweden); and Joel Cracraft, David Mindell, Kevin Omland, Richard Prum, and Nate Rice (USA) discussed the availability of specimens in the region. A few large collections exist (particularly in Brazil and Colombia) but many specimens are scattered in small repositories or in personal research collections. There are researchers and institutes interested in bird barcoding in Argentina, Brazil, Colombia, and Panama; participation needs to be developed in Mexico. Brazil is the only country in the region that is developing a national barcoding network and it has six molecular lab facilities in which bird barcodes can be obtained. There are other lab facilities in Argentina, Colombia, Mexico and Panama.

Members of this regional working group noted that deeper sequence divergences are found in the Neotropics than were reported from North America (north of Mexico). Geographic coverage of samples is not adequate for many of the wide-ranging species in the region so more intensive sampling is needed to provide better information on geographic variation.

Australasian and Antarctic. Les Christidis (Australia), David Lambert (New Zealand). This region is well-positioned to advance quickly if funds are obtained given that most of the Australasian birds are represented by tissues with voucher specimens, as are at least 60% of New Zealand birds.

Oceanian. Rob Fleisher, Sharon Birks (USA), Isao Nishiumi (Japan) A barcoding project in this region will help to illuminate several significant problems, such as the decline of avifaunas on islands and effects of geographic isolation. Oceania includes several subregions that should probably have dedicated working groups (Polynesia, Micronesia, Melanesia). These subregions include a very large number of island nations and protectorates. As a result, there are many complicated regulations on collecting and import/export and no regional networks. The collections and sequencing labs associated with Oceania are all in US institutions (Bishop Museum, Univ. Guam, Smithsonian, Burke Museum) which will create import/export and collecting problems.

Indomalayan. Navjot Sodhi (Singapore) and Sri Sulandari (Indonesia) compiled a list of museums and repositories with the most important regional collections. Some are in the region, such as Raffles Museum of Biodiversity Research (National University of Singapore) which now has approximately 1060 species and 31,000 specimens of birds. Compiling a list of tissue collections in regional museums is an important next step. Other important collections of

Indomalayan birds are in US museums (Burke, LSU, MCZ, Alaska). New collections will probably be needed but obtaining collecting permits may be very difficult.

Meeting participants agreed that collections in the Afrotropical and Indomalayan regions have the greatest needs and are therefore the top priorities for infrastructure development and capacity building.

4. Moderated Discussion

Participants revisited the main logistical issues facing the ABBI. They arrived at the Points of Agreement and agreed to the Action Items presented below.

Data Sharing. As described above under Need 9, participants were divided on the issue of how and when barcode data should be released. Despite these differences, participants shared:

- Point of Agreement 1: Obtaining barcode data can contribute to question-driven research and to the general research infrastructure of ornithology. In cases where barcode data are being collected for a specific research project, the researcher has a right to keep the data private until publication. In other cases, barcode data should be made public as soon as possible so that they can be used by the research community at large;
- Action Item 1: There is sensitivity in the research community that the release of large blocks of sequence data may put some researchers at a disadvantage. ABBI should explore the option of releasing barcode data in a random fashion to avoid unanticipated negative consequences;
- Point of Agreement 2: ABBI specimen and sequence data should be managed through BoLD at the University of Guelph;
- Point of Agreement 3: Members of each regional working group should have access to sequence data submitted by the other members of their working group. Specimen data associated with sequences will be held privately by the submitter and will be password-protected within BoLD. Data submitters will have the final authority over when and how their specimen data are made public; and
- Point of Agreement 4: Sharing of sequence data among regional working groups could be beneficial for error-checking and for integrative analyses. Data sharing among regional working groups will be decided by the data submitter on a case-by-case basis, following specific request for access to sequence data.

Publication of results.

- Point of Agreement 5. ABBI participants are free to publish their data in question-driven articles, and may elect to keep their barcode data private until publication; and
- Point of Agreement 6. Regional working groups and the ABBI Steering Committee may elect to publish articles not tied to specific research questions, and to release data not held private by ABBI participants. These publications may be general ABBI updates, progress reports (e.g., ABBI milestones), or regional reviews of avifaunal diversity.

