

**The Western and Central Africa DNA Barcoding
meeting**

*23-25 October 2008
Hilton Transcorp, Abuja, Nigeria*

**Final Report
December 2008**

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Introduction

On 23-25 October, 2008, the National Biotechnology Development Agency (NBDA) in partnership with the Consortium for the Barcode of Life (CBOL) hosted a three-day DNA barcoding regional meeting for Western and Central Africa countries (see appendices 1 and 2 for regional meeting and short course announcements respectively). A DNA barcoding short course preceded the regional meeting. The short course and the regional meetings were held at the National Institute for Pharmaceutical Research and Development Laboratory and the Transcorp Hilton, Abuja, Nigeria, respectively. The goals of the regional meeting were to:

- Clarify concepts and applications of barcoding;
- Raise awareness as to the uses of DNA barcoding among researchers, research organizations, and potential users;
- Raise awareness to the pitfalls of barcoding, focusing on the responsible application of the technique;
- Explore the potential applications of DNA barcoding to environmental challenges facing countries in central and western Africa; and
- Clarifying funding opportunities to participate in barcoding thrusts.

There were 30 and 62 participants (appendices 5 and 6) to the short course and regional meetings respectively. The participants came from 7 West and Central Africa countries (Benin, Burkina Faso, Cameroon, Ghana, Nigeria, Senegal and Togo). Participants were selected from private and public academic research institutions, museums, government agencies and Non Governmental Organizations. Presenters came from Western and Central Africa region (Benin, Ghana, Cameroon and Nigeria), other regions of Africa (East and South Africa) and also from the international community (Belgium, Canada and United States of America). Participants discussed shared goals, challenges and opportunities in the region. Priority DNA barcoding projects for the region (see appendix 7) were identified. Priority projects include, the barcoding of: (a) useful plants (pesticidal, medicinal and spice plants); (b) agricultural pests (c) human health-related vectors, including mosquitoes, sand flies, tsetse flies, and fresh water snail vectors of schistosomiasis; (d) food safety microbes; (d) fungi in collections in Western and Central Africa; (e) skin fungi; (f) birds related to aeroplane bird strike; (g) fish (FISH-BOL); and (h) bush meat.

Acknowledgments

The Western and Central Africa meeting was made possible through financial support from the following organizations: CBOL, NBDA, Raw Materials Research and Development Council (RMRDC), Nigeria Natural Medicine Research and Development Agency, National Research Institute for Chemical Technology, Zaria (NARICT), Bioscience East and Central Africa (BecA), West African Biosciences Network (WABNet)/ NEPAD Biosciences Initiative, National Agency for Science and Engineering Infrastructure (NASENI), Trinity Biotech (Nig) Limited, National Oil Spill Detection and Response Agency, (NOSDRA), Abuja, National Space Research and Development Agency (NASRDA), Abuja, Nigeria Institute for Pharmaceutical Research and Development (NIPRID) and Idu Industrial Area, Abuja

Background

DNA barcoding is a technique that uses a short, standardized gene sequence to identify species. DNA barcoding is therefore, widely advocated as: (1) a tool for basic research in biodiversity; (2) a way to catalogue and index known biodiversity; (3) a way to accelerate the pace of discovering and cataloguing new species; and (4) a system for identifying organisms for applied purposes. DNA barcoding is increasingly being tested in many areas as a cost-effective tool for identifying and regulating agricultural pests, invasive and disease-carrying species, trade and sale of endangered species, and many other species of concern to governments and society. Because DNA barcoding uses DNA and not morphological features, it can identify eggs, larvae, blood, tissue fragments, and derived/fragmented forms of an organism, such as butchered meat or processed powders.

DNA barcoding has grown rapidly since the concept was proposed in 2003, and CBOL is playing an important role in promoting international partnerships globally to enable stakeholders in all countries to better understand and protect their biodiversity. CBOL has previously organized four regional “outreach” DNA barcoding meetings in:

-Cape Town, South Africa, for the countries of southern Africa

<http://www.barcoding.si.edu/SouthAfricaregional.html>

-Nairobi, Kenya, for the countries of Eastern Africa

<http://barcoding.si.edu/nairobiregional.html> ,

-Campinas, Brazil, for the countries of South and Central America

<http://www.barcoding.si.edu/brazilregional.html>) and

-Taipei, Taiwan, for countries in Asia: <http://www.barcoding.si.edu/asiaregional.html>

The Consortium of the Barcode of Life’s outreach activities to developing countries has sparked barcoding activities of scientific and socioeconomic importance to those regions.

