

international  
**BARCODE  
OF LIFE**



# **DNA Barcoding**

## **Making Every Species Count**



# Presentation Roadmap

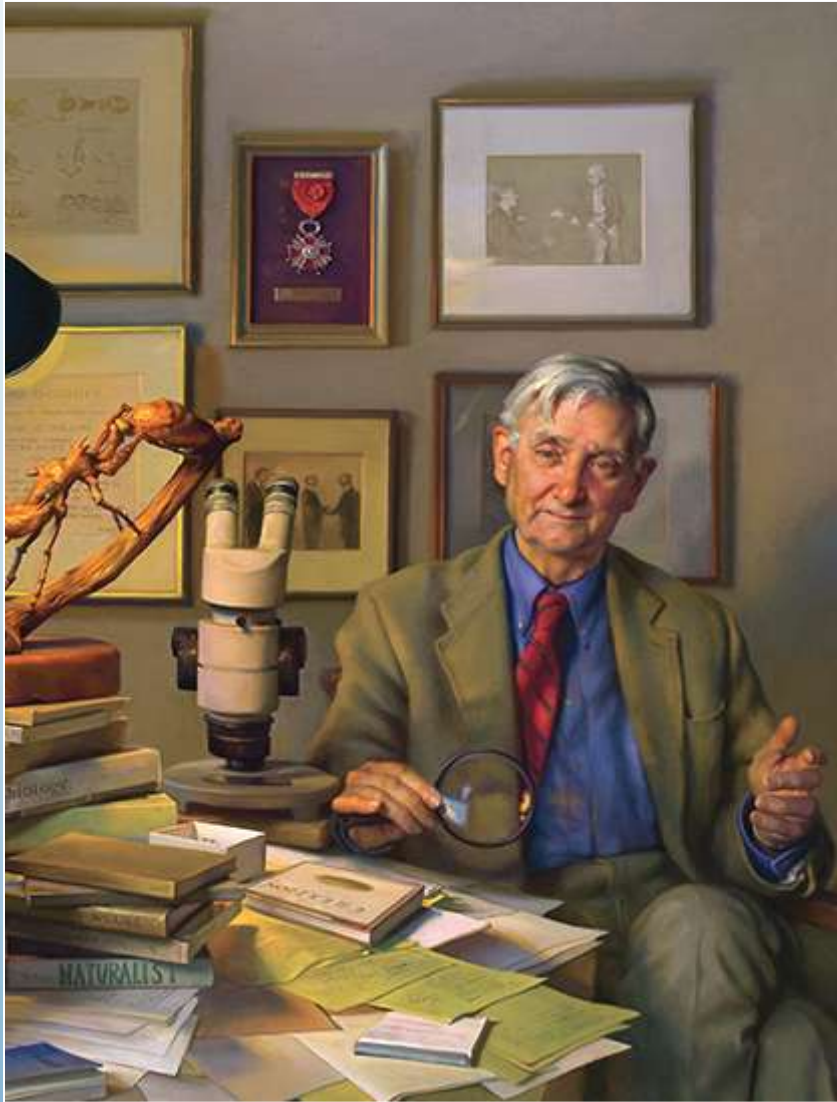
- 1. Biodiversity**
- 2. DNA Barcoding**
- 3. International Barcode of Life Project (iBOL)**

# **Biodiversity:**

**degree of variation of life forms  
within a given ecosystem**



# Mapping Biodiversity 1840 - 2011



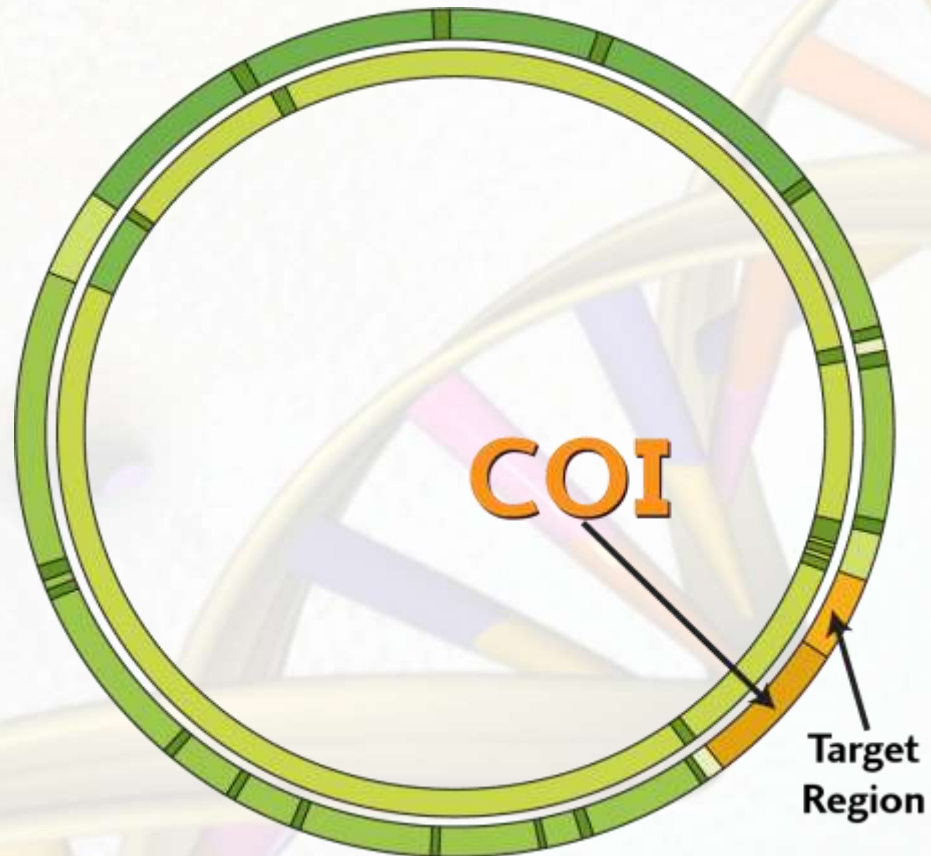
# **DNA Barcode:**

**short standardized DNA sequence enabling  
Species discrimination in a large block of life**



# Barcode Region for Animals

The Mitochondrial Genome



# And for Plants: Two Plastid Markers Adopted

MAY 2007 4010

# Kew Scientist

April 2005 Issue 27

NEWS FROM THE LIVING COLLECTIONS, THE HERBARIUM AND THE LABORATORIES AT KEW & WICKHAMPTON PLACE

**R** Kew has recently joined the Consortium for the Barcoding of Life (CBOL) and helped to organise the first open scientific conference on the subject, 'Barcoding of Life' (7 - 9 February 2005), held by the Natural History Museum, London, and sponsored by the AstraZeneca Foundation. Robin Cowan chaired the international scientific committee that arranged the programme of speakers for the conference.

The CBOL aims to promote the use of short, standardised DNA sequences as an identification tool (barcode) for all species. Differences in the sequences between species will be used to identify samples by comparison with a reference database or highlight unknowns for further taxonomic study. The DNA sequences in the reference database will be linked to taxonomic and geographic information about the species they represent. The many applications of this tool include aiding taxonomic studies and biodiversity surveys through the discovery of unknown species and the identification of individual samples. It will also allow the identification of different life stages of a species (eg. from leaves to adult insect, or seed to plant in flower), and open up access to taxonomic information, especially as technological advances increase the portability and reduce the cost of DNA barcodes.

Presentations at the conference illustrated the use of barcoding in different situations. These ranged from identification of parasite pests being introduced into New Zealand on imported plants (material to forensic and forensic surveys of regions such as Madagascar and Costa Rica), a Barcoding of Life Plant Working Group Meeting was held at Kew after the conference to discuss procedures, applications and the way forward for plant barcoding. This was also chaired by Robin and was attended by representatives from 22 institutions in 13 countries.

Kew is collaborating with other organisations, including the Smithsonian Institution, INBio (Costa Rica), the Natural History Museum (London) and the Royal Botanic Garden Edinburgh, with proposals to collect DNA barcodes for the flowering plants of Costa Rica and the flora of the UK. DNA barcodes are already being used at Kew in projects such as the identification of morphologically difficult (sympatric) life stages. Their possible use in wood identification is also being investigated.