Selection of a barcode gene region for birds.

- Point of Agreement 7. Significant amounts of sequence data for birds have been collected from COI, cyt b and ND2. Only cyt b and COI are found in all eukaryotes. Integrated across all animal groups, COI is proving to be a more effective species diagnostic tool than cyt b. For this reason, ABBI will use COI as the principal barcode gene region, and will use cyt b and ND2 as supplementary regions in cases where they are needed to improve resolution

(drawing on Rasmus Nielsen's presentation, Scott Edwards pointed out that the success of barcoding for species identification will depend more on the histories of avian species and how completely their gene lineages have sorted during the speciation process than on the amount of mtDNA sequenced); and

- Action Item 2. COI sequences will be obtained from those bird tissue samples from which cyt b and ND2 sequences have already been obtained.

Managing voucher specimens, tissue samples and DNA extracts.

- Point of Agreement 8. All ABBI participants must adhere to governmental and institutional policies regarding the collecting of bird specimens, the international transfer of biological material, and the loan of museum specimens. Without explicit permission to do otherwise, borrowers of tissue are expected to return DNA extracts and unused tissue sample to the lending institution;
- Point of Agreement 9. ABBI can provide an important service to the research community by promoting the use of standard tissue preservation protocols among smaller collections;
- Point of Agreement 10. ABBI data should include information on the type of voucher specimen associated with each barcode sequence. Participants agreed that only certain types of specimens could serve as vouchers, and that blood and tissue samples should not be considered as valid voucher specimens. Participants agreed to construct a hierarchy of voucher specimen standards to be used throughout ABBI. The preliminary hierarchy of acceptable voucher specimens is:
 - Gold standard: male study skins with breeding plumage, females, alcohol-preserved specimens;
 - Silver standard: skeleton, skin sample; and
 - Bronze standard: feather, digital image;
- Point of Agreement 11. ABBI data need to include reliable cross-references that associate tissue samples to the voucher specimens from which they were obtained;
- Point of Agreement 12. ABBI projects should offer to compensate lending institutions for processing large loans. This could be in the form of payment of the fairly valued transaction costs or by providing in-kind staff assistance (with proper training and supervision by the lending institution); and
- Action Item 3. ABBI should convene a committee of curators of the major tissue collections to discuss compensation for processing large loan requests.

Sampling Strategy.

- Point of Agreement 13. ABBI should seek to obtain at least one barcode sequence per species that is associated with a study skin voucher specimen; and
- Point of Agreement 14. The number of barcode sequences needed to diagnose a species reliably will vary among species and populations. ABBI should seek to obtain a minimum of five barcode sequences per species that are associated with gold, silver or bronze voucher specimens;

Capacity-building, Training and Other Funding Needs.

- Point of Agreement 15. ABBI should be proactive in training and capacity-building in developing countries. This should be done, wherever possible, through partnerships with existing programs and centers that are providing training in curation, systematic biology, and molecular techniques, such as the biosystematic initiatives in South America;

- Point of Agreement 16. CBOL should assist ABBI in this effort by facilitating interactions with leaders in developing countries that will result in the growth of in-country collection and laboratory capabilities:
 - In-country short courses;
 - North-south training opportunities; and
 - technical assistance and support for capacity-building;
- Point of Agreement 17. ABBI and CBOL should concentrate their efforts in capacity-building and training in the Afrotropical and Indomalayan regions; and
- Point of Agreement 18. Support for graduate student projects will be very important to progress in ABBI.

Organization and Leadership of ABBI.

- Point of Agreement 19. ABBI should be organized and managed through seven regional working groups. Each regional working group should have a designated coordinator who should facilitate communication and/or convene meetings of the group. CBOL should assist in the formation and organization of these working groups;
- Point of Agreement 20. ABBI should be overseen by a Steering Committee that includes the coordinators of the regional working groups and curators of major bird collections;
- Point of Agreement 21. Scott Edwards should be the Interim Chair of the Steering Committee during its formation;
- Point of Agreement 22. Mark Stoeckle should be ABBI's Convener/Coordinator; and
- Point of Agreement 23. ABBI should establish and maintain good lines of communication with the ornithological community and AOU through Avecol and eBEAC.



