VIII-1 Performance statistics for Working Groups in Theme 1 (DNA Barcode Library)

Introduction

Detailed analyses of barcode records for each of the Theme1 working groups are presented in Table 8.1 below. While the data presented in Section IV (Tables 1.1a and 1.1b) and in Table 8.1 are based on assignment of species[14] to a primary WG, we note that using four structural axes for WGs (taxonomic, environmental, thematic, geographic) inevitably means that some BINs could justifiably be placed in more than one WG. Figure 8.1 (below) provides a better sense of the linkages between WGs. For example, WG1.1 is the primary assignment for all vertebrate BINs, but 4952 of these BINs represent marine fishes that also contribute to the overall barcode library for marine life (WG1.8). As well, 240 vertebrate species were collected from either Arctic or Antarctic settings so that they also aid coverage for Polar Bio-surveillance (WG1.10).

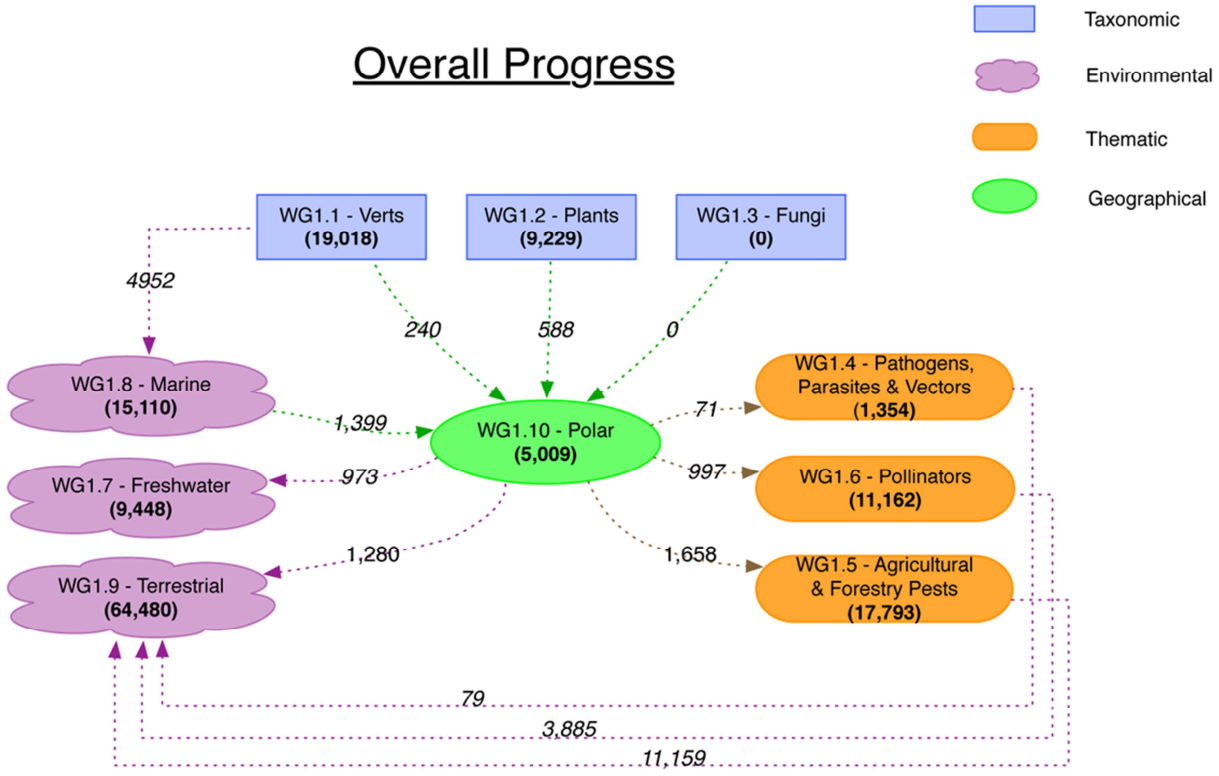

Figure 8.1: The number of BINswith a primary assignment to each WG is shown in brackets within the coloured shapes. Each dashed line indicates the number of BINs that might properly also be assigned to a second WG. For example, 1,399 of the 15,110 BINs with a primary assignment to WG 1.8 were collected from marine waters in the Arctic or Antarctic, so they aid completeness of the barcode library for Polar Life. They have, however, only been counted towards iBOL's 500K goal in their primary WG.

[14]Here, we use the term "species" to include both those that have been human-annotated, and those that have been automatically assigned using an *in silico* clustering algorithm.

Table 8.1: The number of BINs for each major taxonomic group in each Theme 1 Working Group.