Contact: Robin Cowan (r.cowan@kew.org)

## BARCODING PLANTS



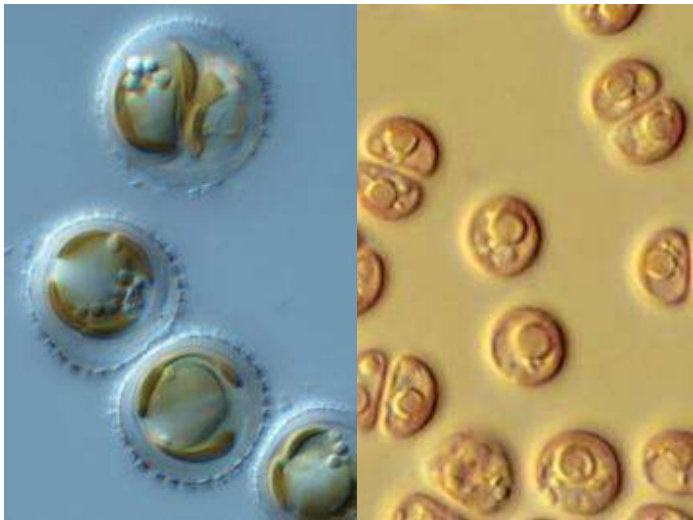



**Kew**  
PLANTS PEOPLE  
POSSIBILITIES

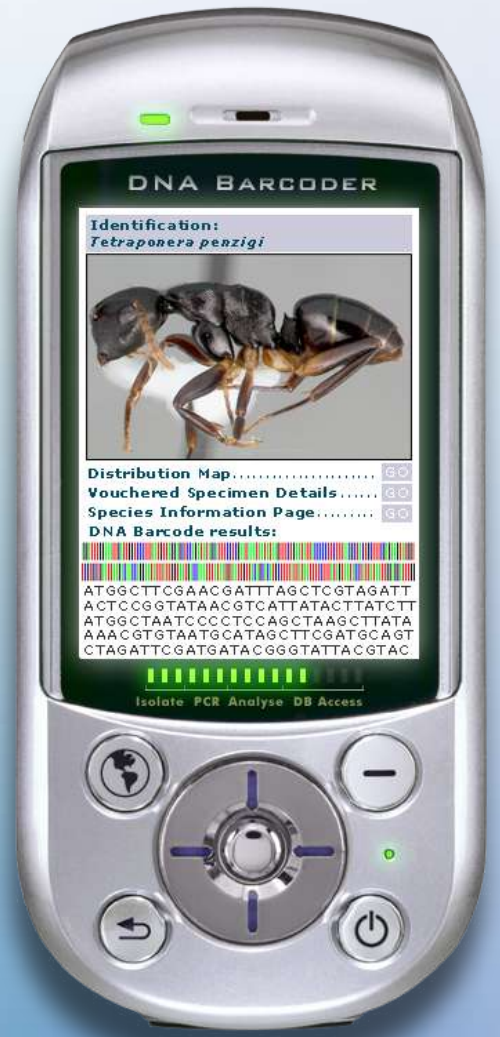


*Strobilanthes moutanensis*, a species native to the UK, and (lower) part of the barcode, with the four DNA bases represented by different colors from: ATCG (Adenine, Thymine, Guanine and Cytosine) resulting in 4096 possible combinations. The four bases are used to identify individual species.

# And for Some Fungi and Protists



# Mapping Biodiversity - 2015



# The Challenge: Gather Millions of DNA Barcodes



**Web-Accessible Data and DNA Barcodes**

This block contains several components: a detailed data entry form with fields for specimen identification, collection data, and a world map; a large phylogenetic tree with many branches; a smaller specimen photograph; and a chromatogram showing DNA sequence peaks.


# The Response: Get Organized



Imagine...


a world in which you can know the name of

any animal      any plant      any fungus      any organism

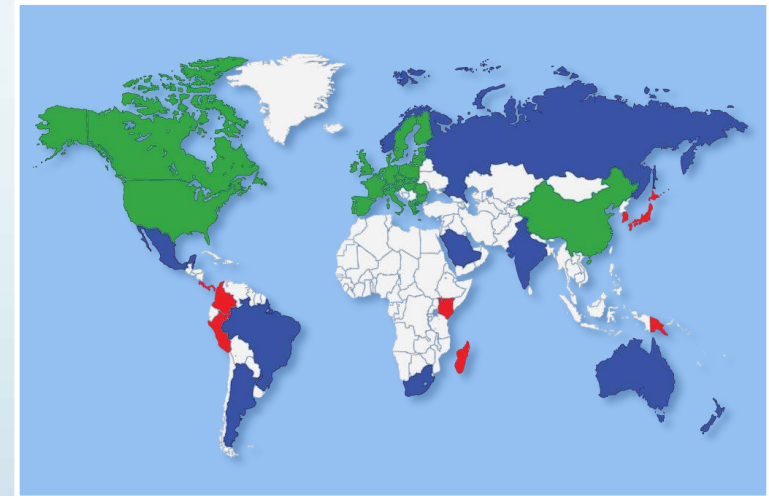


on the spot      in an instant      anywhere on our planet

This is the world that iBOL will build



International Barcode of Life Project  
Assembling the DNA barcode library of life

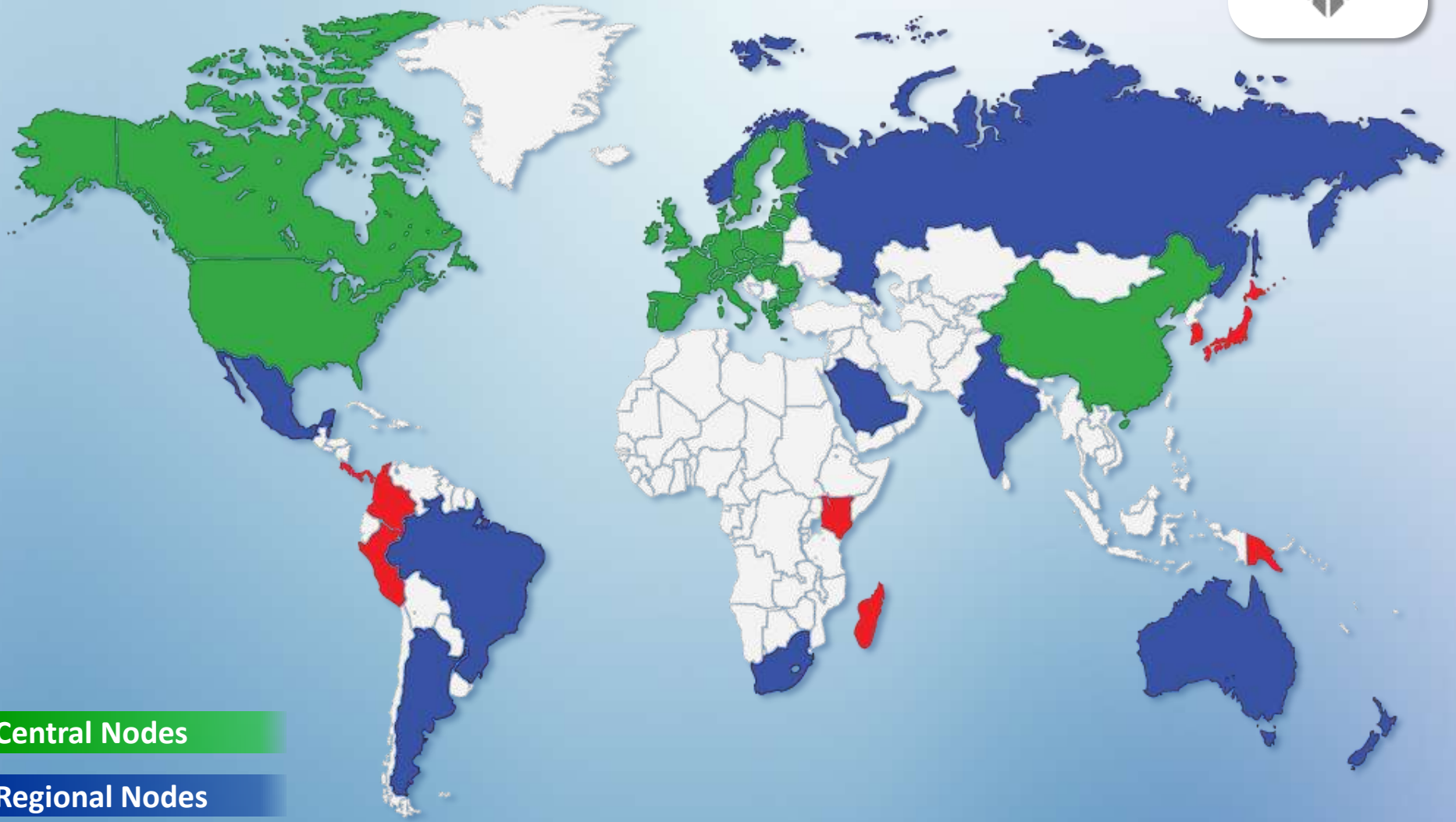
The complex block is a promotional graphic for iBOL. It features a blue background with a landscape of a river and mountains. At the top, it says "Imagine..." followed by "a world in which you can know the name of". Below this are four circular images, each with a label: "any animal" (a fly), "any plant" (a leaf), "any fungus" (a mushroom), and "any organism" (a seed). Below the images are three phrases: "on the spot", "in an instant", and "anywhere on our planet". At the bottom, it says "This is the world that iBOL will build" and includes the iBOL logo and the text "International Barcode of Life Project Assembling the DNA barcode library of life".