Once a reference library is established, DNA barcoding can provide an independent, inexpensive method for verifying identifications of tissue specimens, intact skins, or birds monitored in banding operations. Photo credit Stuart Mackenzie.

Appendix 1. ABBI Workshop Participants

Last name	First name	Affiliation	Country	E-mail
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Appendix 2. Meeting Agenda

ALL BIRDS BARCODING INITIATIVE WORKSHOP

Museum of Comparative Zoology (MCZ) and Center for the Environment (HUCE)
Harvard University, Cambridge, Massachusetts

Day 0. Wednesday, September 7, 2005

7:00–9:00 PM Informal reception at Radisson Hotel Cambridge (Harvard Room)

Day 1. Thursday, September 8, 2005

8:00–9:00 AM	Take free shuttle from hotel to campus; continental breakfast (HUCE)	
9:00–9:25	Scott Edwards	Welcome to MCZ; participant introductions
9:25–9:40	David Schindel	Goals of meeting
9:40–10:15	Kevin Kerr Carla Dove	DNA barcoding North American birds
10:15–10:30	Break	
10:30–10:50	Allan Baker David Lambert	DNA barcoding living and extinct birds
10:50–11:10	Shannon Hackett Allan Baker	Complementarity of Tree of Life for birds and ABBI
11:10–11:30	Mark Stoeckle David Schindel	Overview of logistic issues
11:30–12:00	Discussion	
12:00–1:00 PM	Lunch (HUCE)	
1:00–1:45	Tour of MCZ bird collections; group photo	
1:45–2:00	Scott Edwards Mark Stoeckle	What bird tissues are available already
2:00–2:15	Allan Baker	Overview of ABBI: biogeographic regions
2:15–3:15	Breakout discussion groups by biogeographic region	
3:15–3:30	Break	
3:30–3:45	Jon Fjeldsa Shou-Hsien Li	Palaearctic region overview
3:45–4:00	Christina Miyaki Biff Bermingham	Neotropical region overview
4:00–4:15	Les Christidis David Lambert	Australasian and Antarctic region overview
4:15–4:30	Timothy Crowe Tshifhiwa Mandiwana Raurie Bowie	Afrotropical region overview

4:30–4:45	Navjot Sodhi Sri Sulandari	Indomalayan region overview
4:45–5:00	Sharon Birks Robert Fleischer Isao Nishiumi	Oceanic region overview
5:00–5:20	Allan Baker Scott Edwards	Wrap-up: “What we need by the end of tomorrow:” work plan for tissue exchange and acquisition, field work; sequencing, archiving, and dissemination
5:30–7:30	Informal reception and buffet dinner, Harvard Museum of Natural History (Romer Hall); take free shuttle back to hotel afterwards	

Day 2. Friday September 9, 2005

8:00–9:00 AM	Take free shuttle from hotel to campus; continental breakfast (HUCE)	
9:00–9:10	Allan Baker Scott Edwards	Review of goals for today: outline of work plans for each region and for ABBI overall
9:10–9:30	Carla Cicero	ORNIS: online avian specimen database
9:30–9:50	Rasmus Nielsen	Barcoding theory
9:50–10:10	David Schindel	Standards for barcode records in GenBank
10:10–10:30	Paul Hebert	Demonstration of BoLD
10:30–11:00	Break	
11:00–12:00	Moderated discussion	Database issues, plans for publication
12:00–1:30 PM	Lunch (HUCE)	
1:30–4:00	Moderated discussion and development of action plans	Distributed vs. centralized sequencing; funding; tissue/DNA transfer; new collection; tissue archiving; voucher specimens
3:00–3:20	Break	
4:10–4:30	Paul Hebert Allan Baker	Synthesis
4:30–5:15	Scott Edwards	Conclusion
5:30	Workshop ends, take free shuttle back to hotel; dinner on your own	

Appendix 3. About the Participants

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Current position: Program Director, Alfred P. Sloan Foundation
 Primary involvements: Helping the research community to conduct the Barcode of Life Initiative.