Meeting Structure and Content¹

The DNA barcoding short training course was held on the first day of the meeting (see appendix 3). The second and third days were allocated for introductory presentations on DNA barcoding, its relationship to other biodiversity initiatives as well as managing DNA barcoding data. The presentations also highlighted the lessons learned from CBOL’s previous regional meetings including follow-on barcoding projects developed as a result of the Eastern and Southern Africa regional meetings. In addition, global initiatives, international and regional applications of barcoding and the results of the email survey on national capacity were presented. Regional networks, national summaries of DNA barcoding activities and priorities and break out group discussions were also covered (see appendix 4 for agenda).

¹ See appendices 3 and 4 for the short course and meeting agenda and the presentations linked to these agenda are available at <http://barcoding.si.edu/nigeriaregional.html>

Two groups were formed during the first break-out session to discuss (a) the greatest needs and opportunities for employing DNA barcoding for different: (i) scientific problems; (ii) socio-economic issues; and (b) ways and means of implementing barcoding in the region: (i) in which research institutes, (ii) in which taxonomic groups, and (iii) by which national or regional organizations (government ministries, NGOs)?

The Second break-out session was divided into four groups taking into consideration areas of greatest need and opportunities identified during the first break-out session. These were: (a) the plant; (b) the agriculture; (c) the vertebrate; and (d) the health discussion groups to identify: (a) DNA barcoding projects within the areas of the greatest need and opportunities; (b) lead organizations (c) principle investigators; and (d) potential partner institutions.

Break-out Group Discussion Results.

Major needs and existing opportunities for the DNA Barcoding in the Western and Central Africa

The greatest needs and opportunities for DNA Barcoding in the region were:

- Identifying biological specimens and managing species diversity;
- Addressing environmental degradation, biodiversity loss, human poverty; public health concerns, policy issues, border inspection, air and land safety; and
- Forming a strong regional partnership because the region shares identical biological diversity and species evolution.

Thematic areas (see also table 1) suitable for DNA barcoding application which address the socio-economic needs of the region were found to match with some of the existing global barcoding initiatives. Participants agreed that building partnerships with existing barcoding initiatives would more likely attract funding than individual and localized projects.

Institutions that were identified as capable of undertaking research on priority areas are tertiary and national research institutions. Examples include: OCEAC in Cameroun, The IRD and ISBA in Benin, “Institute Pasteur” in Senegal and the « Centres de Lutttes contre le Paludisme et l’Onchocercose », IITA in Nigeria, IRAD in Cameroon and various specialized institutions and universities.

Main scientific challenges

The main challenges that were identified where barcoding can be useful include:

- Biogeographic assessments and distributions. Barcoding techniques can improve the definition of radiation centres for priority taxa;
- Intra-specific discrimination of species complexes;
- Molecular ecology and improved assessments of community structure of priority species/taxa;
- Environmental degradation and biodiversity loss assessments; and

- Misidentifications, quality control, quality assurance and problems created by agricultural pests.

Socio-economical issues

Barcoding will provide non-specialists with tools and data for improved livelihoods in the region. The groups reported that barcoding can:

- help to boost the yields and quality of crops;
- facilitate sustainable use of natural resources;
- assist in an effective, sustainable control of diseases and public health concerns; and
- assist in poverty alleviation, , policy issues, border inspection, air and land safety

Implementing DNA Barcoding in West and Central Africa

Participants identified the training and capacity enhancement of resource persons as the main prerequisite for implementing barcoding in Western and Central Africa. Also the acquisition of relevant equipment and improving existing infrastructure within selected institutions was identified as relevant for the success of barcoding in the region.

Priority projects were identified within the plant, agriculture, vertebrate and health areas. Participants also selected lead institutions, principle investigators and potential partner institutions for the projects (see appendix 7).

Next Steps:

The following were the next steps identified by the participants:

- Principle investigators in collaboration with partner institutions should prepare concept papers for the identified priority projects;
- A Steering Committee and a Secretariat to direct DNA Barcoding research in the region should be set up;
- CBOL to assist in organizing a mini DNA barcoding workshop for countries of Central Africa. Central Africa participants were to liaise with Bioscience for East and Central Africa (BecA) to find out if BecA would be interested in co-organizing the workshop, and to report back to CBOL.

Appendix 1: Meeting Announcement



DNA Barcoding of Biodiversity in Central and Western Africa Call for Participation in a Regional Meeting 24-25 October, 2008, Abuja, Nigeria

The National Biotechnology Development Agency (NABDA), in partnership with the Consortium for the Barcode of Life (CBOL) and Nigeria Natural Medicine Development Agency (NNMDA) announces a three-day regional meeting on “DNA barcoding” to be held at the Transcorp Hilton in Abuja, Nigeria. Potential participants from Central and Western African countries are invited to send expressions of interest to the organizing committee. Limited funds will be available to support participation in this three day workshop.