**5 Years**

**5M Specimens**

**500K Species**

# Mobilize Community



- Central Nodes
- Regional Nodes
- National Nodes

# Mobilize Community



# Mobilize Community



# Mobilize Community



Argentina, 2010



Europe, 2010

# Mobilize Community - NorBOL



# Engage Partners

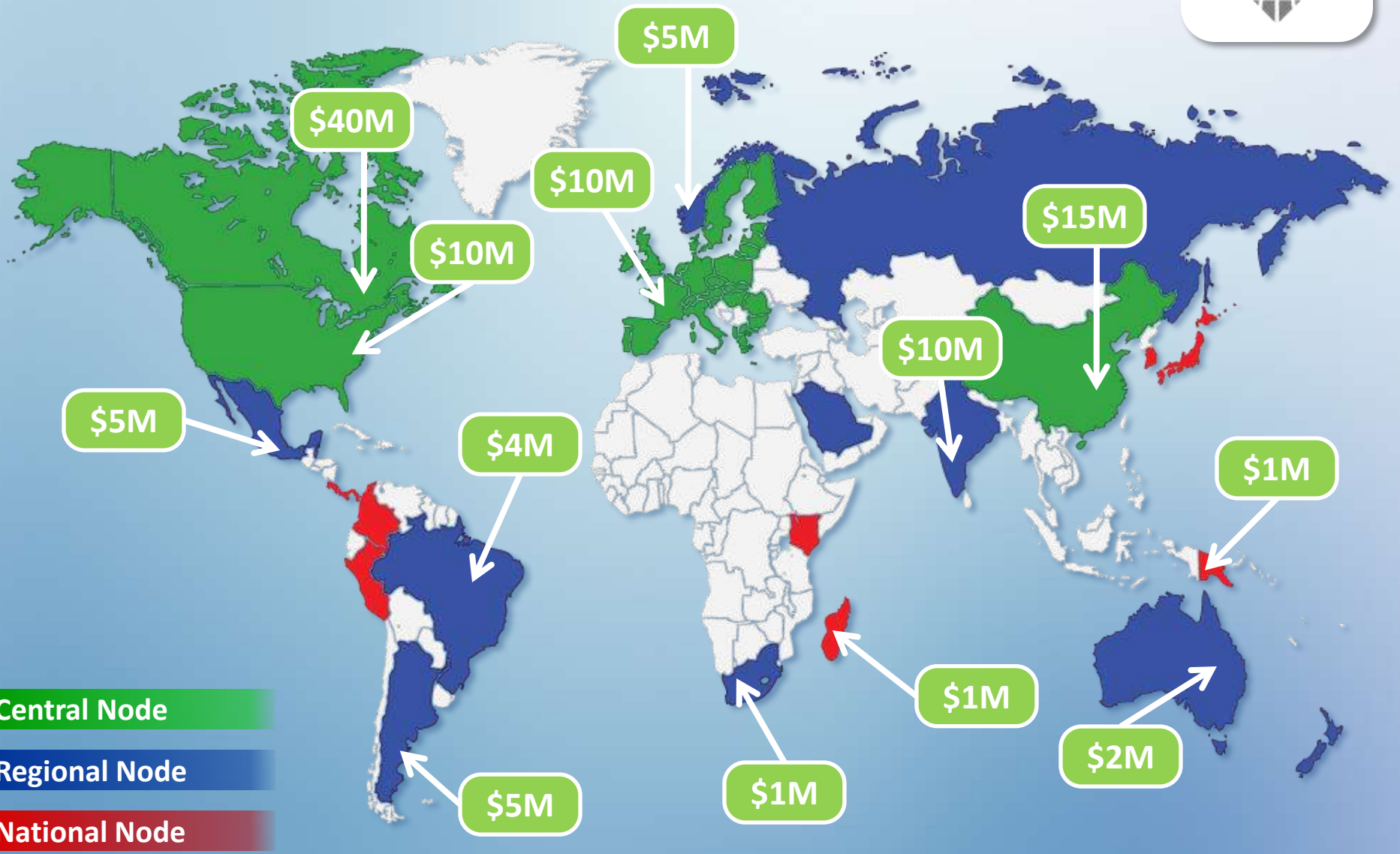


**Nagoya, Japan - Oct 20, 2010**

**Guelph/Toronto, Canada - Sept 24-26, 2010**



# Mobilize Infrastructure

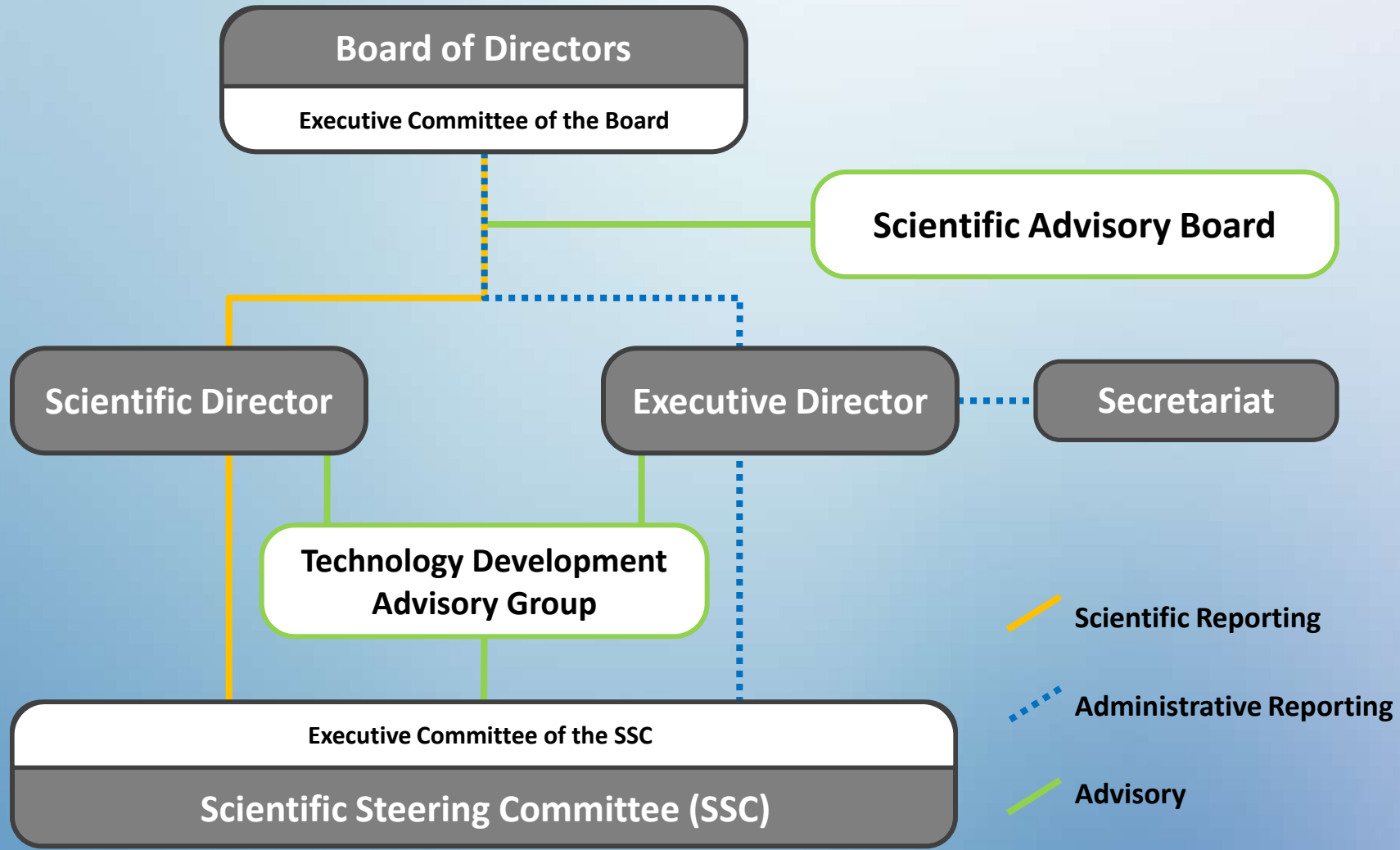


**Central Node**

**Regional Node**

**National Node**

# Build Governance Structure





## iBOL Node Profile

### COUNTRY

#### 1: CONTACT INFORMATION FOR THE IBOL NODE

IBOL Node Name	Web Address	IBOL Node Status (Central, Regional, National, Other)
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#### NODE REPRESENTATIVES

NAME	INSTITUTION	E-MAIL
Primary		
Alternate		

#### 2: VISION OF THE IBOL NODE

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#### 3: MISSION OF THE IBOL NODE

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#### 4: GOALS OF THE IBOL NODE

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#### 5: ACTIVITIES REQUIRED FOR THE IBOL NODE TO ACHIEVE ITS GOALS

Theme	Working Group	Node Activities / Priorities
-------	---------------	------------------------------

#### 6: ORGANIZATION OF THE IBOL NODE

*Participants and organizations providing resources and direction to the iBOL node.  
Roles may include membership of the node steering committee or equivalent.*

NAME	INSTITUTION	E-MAIL	EXPERTISE / POSITION

#### 7: FUNDING PLAN FOR THE IBOL NODE

Funding Source	Receiving Institution / Principal Investigator	Purpose	TOTAL Funding Amount	Timeframe (From - To)	Confirmed or anticipated?