Name: **Allan J. Baker**
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Current position: Head, Department of Natural History
 Primary involvements: As above, plus Professor of Zoology, University of Toronto
 Special taxonomic interests: Birds, especially shorebirds and ratites, nonpasserines generally
 Fieldwork: South America, New Zealand, North America

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Current position: Post-doctoral Researcher
 Primary involvements: Genetic markers in studies of wild and captive populations and museum specimens.
 Special taxonomic interests: Bovids (African antelopes); Birds (Columbiformes, Falconiformes and Accipitriformes)

Name: **James H. Beach**
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Current position: Assistant Director for Informatics
 Primary involvements: Informatics of Collections, Collections data management systems

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Current position: Senior Staff Scientist and Deputy Director
 Primary involvements: Historical biogeography, community assembly and population genetics of birds
 Special taxonomic interests: Passerines
 Fieldwork: Caribbean islands and Central America

Name: **Sharon Birks**
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Current position: Genetic Resources Manager
 Primary involvements: Manage Burke Museum Genetic Resources Collection and loan program; additional management in Burke Ornithology Division
 Special taxonomic interests: Avian family Megapodiidae
 Fieldwork: Current: general avian specimen collection and preparation; Prior: behavioral ecology megapode birds

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Current position: Lecturer, Dept. of Botany and Zoology, Univ. of Stellenbosch & member of DST/NRF Centre of Excellence in birds at the Percy FitzPatrick Institute.
 Primary involvements: Mostly research on bird systematics, taxonomy, distributions and biogeography - both at the species and population levels.
 Special taxonomic interests: Systematics and biogeography of African and SE Asian birds. Particularly passerine birds, in particular sunbirds, flowerpeckers and spiderhunters (Nectariniidae)
 Fieldwork: South Africa, Kenya, Tanzania, Namibia, Malawi. Hope to work in SE Asia should the opportunity arise. Possibilities of Angola, Uganda, Congo and Mozambique

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Current position: Assistant Director and Head of Research and Collections Division
 Primary involvements: Primary administrative roles are: part of the three person Senior Executive Team leading the Australian Museum; Managing the Research and Collections Division (Zoology, Geology, Anthropology and Materials Conservation) which has 82 permanent research and collections staff as well as a further 30 grant funded staff. Primary research role is in collaborating with Dr Janette Norman (Museum Victoria) who is the research leader on projects looking at phylogeography, speciation dynamics and systematics of Australasian birds as well as landscape genetics approaches to biodiversity conservation.
 Special taxonomic interests: Australasian oscines, Australasian Psttaciformes , owls genera Ninox and Tyto.

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Current position: Curator
 Primary involvements: Curator in charge of bird and genetic resource collections; Principle Investigator, ORNIS
 Special taxonomic interests: Corvids, Vireos, Flycatchers, Sparrows, Titmice
 Fieldwork: Western North America primarily

Name: **Joel Cracraft**
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Current position: Curator in Charge, Department of Ornithology
 Primary involvements: Systematics of birds, species concepts and analysis, speciation and speciation analysis, higher-level systematics
 Special taxonomic interests: Higher taxa, passeriforms, birds of paradise

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Current position: Professor
 Primary involvements: Systematics, sustainable utilization of gamebirds, chairman of South African Biosystematics Initiative, council member Southern African Society for Systematic Biology
 Special taxonomic interests: Galliformes, Otididae, range of arid zone passerines
 Fieldwork: Birds in agricultural landscapes

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Current position: Curator of Birds. Starting September 1st: Head of Collections.
 Primary involvements: Megapodes (Megapodiidae), Birds of SE Asia (Systematic notes on Asian birds series).
 Special taxonomic interests: Megapodes (Megapodiidae)
 Fieldwork: Indonesia, Vietnam.

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Current position: Research Scientist
 Primary involvements: Birdstrike Identification
 Special taxonomic interests: Charadriiformes, Falconiformes, Anseriformes
 Fieldwork: USA

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Current position: Assistant Professor
 Primary involvements: Phylogeography of widespread Holarctic and Palearctic avian species. Comparative phylogeography of Europe and Caucasus and evolution of endemism in Caucasus.
 Special taxonomic interests: Tetraoninae, temperate and arctic Passerines and woodpeckers.