The workshop is directed at upper level researchers and project managers/coordinators. The organizers seek the participation of:

- biodiversity researchers and policymakers
- taxonomists with and without experience in molecular biomarkers
- agricultural, environment, and public health scientists
- private sector companies who use, or will use barcoding

DNA barcoding is a new technique that uses a short gene sequence from a standardized position in the genome as a diagnostic tool for identifying species. Barcoding is intended as a reliable, cost-effective tool for documenting biodiversity research, controlling disease vectors, pests, and invasive species, protecting endangered species and other regulatory areas in which species identification is critical. CBOL is an international initiative that promotes the development and use of DNA barcoding. The Consortium is supported by the Alfred P. Sloan Foundation and is hosted by the Smithsonian Institution in Washington, D.C., USA. CBOL has more than 150 Member Organizations from more than 45 countries on six continents, and is devoted to the full participation of developing countries.

Goals of the workshop are to:

- Clarify concepts and applications of barcoding
- Raise awareness as to the uses of DNA barcoding among researchers, research organizations, and potential users
- Raise awareness to the pitfalls of barcoding, focusing on the responsible application of the technique
- Explore the potential applications of DNA barcoding to environmental challenges facing countries in central and western Africa
- Clarifying funding opportunities to participate barcoding thrusts

In addition, a component of the workshop will be used to:

- Assess the greatest needs and opportunities for DNA barcoding in the region. Some emphasis will be put on promoting barcoding in the least developed countries;
- Initiate the formation of a steering committee for barcoding with the intent that this committee will draw up an action plan for central and western Africa, and establish an intra-regional network and intercontinental partnerships to implement the action plan.

CBOL anticipates working with institutes and countries in central and western Africa to implement the resulting action plan, and to cooperate with regional partners through:

- In-country training activities such as short courses for researchers and advanced students on technical aspects of DNA barcoding and associated specimen curation;
- Research training fellowships that will allow researchers and technicians to spend adequate periods of time in partner laboratories for advanced training and pilot research projects;
- Infrastructure improvement such as equipment acquisition; and
- Other forms of high-priority capacity-building identified during the regional meeting.

Send expressions of interest to Christine Onyia: xtieo@yahoo.com

Please indicate if you wish to apply for travel funding, as some funding may be made to a limited number of participants (contingent upon availability of funds).

For more information on CBOL: www.barcoding.si.edu.

Appendix 2: Announcement for a One Day Short Course on DNA Barcoding, 23 October 2008, Abuja, Nigeria

The Consortium for the Barcode of Life (CBOL) and the National Biodiversity Development Agency of Nigeria (NMDA) will be offering a one-day short course on the technical aspects of DNA barcoding. The short course will be held in conjunction with a regional meeting that will take place on 24-25 October 2008. The short course will take place at the *National Institute for Pharmaceutical Research and Development laboratory*. The course is not intended for all participants in the regional meeting, though it may be suitable for some of them (see below, *Who Should Attend?*).

What are the goals of the short course? DNA barcoding is a technique that combines taxonomy, molecular biology, and bioinformatics. The course is intended to introduce taxonomists (including doctoral students, post-docs, and senior researchers) to the laboratory and data management techniques associated with DNA barcoding. The course will not provide sufficient training to begin barcoding; generally, a week of training at a DNA barcoding facility is needed before someone can conduct barcoding research. However, at the end of the course participants will have a better understanding of:

- How barcoding is done,
- The equipment, supplies, and expertise needed to conduct a barcoding project, and
- Resources and training opportunities that is available to laboratories that want to begin DNA barcoding projects.

Who should attend? The course is for researchers and doctoral students who are interested in gathering DNA barcode data for taxonomic research and for research applications (e.g., agriculture, conservation, land use management). The course is not intended for policy officials, administrators, or others not actively involved in basic or applied research activities.

What will be presented? The course will provide an introduction to the major steps in the DNA barcoding process:

- Obtaining the necessary permits for specimen collecting and transfer;
- Capturing specimen data in the field;
- Tissue sampling, preservation and handling;
- DNA extraction;
- PCR amplification;
- Sequencing reactions;
- The BARCODE data standard;
- The BOLD data workbench;
- Managing and submitting DNA barcode data to GenBank or EMBL; and
- Analysis of DNA barcode data.