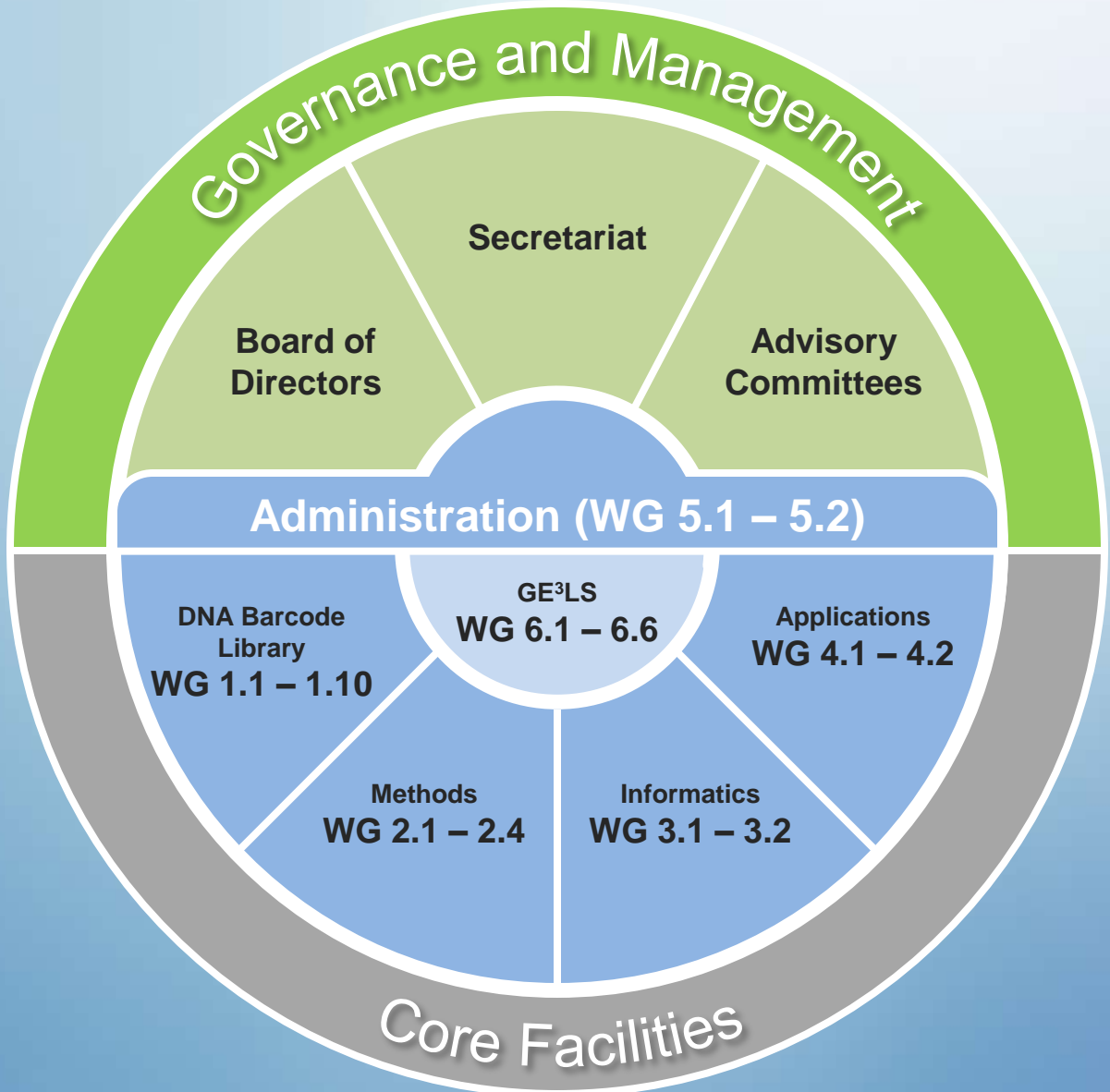
#### 8: CORE FACILITIES PLAN FOR THE IBOL NODE

Institution	Provide (i) Description of facilities available, and (ii) planned specimen capacity (2010-2015)				
	Specimen collection	Sequencing	Informatics / Database	Curation	Other

#### 9: LIST OF KNOWN BARCODING PROJECTS AND ASSOCIATED RESEARCHERS IN COUNTRY / REGION

No.	Institution / PI	Taxa	Purpose	Funding	Management

# iBOL Administration



# SCIENTIFIC STEERING COMMITTEE

	<i>Participating Nations</i>	<i>Working Groups</i>		
CENTRAL NODES	<b>CANADA</b> — (Saunders, Packer)	<b>1.1 Vertebrates</b> <i>Birmingham, Amato</i>	DNA BARCODE LIBRARY	
	<b>CHINA</b> — (Zhang, Huang)	<b>1.2 Land Plants</b> <i>Hollingsworth, Li</i>		
	<b>EUROPEAN UNION</b> — (To be determined)	<b>1.3 Fungi</b> <i>Crous, Seifert</i>		
	<b>UNITED STATES</b> — (Amato, Crandall)	<b>1.4 Animal Parasites, Pathogens and Vectors</b> <i>Masiga, Gregory</i>		
REGIONAL NODES	<b>ARGENTINA</b> — (Tubaro, Diaz de Astarloa)	<b>1.5 Agriculture/Forestry Pests and Parasitoids</b> <i>Foottit, Rasplus</i>		METHODS
	<b>AUSTRALIA</b> — (Mitchell, Lowe)	<b>1.6 Pollinators</b> <i>Packer, Silveira</i>		
	<b>BRAZIL</b> — (Eizirik, Santos)	<b>1.7 Freshwater Bio-surveillance</b> <i>Sweeney, Hogg</i>		
	<b>INDIA</b> — (Lakra, Khedkar)	<b>1.8 Marine Bio-surveillance</b> <i>Saunders, Bouchet</i>		
	<b>MEXICO</b> — (Elias-Gutierrez, Escalante)	<b>1.9 Terrestrial Bio-surveillance</b> <i>Janzen, Fisher</i>		
	<b>NEW ZEALAND</b> — (Hogg, Smith)	<b>1.10 Polar Life</b> <i>Ekrem, Smith</i>		
	<b>NORWAY</b> — (Lifjeld, Ekrem)	<b>2.1 Barcoding Biotas</b> <i>Meyer, Adamowicz</i>		
	<b>RUSSIA</b> — (Abramson, Kalyakin)	<b>2.2 Museum Life</b> <i>Bakker, Miller</i>		
	<b>SAUDI ARABIA</b> — (Al-Hafedh)	<b>2.3 Methodological Innovation</b> <i>Ivanova, Evans</i>		
	<b>SOUTH AFRICA</b> — (Skelton, Bartels)	<b>2.4 Paleobarcoding</b> <i>Poinar, Brochmann</i>		
NATIONAL NODES	<b>COLOMBIA</b> — (Linares, Madrinan)	<b>3.1 Informatics: Core Functionality</b> <i>Hebert, Ratnasingham</i>	INFORMATICS	
	<b>COSTA RICA</b> — (Janzen, Ugalde)	<b>3.2 Informatics: Mirrors</b> <i>Ma, Robert</i>	APPLICATIONS	
	<b>FRANCE</b> — (Rasplus, Le Gall)	<b>4.1 Environmental Barcoding</b> <i>Hajibabaei, Pfenninger</i>		
	<b>FINLAND</b> — (Mutanen)	<b>4.2 Mobile Barcoding</b> <i>Ronaghi, Krull</i>	ADMIN	
	<b>GERMANY</b> — (Waegele, Hausmann)	<b>5.1 Project Management</b> <i>Singer, Hanner</i>		
	<b>KENYA</b> — (Masiga, Oyiyeke)	<b>5.2 Communications</b> <i>Schindel, Stoeckle</i>	GE <sup>3</sup> LS	
	<b>KOREA</b> — (Won Kim, Chang-Bae Kim)	<b>6.1 Equitable use of Genetic Resources</b> <i>Bubela</i>		
	<b>MADAGASCAR</b> — (Fisher, Balsama)	<b>6.2 Regulation of International Trade</b> <i>Phillips</i>		
	<b>NETHERLANDS</b> — (Crous, Bakker)	<b>6.3 IP and Knowledge Management</b> <i>Gold</i>		
	<b>PANAMA</b> — (Birmingham, Sanjur)	<b>6.4 Education Initiatives for Schools/Media</b> <i>Secko</i>		
	<b>PAPUA NEW GUINEA</b> — (Miller, Novotny)	<b>6.5 Governance of Knowledge Mobilization</b> <i>Castle</i>		
	<b>PERU</b> — (Valqui, Orjeda)	<b>6.6 Barcoding and Biological Classification (proposed)</b> <i>Castle</i>		
	<b>PORTUGAL</b> — (Costa, Bastos-Silveira)			
	<b>SPAIN</b> — (Arnedo, Carranza)			
<b>UNITED KINGDOM</b> — (Hollingsworth, Vogler)				