Fieldwork: I have been organizing and participating in general collecting expeditions to Russia since 1992 (Burke Museum 1992-2001, Bell Museum 2002-2003, University of Alaska Anchorage 2004-2005). I am collaborating with two major Russian museums (Moscow State University Zoological Museum and State Darwin Museum) on general collecting in Russia, Crimea, and Iran. I have also begun collecting in Alaska.

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Current Position: Curator of Ornithology, Professor, Organismic and Evolutionary Biology
Primary involvements: Molecular evolution and population genetics of birds; Australo-Papuan passerines; museum curation of vouchers and genetic resources.
Special taxonomic interests: Australo-Papuan passerines
Fieldwork: Australia, New Guinea, North and Central America

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Current position: Senior curator, associate professor
Primary involvements: Research in evolution, systematics and biogeography of birds. Together with colleagues and students I am conducting research in avian phylogenetics and biogeography based primarily on DNA sequence data. The last five years we have been involved in higher-level systematics of passerine birds. The Swedish Museum of Natural History is also building a collection of blood and tissue samples by fieldwork in Sweden and in tropical and subtropical regions of Southeast Asia and South America.
Special taxonomic interests: Passeriformes
Fieldwork: Sweden, South America, Vietnam, Indonesia

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Current position: Collection Manager
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Current position: Professor (biodiversity) and curator of birds
Primary involvements: **Research:** Systematics and biogeography, with special emphasis on the tropical Andes region of South America and Africa. Focus on passerine birds, but also other vertebrate groups. Main themes are mode of speciation and the interaction of historical and ecological factors in molding regional patterns of endemism and species richness. This is developed through traditional biogeographic methods supplemented with DNA-based studies of species-rich groups (in collaboration with other institutes) and comprehensive distributional databases (with external collaboration concerning GIS and remotely sensed environmental parameters). **Conservation priority analysis** (with links to institutions studying human use of natural resources). **Curation:** Curatorial responsibility for the Zoological Museum's collections of Aves. Half time curatorial assistant/taxidermist (Jan Bolding Kristensen). In the later years large efforts to build up tissue collections for DNA studies of tropical avifaunas (July 2005: >27.000 samples of ca. 2,600 species). **Special taxonomic interest:** Passeriformes: phylogeny of the whole group, and speciation within Afrotropical and Andean faunas. Several papers published or in progress with Per Ericson's group (Stockholm), Eric Pasquet's group (Paris), Rauri Bowie (Stellenbosch) and Jaime García-Moreno (Basel).
Fieldwork: Comprehensive fieldwork in the Andes (since 1977) and in eastern Africa (since 1990), with considerable collecting. Collecting Indonesia to Solomon Islands planned for 2006.

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Current position: Head, Genetics Program & Evolutionary Biologist
Primary involvements: Evolutionary and Conservation Biology - population and conservation genetics, systematics, applications of molecular methods to behavior and ecology.
Special taxonomic interests: Birds and their blood parasites (Apicomplexans), and mammals. Within birds, Hawaiian honeycreepers, Myadestes thrushes, Zosterops, Corvus, Acrocephalus, Pachycephalids, Hawaiian anatids, meliphagids,
Fieldwork: Pacific Islands (Hawaii, Marianas, Polynesia), Papua New Guinea, Australia, Western U.S.

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 Special taxonomic interests: [Amphibians](#)
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 Current position: [Canada Research Chair, Molecular Biodiversity](#)
 Primary involvements: [Scientific Director for the Canadian Barcode of Life Network \(BOL.ca\), an organization involving more than 50 researchers from University and governmental laboratories across Canada. Network participants will assemble barcode records for more than 20K animal species over the next 5 years and are also developing barcode protocols for plants, fungi and protists. Aside from my involvements with BOL.ca, I lead the Biodiversity Institute of Ontario, an organization that is deeply involved in the optimization of protocols for DNA barcode analysis and assembly.](#)
 Special taxonomic interests: [Lepidoptera, Zooplankton](#)
 Fieldwork: [Australia, North America](#)