How to register? Please submit the following information to Dr. Lucie Rogo (rogoluc@si.edu)

Name: _____

Institution: _____

I am currently a:

- University professor
- Researcher
- Doctoral student
- Laboratory manager or technician
- Other (please specify) _____

I work on the following taxonomic groups and/or applied research problems:

The research or applied problems for which I may want to use DNA barcoding are:

Appendix 3: Short Course Agenda



Western and Central Africa: DNA barcoding Meeting One-day course on DNA barcoding: Practical advice

Workshop Agenda

Date: 23 October 2008;

Time: 09:00

*Location: National Institute for Pharmaceutical Research and Development
laboratory, Abuja, Nigeria*

SESSION 1

09:30 — Welcome address: Christine Onyia

9:40: Agenda, Goals, Leading Labs concept
(Presenter: Dan Masiga)

10:00 — Obtaining the necessary permits for specimen collecting and material transfer
(Presenter: Lucie Rogo)

TEA — 10:30

SESSION 2

11:00 — Tissue sampling, preservation and capturing specimen data in the field
DNA extraction
PCR amplification
Sequencing reactions/ Options for sequencing
Setting up a facility for DNA barcoding/ equipment needed + useful tips to save
money in the laboratory
(Presenter: Michelle van der Bank)

Questions & Answers/ Discussion

LUNCH — 13:00

SESSION 3

14:00 — The BARCODE data standard
(Presenter: Dan Masiga)

14:30 — The BOLD data workbench
(Presenter: Olivier Maurin)

15:00 — Managing and submitting DNA barcode data to GenBank or EMBL
(Presenter: Olivier Maurin)

Questions & Answers/ Discussion

16:00 — **END OF WORKSHOP**

Appendix 4: Meeting agenda

**Western and Central Africa: DNA barcoding Meeting
Workshop Agenda**

Thursday, October 23, 2008

Short Training Course (separate agenda) and Participants arrive.

Day 1: Friday, October 24, 2008

8:00: Registration

Opening Session

Session Chair: Dr. Christine Onyia, Nigeria Biotechnology Development Agency (NBDA), Abuja, Nigeria

9:00: Communication from the Chair *Dr. Christine Onyia- Director, Environmental Biotech and Bio-conservation Department. National Biotechnology Development Agency (NBDA)*

9:10: Introductions of dignitaries: **Mr. T.F. Okujagu**, *Director General, Nigeria Natural Medicine Development Agency (NNMDA), Lagos, Nigeria*

9:20: Self introductions: *Dr. Christine Onyia* to lead.

9:30: Welcome remarks: *Prof B.O Solomon Director General, NBDA, Abuja, Nigeria*

9:40: Goodwill message by the Special Guest of Honor: *His Excellency, Barr. Sullivan Chime, Executive Governor of Enugu State, Nigeria*

9:50: Introduction to the Consortium for Barcode of Life: *Dr. Scott Miller –Smithsonian Institution and CBOL, Washington, D.C., USA*

10:10: Opening Speech: *Chief (Mrs.) Grace Ikpikwere, mni, JP, Hon. Minister of Science and Technology, Nigeria*

10:30: Tea Break

10:50: Overview of DNA barcoding and its relations to other biodiversity initiatives: *Dr. Scott Miller, CBOL Chair, USA*

11:10: Lessons Learned from CBOL Regional Meetings, Goals of Western and Central African Meeting: *Dr. Scott Miller CBOL Chair, Washington, D.C. USA*

11:30: The Process of DNA barcoding and management of barcode data *Dr. Bob Hanner, University of Guelph, Canada. Recorded presentation.*

11: 50: Scale Insect Barcoding Initiative: The Scale Insect Barcoding Project (Project developed following the S.African Regional Barcoding workshop): **Dr. Ian Millar**, *Plant Protection Research Institute, Pretoria, S.Africa.*

12.10: Fish Barcode of Life Initiative (FISH-BOL): **Dr. Ernst Swartz**, *South African Institute for Aquatic Biodiversity Grahamstown, South Africa.*

12:30: East Africa Cyprinid Initiative: **Dr. William Ojwang**, *Kenya Marine and Fisheries Research Institute, Kisumu, Kenya.*

12: 50: Results of e-mail survey of national capacity: **Dr. Lucie Rogo** –*CBOL Secretariat, Washington, D.C., USA*

1:00: Lunch

Session 1: Application of DNA Barcoding: International Experience

Session Chair: **Dr. Dan Masiga**, *International Center of Insect Physiology and Ecology, Nairobi, Kenya.*

2:00: Tephritid Barcoding Initiative and barcoding of agricultural pests: **Dr. Massimiliano Virgilio**, *Royal Belgian Institute of Natural Sciences, Royal Museum for Central Africa Brussels, Belgium*