# Activate

## Coordination

## Infrastructure

Board of Directors

Advisory Committees

Secretariat

GE<sup>3</sup>LS

Biorepositories

Collections

Sequencing

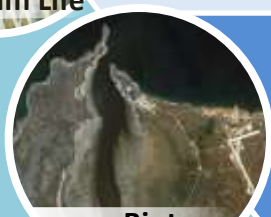
Informatics



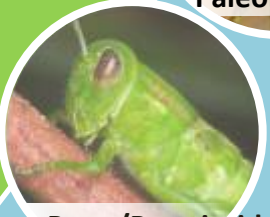
Museum Life



Paleobarcoding



Biotas



Pests/Parasitoids



Pathogens



Pollinators



Marine Life



Terrestrial



Polar Life



Freshwater



Vertebrates



Invertebrates

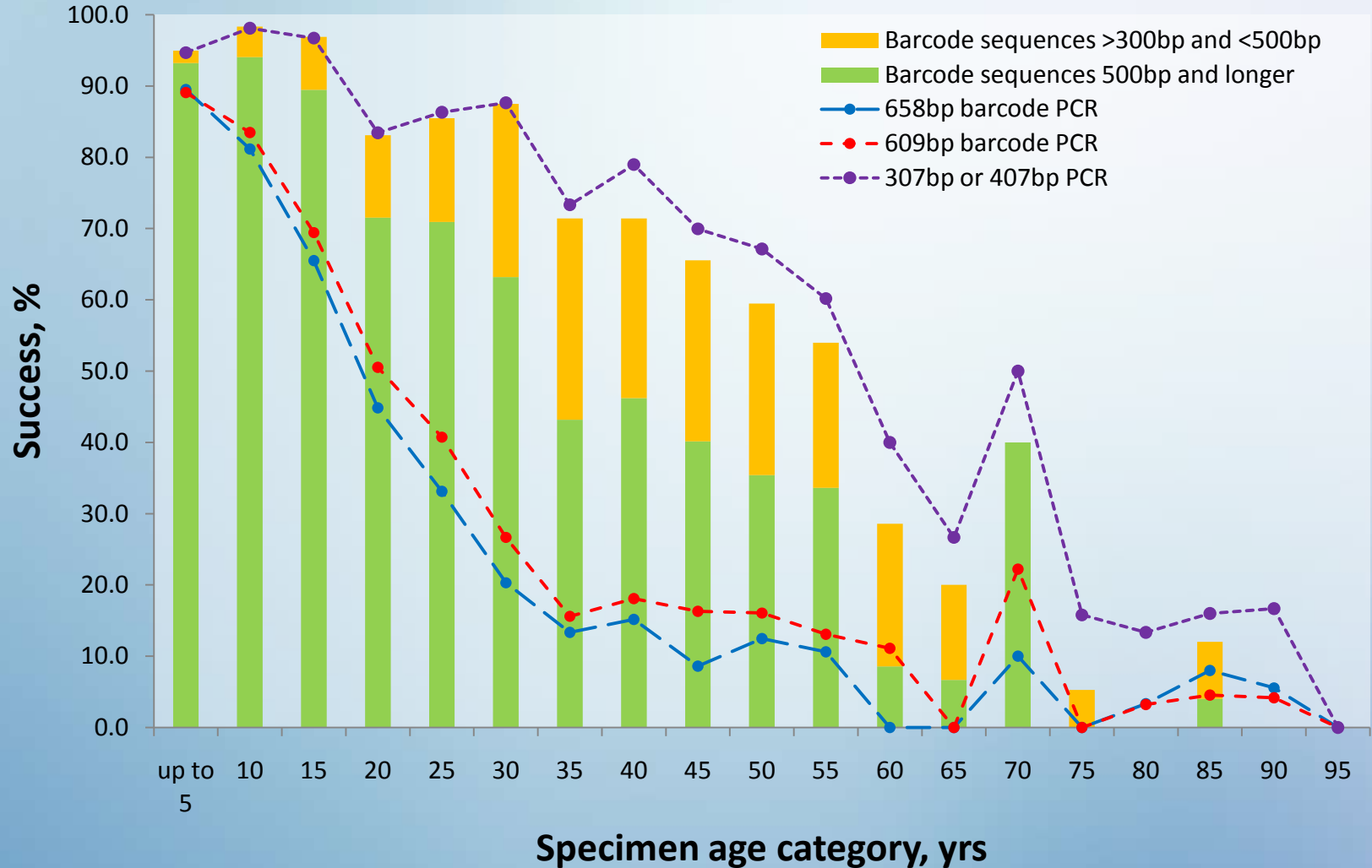


Plant Life



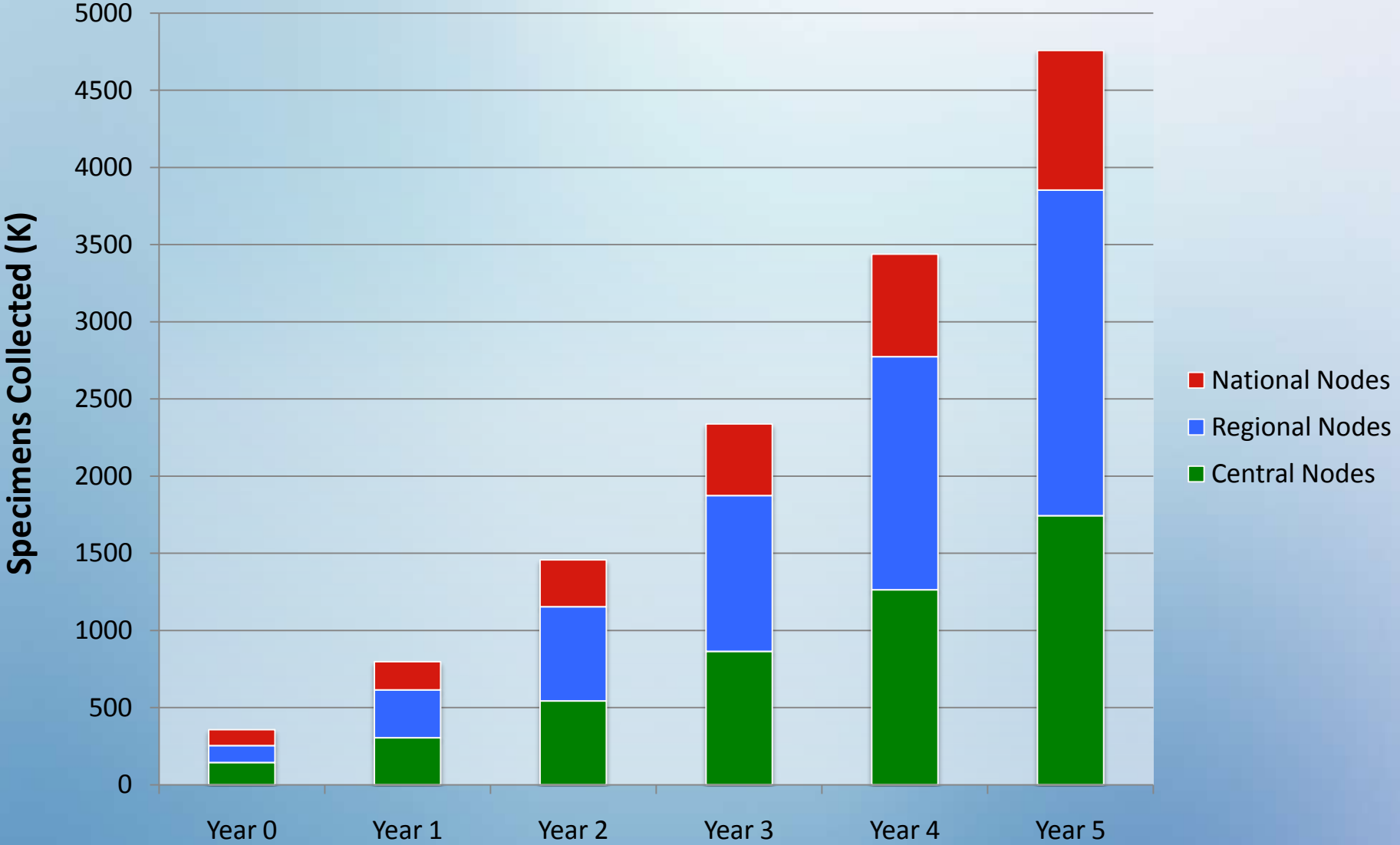
Fungi

## iBOL Working Groups



Percentage success in PCR amplification for three amplicon lengths (dashed lines; blue = 700bp, red = 612bp, purple = 307 - 408bp) for specimens of Lepidoptera of varied age in ANIC. The bars indicate percentage success in sequence recovery for two amplicon lengths with the green bar indicating those sequences that qualify as barcodes (length >500bp).