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kalyakin@rambler.ru
 Current position: [Secretary for Research](#)
 Primary involvements: [They are rather wide. One part includes field studies of ecology \(primarily trophic adaptations and links\) of forest Passerines of Vietnam \(from 1989, including collecting skins and birds in alcohol\) and morpho-functional analysis of their jaw apparatus in lab. Collected materials are used in several taxonomic investigations in co-operation with the Paris Museum.](#)

[I am also an administrator \(my position is analogous to that of vice-director responsible for the science activity of staff members\) of one of two large, mostly zoological depositories in Russia and the former Soviet Union. Our ornithological collection is not as large as the collection in the Zoological Institute of St-Petersburg \(122,000 against ca. 160,000 specimens\), but recently it has grown much more active. We have legal permission to continue collecting in Russia and have contacts with local collectors all over Russia. We also have more than 1,000 specimens \(skins and in alcohol\) from Mongolia and from Vietnam. A collection of tissues kept in a common refrigerator was established four years ago and now includes more than 4,000 examples from more than 500 species \(ca. 80–90% from Russian fauna, others from USA and Vietnam\).](#)
 Special taxonomic interests: [Passeriformes, mainly Eurylaimiidae, Timaliidae, Pycnonotidae and Sylviidae.](#)
 Fieldwork: [Vietnam](#)

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 Current position: [M.Sc. student](#)
 Primary involvements: [Barcoding the birds of North America](#)
 Special taxonomic interests: [None designated yet](#)
 Fieldwork: [Previous conservation work with the wood turtle](#)

Name: **David Lambert**
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 Primary involvements: [Molecular ecology and evolution](#)
 Special taxonomic interests: [Birds \(both extant and extinct\)](#)
 Fieldwork: [Antarctic - research on evolutionary rates estimated from both modern and ancient populations of Adélie penguins has been ongoing for a decade.](#)

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 Current position: Research associate, Zoology Department, Tel-Aviv University & assistant curator of birds at the National Museum of Natural History, Tel-Aviv University
 Primary involvements: Bird vocal behavior; bird population genetics
 Special taxonomic interests: Passeriformes
 Fieldwork: Song dialects and population genetics of the orange-tufted sunbird (*Nectarinia osea*)

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 Current position: Professor, Ph.D. & Post-Doc. advisor
 Primary involvements: Phylogeny of snowfinches, Corvidae, Paridae and Turdinae; Species limits & vocalization of some species in Cuculidae; (Subject: Ornithology, Avian Ecology, Avian evolution, Vocalization, Molecular biology, Bird Flu). Academic Council Member in Institute of Zoology, CAS; Curator in the Museum of Zoology, IOZ; Council Member of Management in Museum of Zoology, IOZ.
 Special taxonomic interests: Snowfinches, Laughingthrushes, Thrushes, Cvids, Tits, and other groups in China.
 Fieldwork: All over the country (China), especially in the Qinghai-Tibet Plateau

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 Primary involvements: Intraspecific geographic variation; Molecular ecology
 Fieldwork: Taiwan and mainland China

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 Current position: Ph.D. candidate with a grant from CONICET (Argentina's Research Council). Advisor: Dr. Pablo L. Tubaro.
 Primary involvements: I am involved in my Ph.D. research project and in other projects being undertaken in Dr. Tubaro's laboratory. The research conducted in the laboratory spans diverse aspects of avian evolutionary biology and is mainly related to 1) systematics and phylogeography of Neotropical birds, 2) hybridization and speciation, 3) evolution of behavioral and morphological traits, and 4) the application of the knowledge obtained in our studies to the conservation of endangered species.
 Special taxonomic interests: We are mainly interested in studying different aspects of evolutionary biology in avian groups that radiated in the Neotropics, but we are interested in one group in particular. In relation to phylogenetics, we are currently studying furnariids, *Sporophila* seedeaters and *Sturnella* meadowlarks. We are also involved in the study of the phylogeography of the Rufous-collared sparrow (*Zonotrichia capensis*). Regarding hybridization and speciation, we have been recently studying ducks, pigeons and doves. In relation to the evolution of behavioral and morphological traits, we are studying several Neotropical groups. Finally, we are also involved in projects that deal with the conservation problems of *Sporophila* seedeaters and *Sturnella* meadowlarks.
 Fieldwork: We are currently conducting fieldwork in various areas of Argentina. In relation to our research projects, we are working mainly in Buenos Aires and La Pampa provinces. We are also collecting specimens and tissue samples for the Museum avian collection in these trips. Apart from that, we conducted various collecting trips in collaboration with institutions from North America in the last few years and are planning more trips for the second half of this year (the Institutions are the University of Alaska - Fairbanks, the American Museum of Natural History, and Cornell University). On these field trips we are collecting specimens and tissue samples from several avian groups in Southern and Northwestern Argentina.