2:20: Plant DNA Barcoding: **Dr. Michelle Van der Bank**, *University of Johannesburg, South Africa*

2:40: TreeBOL: The African Campaign: **Dr. Olivier Maurin**, *University of Johannesburg, South Africa*

3:00: Bee Barcoding (Bee-BOL) campaign: **Jason Gibbs**, *York University, Canada*

3:20: Coffee/Tea Break

Session 2: Application of DNA Barcoding: Western and Central African experience

Session Chair: **Dr. Gaston Achoundong**, *Institute of Agronomic Research, Yaounde, Cameroon*

3:40: DNA Barcoding of Microorganisms: **Dr. Ranajit Bandyopadhyay**, *International Institute of Tropical Agriculture, Ibadan, Nigeria.*

4:00: DNA barcoding initiative for Conservation and barcoding of Bush-meat: **Dr. Janette Wallis**: *American University of Nigeria, Yola*

4:20: DNA barcoding for disease vectors- *Dr. Daniel Boakye, Noguchi Memorial Institute for Medical Research, University of Ghana.*

Discussions

5:30. Meeting Adjourned

7:00. Dinner at the Arts and Crafts Village, hosted by **Mr. Gerry Nash, the MD/CEO of Trinity Biotech (Nig) Limited, (Trinitron Biotech),** Sheda Science and Technology Complex, Abuja.

Saturday, October 25, 2008

Session 2

Session Chair: Lucie Rogo

9:00: Description and discussion of regional networks for biodiversity and bio-informatics: *Dr. Muaka Toko, Bionet-WAFRINET, Cotonou, Benin.*

What networks exist in the region (strengths, weaknesses and possibilities)?

How can we strengthen and utilize these networks optimally for DNA Barcoding?

9: 20: Activities of the French Ifora Project in Central Africa. *Dr Philippe Le Gall, Institut de Recherche Agricole por le Developement (IRAD), Yaounde, Cameroon.*

9: 40: Brief National Summaries of DNA barcoding activities and Priorities (2-5 minutes) Benin (*Dr. Goergen, Georg*); Burkina Faso (*Dr Moussa Ouedraogo*); Cameroon (*Dr. Tindo Maurice*); Gabon (*Dr. Mavoungou Jacques François*); Ghana (*Dr. Millicent Cobblah*); Nigeria (*Prof Dr. Ayodeji Olayemi*); Senegal (*Dr. Abdoul Aziz Niang*) and Togo (*Dr. Komina Amevoïn*).

10: 20: Coffee/Tea Break

10:40: African experience and lessons Learned since the DNA Barcoding Regional Meetings in 2006- *Dr. Dan Masiga, International Centre of Insect Physiology and Ecology, Kenya.*

11:00: *Dr. Scott Miller: Smithsonian Institution/CBOL, Washington, D.C., USA*

Setting the scene for break-out group discussions of Regional Opportunities

Topics for discussion in break-out groups:

- What are the greatest needs and opportunities for employing DNA barcoding?
- For which scientific problems?
- For which socio-economic issues?
- How should DNA barcoding be implemented in the region?

- In which research institutes?
- In which taxonomic groups?
- By which national or regional organizations (government ministries, NGOs)?

11: 10: *First Break out Group Discussions*

Session Chair: *Scott Miller, Smithsonian Institution/CBOL*

Group 1: French Speaking Group

Moderator: **Dr. Phillipe Le Gall**, IRD

Rapporteur: **Dr. Ir. Nourou YOROU**, Université of Abomey-Calavi

Topics for discussion by both Groups 1 and 2:

- What are the greatest needs and opportunities for employing DNA barcoding?
- For which scientific problems?
- For which socio-economic issues?
- How should DNA barcoding be implemented in the region?
 - In which research institutes?
 - In which taxonomic groups?
 - By which national or regional organizations (government ministries, NGOs)?

Group 2: English Speaking Group

Moderator: **Prof Oluwatoyin T. Ogundipe**, University of Lagos

Rapporteur: **Dr. Adeniyi A. Jayeola**, University of Ibadan.

Topics for discussion by both Groups 1 and 2:

- What are the greatest needs and opportunities for employing DNA barcoding?
- For which scientific problems?
- For which socio-economic issues?
- How should DNA barcoding be implemented in the region?
 - In which research institutes?
 - In which taxonomic groups?
 - By which national or regional organizations (government ministries, NGOs)?

12: 30: Group Reports by the Rapporteurs (**10 minutes each**) and discussion

1:00: Lunch

Session 3: Second Break out group Discussions.