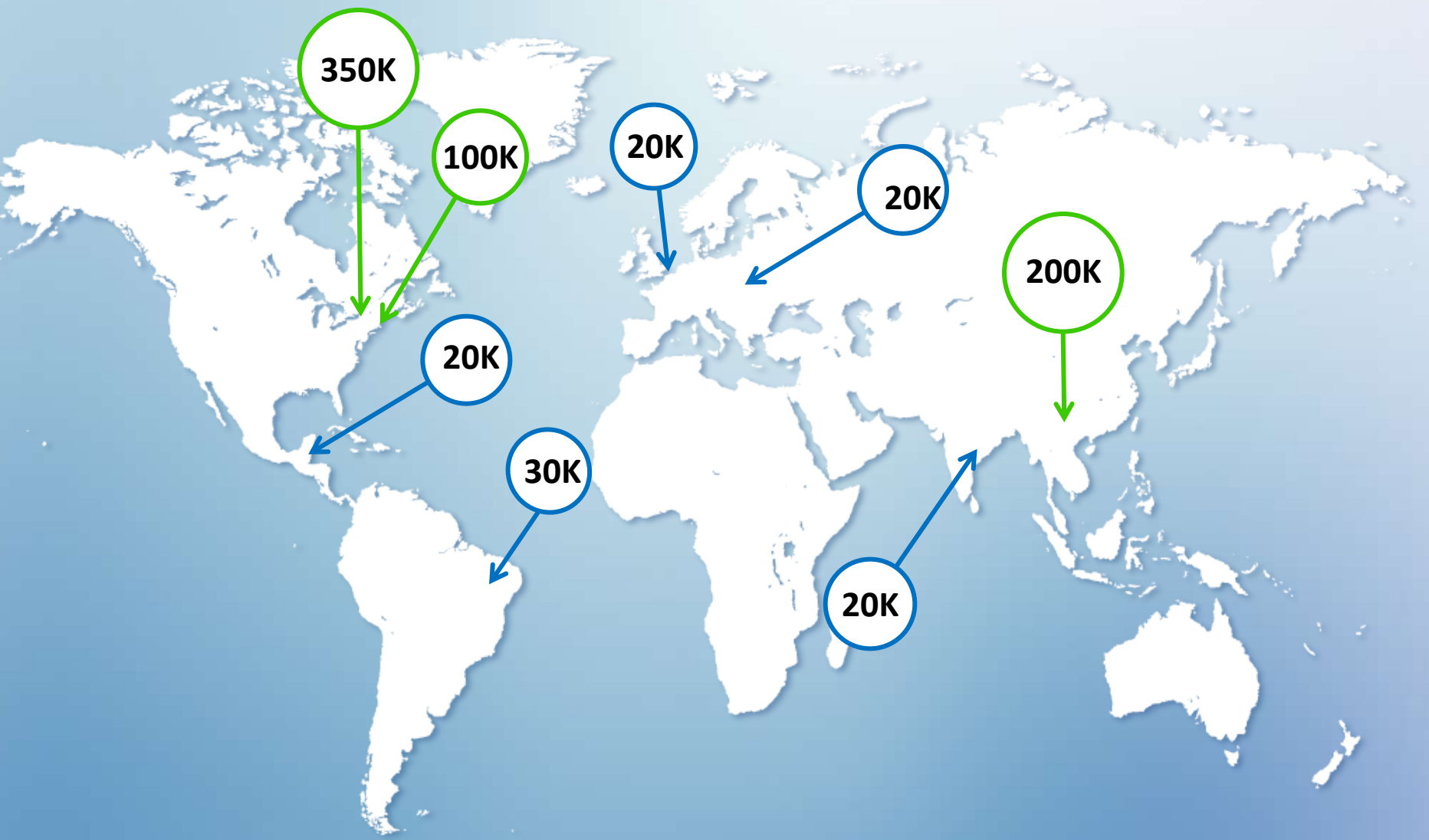
# Assemble Millions of Specimens



# Assemble Millions of Specimens



# Sequence Millions of Specimens



# Manage Millions of Barcodes



Published Projects | Taxonomy Browser | Request an Account | Identify Specimen | Introductory Tutorial | Documentation | Data Release | Citation

The Barcode of Life Data Systems (BOLD) is an online workbench that aids collection, management, analysis, and use of DNA barcodes. It consists of 3 components (MAS, IDS, and ECS) that each address the needs of various groups in the barcoding community.

## MANAGEMENT & ANALYSIS

**BOLD-MAS** provides a repository for barcode records coupled with analytical tools. It serves as an online workbench for the DNA barcode community.

Username

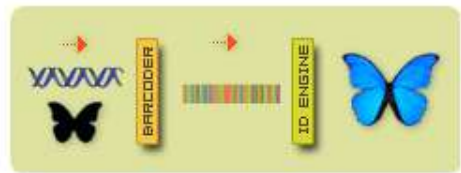
Password

[Request a new user account](#)

[Forgot your username or password?](#)

## IDENTIFICATION ENGINE

**BOLD-IDS** provides a species identification tool that accepts DNA sequences from the barcode region and returns a taxonomic assignment to the species level when possible.



## EXTERNAL CONNECTIVITY

**BOLD-ECS** provides web developers and bioinformaticians the ability to build tools and workflows that can be integrated with the BOLD framework. BOLD-ECS supplies REST services that allows access to public sequence and specimen data. We welcome the addition of new analytical modules.



BARCODE COUNTS	
Formally Described Species With Barcodes	96,162
Total Barcode Records	1,128,307
Source	Breakdown
GenBank	108,943
Canadian Centre	934,003
Others	85,361

## BOLDSYSTEMS BOLD 2.5 Release

Version 2.5, unveiled on Nov 11th 2009 at the Third International Barcoding of Life conference in Mexico City, provides new core functionality including support for multiple sequence markers per specimen and more complex workflows. Features include identification services for ITS, matK, and rbcL markers; comparative analytics, web services and a variety of convenience upgrades. A few are highlighted here :

- Accumulation curves** Explore diversity of species and sequences by site or higher level taxonomy.
- Multi-marker analysis** All analytical tools have been upgraded to support processing and visualization of all registered markers.
- Alignment browser** Quickly identify alignment errors and evaluate substitutions through the alignment browser which support visualization of amino translations of coding sequences.
- Web Services** A two phase data retrieval service based on Representational State Transfer (REST) is available at services.boldsystems.org to access and retrieve published data on BOLD in text, XML and JSON formats.

## BARCODING CAMPAIGNS



# Manage Millions of Barcodes

**Barcode Cluster (BIN) Statistics**

**BIN DETAILS:**

BIN Name:	BIN CODE:	BIN GUID:	BOLD AAC CODE:
Member Count:	12	Maximum Distance:	0.02
Average Distance:	0.03	Distance Variance:	0.02
Cluster:	MN - 2.2 edge - COX1	Distance to Nearest Neighbor:	0

**NEAREST NEIGHBOR (BIN) DETAILS:**

Nearest BIN Name:	BIN CODE:	Nearest BIN GUID:	BOLD AAC CODE:
Member Count:	13	Maximum Distance:	0.06
Average Distance:	0.03	Distance Variance:	0.04
Nearest Member:	BJUDSMG2-10		
Nearest Member Taxonomy:	Chordeiles Aves, Charadriiformes, Alcedae, Coraciiformes, Coraciiformes, Coraciiformes		

**TAXONOMY:**

- Phylum: Chordata (12)
- Class: Aves (12)
- Order: Charadriiformes (12)
- Family: Alcedae (12)
- Subfamily: Alcedae (12)
- Genus: Alcedo (12)
- Species: Alcedo semitorquata (12)

**COLLECTION LOCATION:**

- Country: Canada - (7)
- Newly - (2)

**Specimen Images:**



**Representative Image (Hand-chosen)**

**Related Publications**

**PUBLICATION:**

Clifton J. Perkins, G. Sergio L. Baker, A.J. Allen. J. DNA evidence for a Palearctic origin of the Atlantic (Aves: Charadriiformes) in the Pacific and multiple dispersals across northern oceans. *Mol. Phylogenet. Evol.* 2008 69 01:80-93-45 [10.1016/j.ympev.2008.01.018]

Clifton J. Johnsen, A. Roca, E. Ericson, P.G.P. Zoster, D. Hart, K.C.R. Stead, M.Y. and Liang. J.T. DNA barcoding of Scandinavian birds reveals divergent lineages in trans-Atlantic species *Journal of Ornithology* 2010 01-10 [10.1007/s00435-010-0107-7]

**DATA MANAGERS:**

Public Data: [Public Data](#)

Private Data: [Private Data](#)

**Phylogenetic Relationship of BIN Members**



**Distribution Map for BIN Members**

**Expert Notes About Taxonomy, Behaviour, Ecology, etc.**

**EXPERT IDENTIFICATION:**

Date	Expert Name	Assigned	Confidence	Reason

**BEHAVIOUR NOTES:**

Date	Name

**ECOLOGY NOTES:**

Date	Name

**LIFE HISTORY NOTES:**

Date	Name

**Attribution:**

**Specimen Depositories:**

- Agder Museum of Natural History - (1)
- Biodiversity Institute of Ontario - (2)
- Canadian Wildlife Service - (2)
- Mixed from Cambick, NCB - (1)
- Royal Ontario Museum - (2)
- Swedish Museum of Natural History - (2)
- Trinity University Museum - (1)

**Researching Contacts:**

- Biodiversity Institute of Ontario - (2)
- Natural History Museum, University of Oslo - (2)

**Photography:**

- Roar Solvann - (1)
- Sven Mathisen - (1)

**Specimen Identification:**

- GenBank - (7)

**Attribution for Repositories, Sequencing Centres, Photographers, Collectors, Funders**

# BOLD Taxonomy Browser

**Parnassius** (genus) - Arthropoda; Insecta; Lepidoptera; Papilionidae; Parnassiinae;

## Sub-taxa

### Species (81)

- [Parnassius acco](#) [2]
- [Parnassius accestis](#) [3]
- [Parnassius actius](#) [4]
- [Parnassius andreji](#) [2]
- [Parnassius apollo](#) [42]
- [Parnassius apollo adonais](#) [1]
- [Parnassius apollo alpehazkyi](#) [1]
- [Parnassius apollo batholomaeus](#) [1]
- [Parnassius apollo claudius](#) [1]
- [Parnassius apollo democratus](#) [2]
- [Parnassius apollo finnmarkius](#) [1]
- [Parnassius apollo melliculus](#) [2]
- [Parnassius apollonius](#) [8]
- [Parnassius apollo tiemo](#) [1]
- [Parnassius arcticus](#) [2]
- [Parnassius ariadne](#) [12]
- [Parnassius ariadne clarus](#) [1]
- [Parnassius autocrator](#) [2]
- [Parnassius behrii](#) [22]
- [Parnassius boedromius](#) [2]
- [Parnassius bremeri](#) [4]
- [Parnassius cardinal](#) [5]
- [Parnassius cephalus](#) [2]
- [Parnassius charltonius](#) [3]
- [Parnassius clarius](#) [1]
- [Parnassius clodius](#) [24]
- [Parnassius davydovi](#) [2]
- [Parnassius delphius](#) [27]
- [Parnassius delphius albulus](#) [1]
- [Parnassius epaphus](#) [4]
- [Parnassius eversmanni](#) [17]
- [Parnassius glacialis](#) [4]
- [Parnassius hanningtoni](#) [2]
- [Parnassius hardwickii](#) [2]
- [Parnassius hide](#) [2]
- [Parnassius honrathi](#) [4]
- [Parnassius huberi](#) [1]
- [Parnassius hunza](#) [2]
- [Parnassius imperator](#) [3]
- [Parnassius infernalis](#) [6]
- [Parnassius infernalis mustagata](#) [3]
- [Parnassius inopinatus](#) [2]