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 Current position: Curator
 Primary involvements: My primary research focuses on the systematics of both African 'Francolins' and 'Spurfowls' as known today. The main focus is on unraveling the taxonomic confusion as well as understanding the phylogenetic and biogeographical relationship within species and between different species groups as in Hall's (1963) monograph. DNA sequences, morphological information and also calls are of interest in my research.
 Special taxonomic interests: African Francolins

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 Current position: Professor, of Ecology and Evolutionary Biology; Director and Curator of Birds, University of Michigan Museum of Zoology
 Primary involvements: Phylogeny of avian families and orders; Phylogeny within Accipitridae; Conservation genetics and phylogeography of Accipitridae and other Falconiformes; Coevolution of Galliformes (and other avian orders) and retroviruses (Retroviridae); Role of evolutionary biology in society
 Special taxonomic interests: Falconiformes, Strigiformes, Galliformes
 Fieldwork: With collaborators: Israel, Phillipines, Greenland, Panama, Pakistan/Cambodia (for *Gyps* and other Old World vulture species)

Name: **Cristina Yumi Miyaki**
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 Current position: University teacher
 Primary involvements: I use molecular phylogenetics and population genetics to study biogeography and systematics of neotropical birds, with emphasis on psittacids, passerines, and boobies. Some of the projects are also devoted to the conservation of endangered species.
 Special taxonomic interests: psittacids, passerines, and boobies.
 Fieldwork: Neotropical region

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 Current position: Head of Department and Senior Research Scientist, Ornithology department, National Museums of Kenya.
 Primary involvements: Leading, initiating, planning, supervising, conducting and participating in ornithology department research activities. As the Senior Research Scientist and Head of the Ornithology Department, The National Museums of Kenya, my work involves administration, conducting and facilitating taxonomic, action-oriented and conservation-based ornithological research and training, collecting, documenting, and disseminating information on birds and their habitats. The Department of Ornithology has an active program of fieldwork throughout Kenya and northern Tanzania and is engaged in taxonomic work, mainly in Pipits. We also collect blood samples in all field work visits for our blood database. The Department holds one of the largest collections of bird specimens in tropical Africa, including more than 30,000 study skins, tissues, nests, and type specimens for a number of Kenyan species. Over 900 mounted bird specimens are displayed in the Nairobi Museum Gallery and provide a unique opportunity of viewing the great assemblage of avifaunal beauty of this region.
 Special taxonomic interests: Motacilidae
 Fieldwork: Kenya (Grassland, Forest, Arid & Semi-arid, Wetland); Northern Tanzania (Serengeti Mara Ecosystem)

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 Current position: Professor of Evolutionary Biology
 Primary involvements: Statistical methods in population genetics, molecular ecology, and molecular evolution.

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 Current position: Curator of birds
 Primary involvements: Geographical variation in morphology and intraspecific molecular phylogeny of birds are engaged. Populations of passerine birds from Japan and adjacent areas are especially targeted in order to know the origin of Japanese bird populations.
 Special taxonomic interests: Sylviidae and Turdidae
 Fieldwork: East Asia

Name: **Kevin Omland**
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 Current position: Assistant Professor
 Primary involvements: Longstanding interest in species level polyphyly and paraphyly

Special taxonomic interests: [New World Orioles \(Icterus\), Corvus, Anas](#)
 Fieldwork: [Eastern US, Mexico](#)