Session Chair: Dr. Toko Muaka

Group 1: Plants

Moderator: **Prof Oluwatoyin T. Ogundipe**, University of Lagos
Rapporteur: **Dr. Adeniyi A. Jayeola**, University of Ibadan.

Group 2: Agriculture

Moderator: **Dr. Goergen**, Georg, IITA, Benin

Rapporteur: **Dr. Djieto-Lordon Champlain**, Yaoundé University-Dept of Animal Biology

Group 3: Vertebrates

Moderator **Dr. Jeanette Wallis**, American University of Nigeria

Rapporteur: **Dr. Ernst Swartz**, South African Institute for Aquatic Biodiversity, Grahamstown

Group 4: Health

Coordinator: **Prof. Daniel Boakye**, Nguchi Memorial Institute for Medical Research, Ghana

Rapporteur: **Miss Enang Moma**, Federal Ministry of Science & Technology, Abuja

2:00: Group Discussions continue.

4:00: Presentation of report by rapporteurs (10 minutes each) and discussion

4:40: Discussions and Identification of the highest-priority barcoding projects in the region **with Coordinators and partners of the projects named-**

Moderator: **Dr. Scott Miller**: *Smithsonian Institution/CBOL, Washington, D.C., USA*

6:00: Vote of Thanks- Dr. Christine Onyia

6:05: Closing Remarks- Prof. B. O. Solomon

7:00: Dinner at the Hilton Transcorp hosted by Prof. A. O. Adewoye, Director General of National Agency for Science and Engineering Infrastructure (NASeni), Idu, Abuja,

Appendix 5: Participant List

	NAME	INSITUTION	COUNTRY	E-MAIL CONTACT
1	Dr. Massimiliano Virgilio	Royal Museum for Central Africa Brussels	Belgium	m.virgilio@skynet.be
2	Dr. Goergen, Georg*	Collections, International Institute of Tropical Agriculture (IITA)	Benin	G.Goergen@cgiar.org
3	Dr. Muaka. Toko*	Bionet/ IITA	Benin	m.toko@cgiar.org
4	Dr. Ir. Nourou*	Faculty of Agric. Sciences, University of Abomey-Calavi, Cotonou	Benin	n.s.yorou@gmail.com
5	Dr Moussa Ouedraogo	Centre National de la Recherche Scientifique et Technologique	Burkina Faso	moussasegnam@hotmail.com
6	Dr. Gaston Achoundong	Institute of Agronomic Research, National Herbarium, Yaounde	Cameroon	gachoundong@yahoo.fr
7	Dr. Arouna Ndassa	General Biology- Univ. of Yaounde I	Cameroon	bioakamp@yahoo.fr
8	Dr. Djieto-Lordon Champlain	Dept of Animal Biology- Yaoundé University	Cameroon	champlain_djieto@yahoo.ca
9	Dr. Mapometsem Pierre Marie	Plant Biology- Ngaoundéré University	Cameroon	pmapong@hotmail.com
10	Dr. Ngono Ngane Rosalie	Depts. Of biochemistry- Univ. of Douala	Cameroon	angono@yahoo.com
11	Dr. Philippe Le Gall	Institut de Recherche Agricole por le Development (IRAD), Yaounde	Cameroon	Philippe.Le-Gall@ird.fr
12	Prof. Tchouamo Isaac Roger	Ministry of Scientific Research, Rep of all Research Institutions	Cameroon	it chouamo@yahoo.com
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17	Dr. Dan Boakye	Nguchi Memorial Institute for Medical Research	Ghana	DBoakye@noguchi.mimcom.org
18	Dr. Ameka, Gabriel Komla*	University of Ghana	Ghana	kgameka@ug.edu.gh
19	Ms. Millicent Cobblah*	Univ. of Ghana	Ghana	macobb@ug.edu.gh
20	Dr. Dan Masiga*	International Center of Insect Physiology & Ecology, Nairobi	Kenya	dmasiga@icipe.org
21	Dr. William Ojwang*	Kenya Marine and Fisheries Research Institute, Kisumu	Kenya	w_ojwang@yahoo.com
22	Dr. Mrs. Omokafe A. Ugbogu*	Forestry Research Institute of Nigeria	Nigeria	omokafeugbogu@yahoo.com
23	Dr. Adeniyi A. Jayeola*	Plant Systematics & Africa TreeBool Project - University of Ibadan.	Nigeria	adeniyi.jayeola@googlemail.com
24	Prof. J. C. Ogbonna*	Dept. of Microbiology, University of Nigeria, Nsukka	Nigeria	jctogbonna@yahoo.com
25	Prof Amos Akingbohunge	Department of Plant Science, Obafemi Awolowo University	Nigeria	aakingbo@yahoo.com
26	Ngwai Yakubu	Sheda Science and Technology Complex	Nigeria	ybnqwai@yahoo.com

		(SHESTCO), Abuja		
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37	Prof. B.E. Okoli*	University of Port Harcourt.	Nigeria	profokoli@yahoo.com
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(* Short course participants).