## Taxon Description (Wikipedia)

*Parnassius* is a genus of northern circumpolar and montane (alpine and Himalayan) butterflies usually known as *Apollo*s. They can vary in colour and form significantly based on their altitude. They also show an adaptation to high altitudes called altitudinal melanism. They show dark bodies and darkened colouration at the wingbase which helps them warm faster using the sun. Although classified under the Swallowtail butterfly family, none of the *Parnassius* species possess tails. The larvae feed on species of plants belonging to the Papaveraceae and Crassulaceae families, and like the other swallowtail butterfly larvae, possess an osmeterium. Unlike most butterflies that have exposed pupae, they pupate inside a loose silken cocoon. [full article at Wikipedia](#)

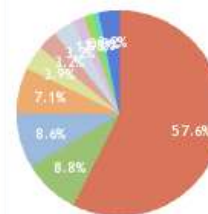
## BOLD Stats

Specimen Records:	569
Specimens with Sequences:	541
Specimens with Barcodes:	533
Public Records:	315
Species:	81
Species With Barcodes:	79

[Species List - Progress](#)

[Download Public Sequences](#)

## Sample Sources



- Mined from GenBank, NCBI [268]
- Research Collection of Roger Vila [41]
- Research Collection of Crispin S. Guppy [40]
- McGuire Centre for Lepidoptera and Biodiversity [33]
- Canadian National Collection of Insects, Arachnids and Nematodes [22]
- Research Collection of Norbert G. Kondla [15]
- Biodiversity Institute of Ontario [15]
- Research Collection of Kenelm Philip [9]
- Research Collection of Ralph Sturm [7]
- Zoological State Collection, Munich [4]
- 6 Others [15]

## Imagery

images representing subtaxa of *Parnassius*



*Parnassius tianschanicus*

Sample ID: 2005-LOWA-492  
 License: Copyright (2010)  
 License Holder: BIO Photography Group, Biodiversity Institute of

# Share Data



# Share Data



# Share Data



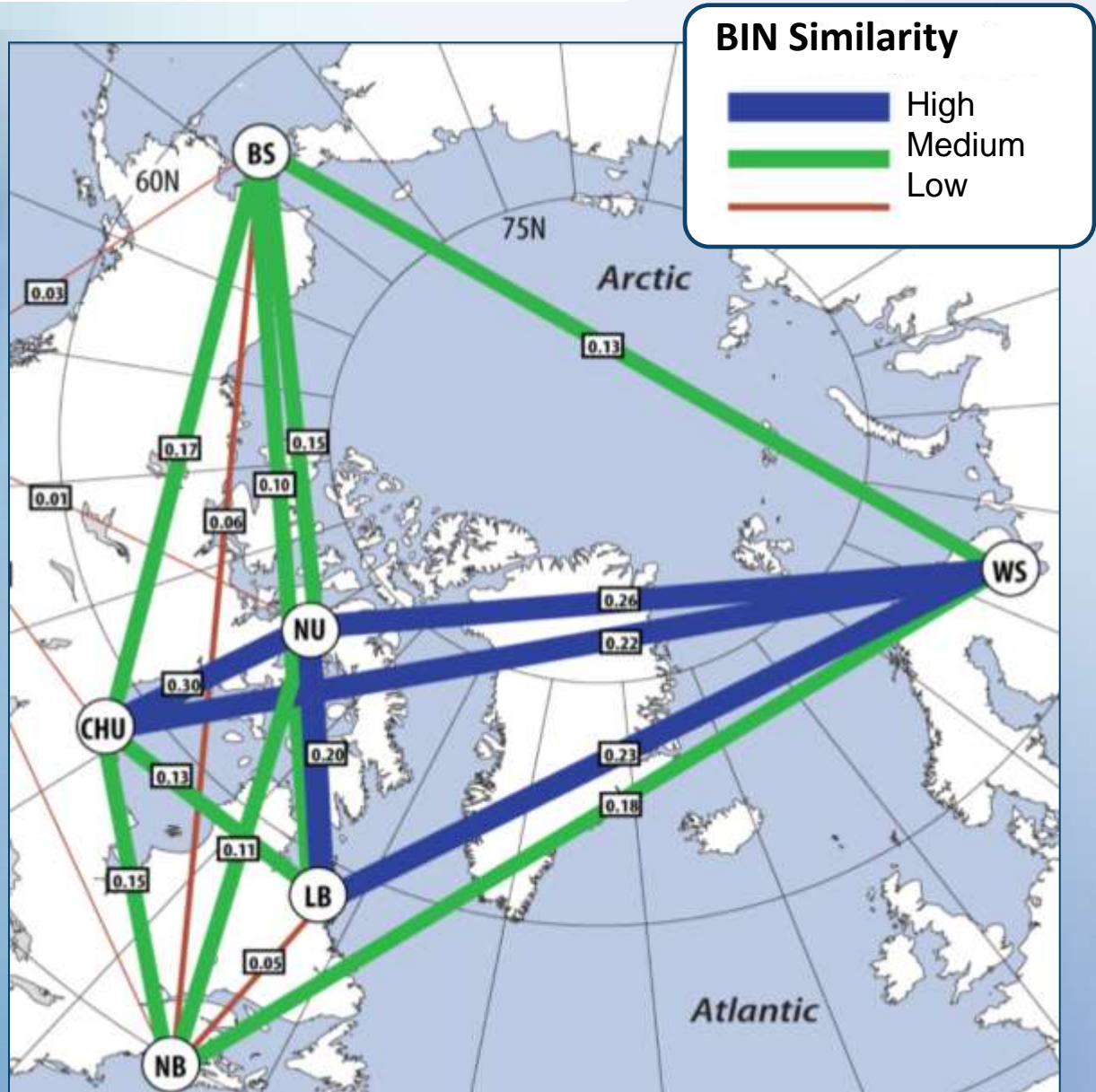
## TAXA THAT HAVE BARCODES

Animals	Individuals	Classes	Orders	Families	Genera	Species
Arthropoda	802,596	16	110	1,136	17,497	113,561
Chordata	171,656	16	132	402	5,595	19,215
Mollusca	36,881	7	66	54	1,692	7,144
Annelida	11,548	4	19	16	478	2,497
Echinodermata	9,285	5	32	8	357	1,015
Platyhelminthes	1,702	4	17	16	119	248
Cnidaria	1,674	6	23	2	199	259
Nematoda	1,517	4	14	9	81	312
Rotifera	1,308	3	6		36	257
Porifera	486	3	12	3	59	103
Nemertina	486	2	5		35	143
Bryozoa	216	3	5		46	101
Onychophora	160	1			6	45
Acanthocephala	124	2	4		9	21
Tardigrada	113	1	1		6	10
Chaetognatha	108	1	2		9	42
Brachiopoda	88	4	6	14	26	47
Sipuncula	36	2	3		13	17
Hemichordata	9	1			2	5
Acoelomorpha	9	1			1	5
Gnathostomulida	8		2		7	8
Cephalorhyncha	8	1	1		1	6
Echiura	7	1	2	1	3	4
Entoprocta	3		1		3	3
Xenoturbellida	2				1	1
<b>Totals</b>	<b>1,040,030</b>	<b>88</b>	<b>463</b>	<b>1,661</b>	<b>26,281</b>	<b>145,069</b>

Node	Specimen Count	Other Countries and Regions	Specimen Count
<b>Central</b>	<b>141,807</b>	<b>Other</b>	<b>55,296</b>
Canada	58,864	Indonesia	4,559
United States	48,479	Antarctica	4,121
China	5,956	Gabon	4,064
European Union	28,508	French Guiana	3,167
<i>Austria</i>	<i>1,251</i>	Ecuador	3,139
<i>Bulgaria</i>	<i>1,080</i>	Thailand	2,036
<i>Finland</i>	<i>6,983</i>	Turkey	1,694
<i>France</i>	<i>2,171</i>	Pakistan	1,602
<i>Germany</i>	<i>9,138</i>	Tanzania	1,463
<i>Italy</i>	<i>2,532</i>	Vietnam	1,298
<i>Netherlands</i>	<i>106</i>	Bolivia	1,119
<i>Poland</i>	<i>283</i>	Taiwan	1,092
<i>Portugal</i>	<i>247</i>	Chile	1,026
<i>Spain</i>	<i>3,303</i>	Iran	1,022
<i>Sweden</i>	<i>989</i>	Comoros	946
<i>United Kingdom</i>	<i>425</i>	Belize	923
<b>Regional</b>	<b>56,732</b>	Czech Republic	834
Australia	26,783	Paraguay	810
Mexico	12,181	D.R. of the Congo	685
South Africa	5,187	Cameroon	668
Brazil	6,023	Seychelles	665
New Zealand	2,270	Guatemala	593
Norway	1,272	Japan	579
Argentina	1,230	Malaysia	577
Russia	1,360	Philippines	574
India	421	Mozambique	522
Saudi Arabia	5	Others	15,518
<b>National</b>	<b>71,891</b>		
Costa Rica	51,151	<b>GRAND TOTAL</b>	<b>325,726</b>
Papua New Guinea	6,364		
Madagascar	6,083		
Peru	3,348		
Panama	3,029		
Kenya	1,067		
South Korea	614		
Colombia	235		