Name: **Juan Diego Palacio Mejia**
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Current position: [Senior researcher](#)
 Primary involvements: [DNA and Tissue collection manager. In our lab we have worked with mtDNA in Birds, Myioborus and Grallaria genus, and nuclear genes in Crax genus. My investigation line is in plants, with population genetics in Oaks \(Quercus humboldtii\) in the Colombian Territory.](#)
 Special taxonomic interests: [Plants](#)
 Fieldwork: [Evolution and population genetics of tropical trees](#)

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 Current position: [Professor, Ecology and Evolutionary Biology, Curator of Ornithology, Head Curator of Vertebrate Zoology, Yale Peabody Museum](#)
 Primary involvements: [Avian Evolution, Feather](#)
 Special taxonomic interests: [Birds, Suboscines, Cotingas \(Cotingidae\), Manakins \(Pipridae\)](#)
 Fieldwork: [Neotropics, Madagascar](#)

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 Current position: [Head, Bird Group, The Natural History Museum](#)
 Primary involvements: [I am primarily \(in U.S. terminology\) a Collections Manager rather than a Research Curator, with overall responsibility for all the NHM's non-fossil avian collections and all visitors and enquiries associated with them. In addition, I undertake some research myself and supervise research projects involving a variable number of postdocs and PhD students.](#)
 Special taxonomic interests: [Indian Ocean land birds](#)
 Fieldwork: [Indian Ocean islands](#)

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 Current position: [Research Director](#)
 Primary involvements: [Responsible for Conservation Genetics and Laboratory of Genetics at the Italian Wildlife Institute \(INFS\)](#)
 Special taxonomic interests: [Galliformes](#)
 Fieldwork: [Molecular population and conservation genetics of avian species; molecular systematics.](#)

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 Current position: [Ornithology Collection Manager](#)
 Primary involvements: [Research - Ground Antbirds \(Formicariidae\); Administrative - Oversee the curation of 200,000 bird study skins and 13,000 bird tissue samples in the Academy's collection.](#)
 Fieldwork: [South America, Africa, Australia](#)

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 Current Position: [Executive Secretary, Consortium for the Barcode of Life](#)
 Primary involvements: [Purely administrative; facilitating the All Bird Barcoding Initiative.](#)

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Current position: [Research, Professor of Department of Genetics /Federal University of Pará \(UFPA\), Brazil](#)
 Primary involvements: [Molecular biology and animal evolution](#)
 Special axonomic interests: [Neotropical Birds and Primates](#)
 Fieldwork: [Northern Brazil \(Amazonia\)](#)

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Current position: [Associate Professor](#)
 Primary involvements: [Research/teaching. I have been studying the effects of rain forest loss and degradation on Southeast Asian fauna for the past ten years. My research has extensive field component. My students and I have been working in Singapore, Malaysia, Indonesia, and Philippines. I also plan to start up a project in Sikkim \(India\).](#)
 Special taxonomic interests: [Southeast Asian birds](#)
 Fieldwork: [Singapore, Malaysia, Indonesia, Philippines and possibly India.](#)

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Current position: [Visiting Scientist, The Rockefeller University](#)
 Primary involvements: [Developing DNA barcoding as a widely available research tool; Interim Coordinator for All Birds Barcoding Initiative](#)

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Current position: [Head, genetic laboratory of zoological division](#)
 Primary involvements: [Establishment of DNA bank on Indonesian faunae; Molecular characterization on mammals and birds](#)
 Groups of special taxonomic interest: [Birds](#)
 Fieldwork: [National Parks, Zoos, Captivity](#)

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Current position: [Curator in charge Primary research or administrative involvements: maintenance of the Cryo Collection, administration of databases, consultantship and investigation development with molecular techniques carried out with samples belonging to the collection or of external projects to this, with different biological groups. I have worked with mtDNA in birds but not with DNA barcodes yet. The samples of the collection are representative of the whole Colombian territory.](#)

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Current position: [Manager, LAB, National Museum of Natural History](#)
 Primary involvements: [Provide a DNA Barcoding Laboratory pipeline for high-throughput, efficient and cost-effective generation of DNA data. Explore areas for improvement in the extraction of molecular data from museum specimens of all preservation strategies.](#)