Appendix 6. Group Photo



Appendix 7: List of DNA Barcoding Projects

Priority Projects

1. Useful Plants Barcode of Life (UPs-BOL) including, pesticidal, medicinal and spice plants in Western and Central Africa

Lead Institutions during project proposal preparation: University of Lagos (contact person: Prof Oluwatoyin T. Ogundipe for West Africa region), and Institute of Agronomic Research, Yaounde (contact person: Dr. Gaston Achoundong for Central Africa region).

Partner Institutions: Nigerian Natural Medicine Dev. Agency Lagos (NNMDA) - Contact: Dr. Oche; The National Centre for Genetic Resources and Biotechnology (NACGRAB), Ibadan, (contact: Mr. Lyam Paul); Forestry Research Institute of Nigeria (FRIN) (contact: (Dr. Omokafe ugbogu) and University of Yaounde I (Contact: Dr. Libert Brice Tonfack).

2. Barcoding agricultural pests of western and central Africa (to include nematodes and white flies):

Lead Institutions:

Institut de Recherche Agricole por le Development (IRAD), (contact Person: Dr. Philippe Le Gall and International Institute of Tropical Agriculture (IITA), Benin (contact: Dr. Georg Goergen)

Partner Institutions:

Whiteflies: University of Yaounde; Natural History Museum, Obafemi Olowolo; IRAD; Biodiversity Institute of Africa and University of Portharcout.

3. Vector-BOL in west and central Africa

a. barcoding human health related vectors including mosquitoes and fresh water snail vectors of schistosomiasis:

Lead Institution: Noguchi Memorial Institute for Medical Research, Ghana, (contact: Dr. Dan Boakye)

Partner Institution: University of Yaounde, (contact person: Dr. Arouna Ndassa).

b. Barcoding of tsetse flies:

Lead Institution: International Center of Insect Physiology and Ecology (an existing program).

c. Barcoding of sandflies:

Lead Institution: Institut Fondamentale d'Afrique Noire (IFAN), Dakar, Senegal: (contact person: Dr. Abdoul Niang).

d. Barcoding food safety microbes (food fungi):

Lead Institutions: IITA, Nigeria (contact: (Dr. Bandyopadhyay Ranajit) and University of Abomey Calavi, Cotonou, Benin (contact person: (Dr. Nourou Yourou)

Partner Institution: Sheda Science and Technology Complex (SHESTCO), (contact person: Ngwai Yakubu).

4. Barcoding fungi in collections in Western and Central Africa:

Lead Institutions: IITA, Nigeria (contact: (Dr. Bandyopadhyay Ranajit) and University of Abomey Calavi, Cotonou, Benin (contact person: (Dr. Nourou Yourou)
IITA and University of Abomey Calavi, Cotonou, Benin.

5. Barcoding of Skin fungi:

Lead Institution: Noguchi Memorial Institute for Medical Research, Ghana, (contact person: Dr. Dan Boakye)

6. Barcoding of Birds as relates to aeroplane bird strike:

Lead Institution: Bird Hazard Control, Federal Airports Authority of Nigeria, (contact person: Dr. Niyi Dehinbo).

Partner Institution: IITA Benin (linking with Agriculture pest project; Ornithological Bird Institute (contact: Director Georgina) and Natural History Museum Obafemi Awuolowo University.

7. Barcoding of Fish (FISH-BOL) in Western and Central Africa:

Lead Institution: South African Institute for Aquatic Biodiversity, Grahamstown-Existing project, (contact persons: Dr. Ernst Swartz & Monica Mwale).

Partner Institutions: Nigerian Institute for Oceanography and Marine Research Victoria Island, Lagos; Natural History Museum Obafemi Awuolowo University, (contact person: Ayodeji Olayemi); Nigerian Institute of Freshwater Fisheries (contact person: Dr Olufeagba); University of Agriculture Abeokuta Nigeria (contact person: Prof Sylvia Uzochukwu); National Biotechnology Development Agency (contact person: Christopher Orji) and NACGRAB (contact person: Mr. Liam Paul).