# Build Knowledge

## Measuring Similarity In Polychaete Communities



# Impact Society



Mouse head in microwave dinner

*Journal of Food Protection, Vol. 72, No. 4, 2009, Pages 810-817*

## Public Health Response to Puffer Fish (Tetrodotoxin) Poisoning from Mislabeled Product

NICOLE J. COHEN,<sup>1\*</sup> JONATHAN R. DEEDS,<sup>2\*</sup> EUGENE S. WONG,<sup>3</sup> ROBERT H. HANNER,<sup>3</sup> HAILE F. YANCY,<sup>4</sup> KEVIN D. WHITE,<sup>2</sup> TREVONNE M. THOMPSON,<sup>5†</sup> MICHAEL WAHL,<sup>5</sup> TU D. PHAM,<sup>1</sup> FRANCES M. GUICHARD,<sup>1</sup> IN HUH,<sup>6</sup> CONNIE AUSTIN,<sup>7</sup> GEORGE DIZIKES,<sup>8</sup> AND SUSAN I. GERBER<sup>1</sup>



Molecular Ecology Resources (2010)

doi:10.1111/j.1755-0998.2010.02884.x

## DNA BARCODING Birdstrikes and barcoding: can DNA methods help make the airways safer?

JOHN WAUGH,\* MAX W. EVANS,† CRAIG D. MILLAR‡ and DAVID M. LAMBERT§



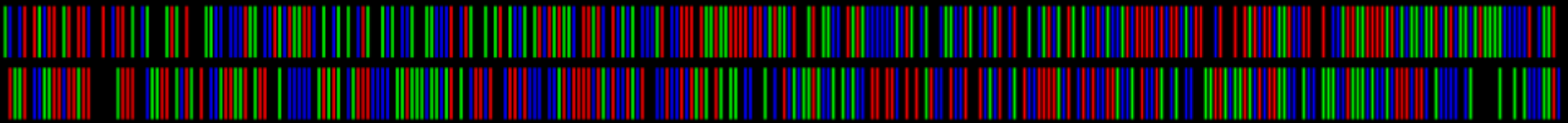
## Using COI barcodes to identify forensically and medically important blowflies

L. A. NELSON<sup>1</sup>, J. F. WALLMAN<sup>2</sup> and M. DOWTON<sup>1</sup>

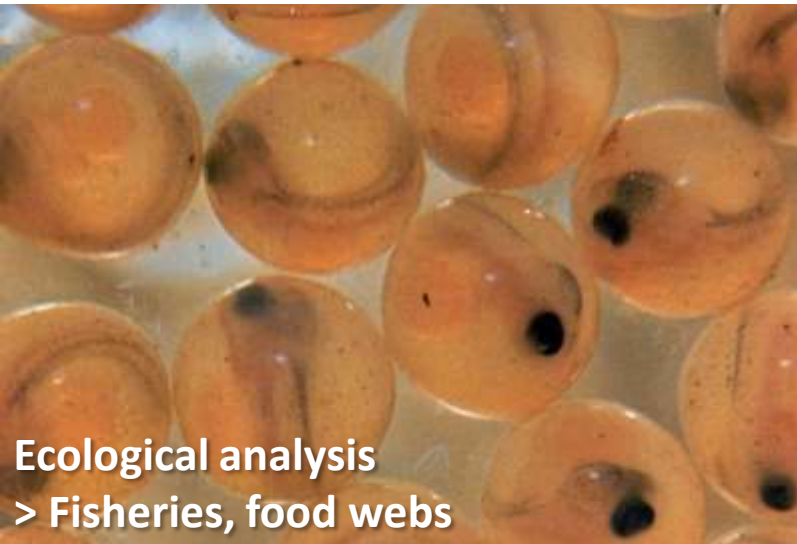
<sup>1</sup>Institute for Biomolecular Science, School of Biological Sciences, University of Wollongong, New South Wales, Australia and

<sup>2</sup>Institute for Conservation Biology, School of Biological Sciences, University of Wollongong, New South Wales, Australia

# DNA Barcoding: a New Weapon In the Battle Against Pests and Invasive Species



# Impact Society



Ecological analysis  
> Fisheries, food webs

Next Generation  
Sequencing

Real World  
Applications



Environmental Assessment  
> Oil Sands



Natural Health  
Supplements

Eye on Education

## DNA Barcoding Investigations Bring Biology to Life

SUSAN MUSANTE

### Fish Tale Has DNA Hook: Students Find Bad Labels



*There's Something Fishy About This Sushi!*

Do restaurant menus always tell the truth? High school students Kate Stoeckle and Louisa Strauss asked themselves this question while eating sushi in New York City. They decided to identify the fish in their sushi. Kate and Louisa gathered 60 fish samples from local restaurants and grocery stores. They sent the samples to a lab that used DNA barcoding to test the samples.

The tests showed that 25 percent of the samples were mislabeled! Often, inexpensive fish was labeled as more expensive fish. For example, a sample labeled "red snapper" was actually Atlantic cod. Another sample was from an endangered fish.

In the future, DNA barcoding could be done by using a handheld device. Such a device might look similar to a supermarket barcode scanner. Then, anyone could identify a fish's DNA.

**Research It:** Find out more about DNA barcoding. Identify a question you could answer by using this technology. Describe how you could use DNA barcoding to answer your question.

129

*Kids Doing Science*

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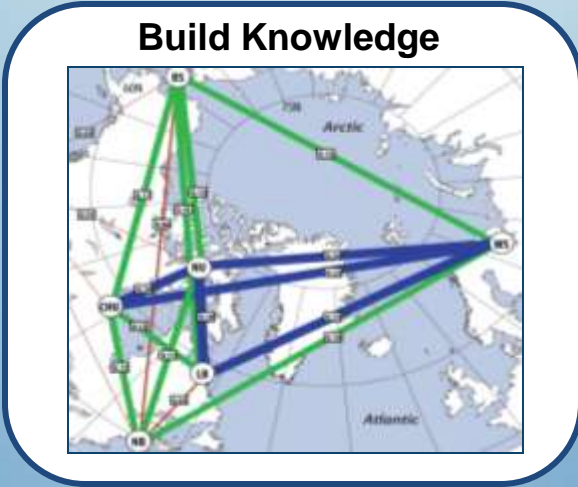
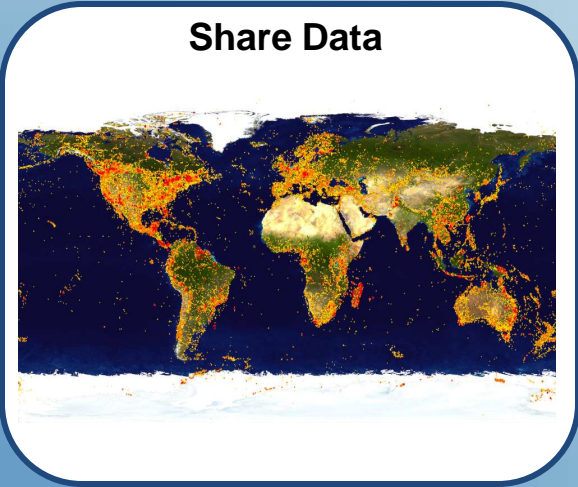


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# Impact Society



# Harnessing Biodiversity - 2015





# iBOL and NorBOL

Managing Biodiversity for the  
Benefit of Society



# Manage Millions of Barcodes





# iBOL Working Groups

The purpose of iBOL's working groups (WGs) is to advance iBOL's scientific agenda, which is organized under six themes:

- » Theme 1 DNA Barcode Library (WG 1.1 – 1.10)
- » Theme 2 Methods (WG 2.1 – 2.4)
- » Theme 3 Informatics (WG 3.1- 3.2)
- » Theme 4 Applications (WG 4.1 – 4.2)
- » Theme 5 Administration (WG 5.1-5.2)
- » Theme 6 GE3LS (WG 6.1-6.6)

# iBOL Nodes

iBOL nodes are the networks of leading researchers and key organizations which oversee capacity building, direction, deliverables and financial accountability for their nation's or region's participation in iBOL. iBOL Nodes whose activities are confined to a single country are designated as **National Nodes**, while **Regional Nodes** are those with the additional capacity to expand partnerships, establish a funding base and develop infrastructure for DNA barcoding and related research on a regional basis that extends beyond their national boundaries. **Central Nodes** are National or Regional Nodes that can and will barcode samples from diverse sources and geographies, and act as leaders in knowledge and technology transfer across (other) Central, Regional and National nodes.