8. Screening of Bush meat using barcoding (start with mega fauna) and barcoding small mammals as bioindicators and vectors of disease in Western and Central Africa:

Lead Institution: American University of Nigeria, (contact person: Dr. Jeanette Wallis).

Partner Institutions: Natural History Museum Obafemi Awuolowo University); International Primatological Society, Society for Conservation Biology – African section and NACGRAB (contact: Liam Paul).

Other Projects of Interest in the Western and Central African Region

9. Barcoding of fruitflies:

Relevant Institution: University of Lome, Togo (Dr. Komina Amevoïn).

10. Barcoding of vegetable pests

11. Barcoding of pollinators in particular stingless bees:

Relevant Institution: University of Cape Coast (Contact: Drs. Rofela Combey and Peter Kwapong).

12. Barcoding of Mushrooms:

Relevant Institutions: Forestry Research Institute of Nigeria (contact: Omokafe Ugbogu) and University of Abomey-Calavi, Benin (contact: Dr. Ir. Nuorou S. Yorou).

13. Barcoding of trees (TREE-BOL), to include timber, CITES list and also trees for bio-energy (shrubs and also algae).

Relevant Institutions: Bio-energy: University of Port Harcourt (Contact: Prof. Okoli); Forestry Research Institute of Nigeria (contact: Omokafe ugbogu); timber: University of Ibadan (contact: Adeniyi Jayeola) and NACGRAB (contact: Liam Paul).

14. Barcoding of scale insects:

Relevant Institutions: IRAD, IITA and University of Agriculture, Abeokuta, Nigeria.

15. Barcoding of stem borers:

Relevant Institutions: IRAN, Ghana Atomic Commission and University of Ghana (Contact: Ms. M. Cobblah).

16. Barcoding of Alien Invasive plant Species:

Relevant Institutions: University of Port Harcourt (contact. Prof. Okoli) and University of Dakar (contact: Noba Kandioura).

17. Barcoding of endangered plant species:

Relevant Institutions: Forestry Research Institute of Nigeria (contact: Omokafe ugbogu) and NACGRAB (contact: Liam Paul).

Appendix 8: Meeting Organizers

Consortium of the Barcode of Life (CBOL) – <http://barcoding.si.edu>

The Consortium for the Barcode of Life (CBOL) is an international initiative devoted to developing DNA barcoding as a global standard for the identification of biological species. CBOL promotes:

- the rapid compilation of high-quality DNA barcode records in a public library of DNA sequences,
- the development of new instruments and processes that will make barcoding cheaper, faster, and more portable,
- the participation of taxonomists and taxonomic research organizations in all regions and countries, and
- the use of DNA barcoding for the benefit of science and society

As of early 2008, CBOL had over 170 Member Organizations from more than 150 countries. CBOL is supported by the Alfred P. Sloan Foundation and is hosted by the Natural History Museum, Smithsonian Institution.

National Biotechnology Development Agency (NABDA)

National Biotechnology Development Agency, a parastatal under the Federal Ministry of Science and Technology was established by the Federal Government of Nigeria in 2001 for effective coordination and implementation of National Biotechnology Policy. NABDA's overall objective is to ensure realization of its mandate through the provision of an enabling environment that responds to the needs of the biotechnology industry, the Research & Development communities and the relevant national and international concerns. NABDA has six Zonal Centers of Excellence being developed in the six premier Universities in Nigeria located in the six geo-ecological zones of the country

National Goals:

- Exploration, collection, evaluation and utilization of indigenous genetic resources through Research & Development;
- Establishment of well-equipped laboratories for biotechnology research, biodiversity conservation and bioresources development;

- Development of critical mass of human resources to drive the nation's biotechnology and bioresource development;
- Elaboration of “bridges” between laboratories and market places; and
- Networking and Collaborations between scientists and laboratories within the country, the sub – region and globally.

Table 1. Thematic areas and priority taxa for the DNA Barcoding in Western and Central Africa.

	Thematic areas	Priorities taxa
Human and Animal Health	<ol style="list-style-type: none"> 1. Disease vectors 2. Pathogenic agents 3. Food safety microbes and poisonous fungi 4. Medicinal plants 	Mosquitos, Phlebotomines, skin fungi, aflatoxines and poisonous mushrooms
Agriculture	<ol style="list-style-type: none"> 1. Agricultural pests, 2. Plant pathogens 5. GMOs 	Acridids, stem borers, fruits flies, Nematodes, Viruses and fungi
Environment	<ol style="list-style-type: none"> 1. Timber, 2. Bio-indicators 3. Invasive alien species 4. Endangered and CITES protected species, 5. Bush meat 6. Migratory species 	Threatened species, Migratory species