Working Group 1.1: Vertebrates					
Groups	**Species Targets**	**iBOL Q1 to Q5 Progress**		**Overall Progress to Target**	
		Species	Progress	Species[15]	Progress
Amphibians	6,000	147	2%	1,206	20%
Birds	10,000	39	0%	3,564	36%
Fishes	30,000	1,007	3%	10,738	36%
Mammals	5,000	218	4%	2,177	44%
Other Vertebrates	1,000	2	0%	329	33%
Reptiles	8,000	145	2%	1,004	13%
Grand Total	**60,000**	**1,413**	**2%**	**19,018**	**32%**

Working Group 1.2: Land Plants					
Groups	**Species Targets**	**iBOL Q1 to Q5 Progress**		**Overall Progress to Target**	
		Species	Progress	Species[15]	Progress
Conifers	300	15	5%	103	34%
Cycads	270	56	21%	58	21%
Ferns	2,400	19	1%	51	2%
Flowering Plants	94,000	4,568	4%	8,989	9%
Mosses	2,700	0	0%	3	0%
Other Plants	330	5	1%	25	28%
Grand Total	**100,000**	**4,663**	**5%**	**9,229**	**9%**

Working Group 1.4: Parasites, Pathogens &Vectors					
Groups	**Species Targets**	**iBOL Q1 to Q5 Progress**		**Overall Progress to Target**	
		Species	Progress	Species[15]	Progress
True Bugs	100	7	7%	54	54%
Parasitic Flatworms	700	17	2%	181	26%
Fleas	2,000	10	1%	11	1%
Biting Flies	6,000	135	2%	850	14%
Parasitic Roundworms	100	2	2%	159	159%
Tapeworms	100	5	5%	30	30%
Ticks	1,000	5	1%	69	7%
Grand Total	**10,000**	**181**	**2%**	**1,354**	**14%**

[15]Species barcoded prior to the start of the iBOL Project

Working Group 1.5 Agricultural and Forestry Pests and Their Parasitoids					
Groups	**Species Targets**	**iBOL Q1 to Q5 Progress**		**Overall Progress to Target**	
		Species	Progress	Species	Progress
True Bugs	5,000	712	14%	2,505	50%
Earwigs	100	16	16%	20	20%
Grasshoppers	500	151	30%	689	138%
Lacewings & kin	500	129	26%	277	55%
Mantises	100	9	9%	155	155%
Parasitic Flies	3,000	956	32%	1,829	61%
Parasitic Hymenoptera	8,000	2,293	29%	6,351	79%
Pest Flies	2,000	874	44%	1,699	85%
Predatory Beetles	4,000	1,515	38%	3,755	94%
Sawflies	700	80	11%	284	41%
Stick Insects	100	23	23%	29	29%
Thrips	1,000	96	10%	200	20%
Grand Total	**25,000**	**6,854**	**27%**	**17,793**	**71%**

Working Group 1.6: Pollinators					
Groups	**Species Targets**	**iBOL Q1 to Q5 Progress**		**Overall Progress to Target**	
		Species	Progress	Species	Progress
Bees	20,000	1,587	8%	3,706	19%
Other Hymenoptera	10,000	855	9%	2,042	20%
Pollinating Beetles	10,000	1,284	13%	1,931	19%
Pollinating Flies	9,000	1,751	19%	3,483	39%
Other Insect Pollinators	1,000	0	0%	0	0%
Grand Total	**50,000**	**5,477**	**11%**	**11,162**	**22%**

Working Group 1.7: Freshwater Bio-surveillance					
Groups	**Species Targets**	**iBOL Q1 to Q5 Progress**		**Overall Progress to Target**	
		Species	Progress	Species	Progress
Aquatic Flies	5,500	947	17%	1,710	31%
Caddisflies	7,500	1,199	16%	3,620	48%
Crustaceans	500	50	10%	995	199%
Dragonflies	2,500	92	4%	240	10%
Mayflies	2,500	232	9%	589	24%
Freshwater Molluscs	500	9	2%	1,057	211%
Other Aquatic Insects	500	52	10%	65	13%
Rotifers	500	24	5%	242	48%
Stoneflies	2,500	158	6%	419	17%
Water Beetles	1,000	154	15%	281	28%
Water Bugs	1,000	32	3%	80	8%
Worms & Leeches	500	0	0%	150	30%
Grand Total	**25,000**	**2,949**	**12%**	**9,448**	**38%**

Working Group 1.8: Marine Bio-surveillance					
Groups	**Species Targets**	**iBOL Q1 to Q5 Progress**		**Overall Progress to Target**	
		Species	Progress	Species	Progress
Echinoderms	5,000	345	7%	1,008	20%
Jellyfish and Corals	3,000	14	0%	254	8%
Other Algae	2,000	99	5%	348	17%
Marine Arthropods	30,000	577	2%	5,050	17%
Marine Worms	15,000	168	1%	1,078	7%
Marine Molluscs	30,000	246	1%	4,828	16%
Other Minor Phyla	3,000	28	1%	350	12%
Red Algae	10,000	947	9%	2,092	21%
Sponges	2,000	0	0%	102	5%
Grand Total	**100,000**	**2,424**	**2%**	**15,110**	**15%**

Working Group 1.9: Terrestrial Bio-surveillance					
Groups	**Species Targets**	**iBOL Q1 to Q5 Progress**		**Overall Progress to Target**	
		Species	Progress	Species	Progress
Ants	8,000	2,484	31%	4,979	62%
Springtails	2,500	754	30%	1,634	65%
Earthworms	2,500	482	19%	1,197	48%
Land Snails	1,000	256	26%	1,209	121%
Mites & Spiders	6,000	2,229	37%	4,272	71%
Moths & Butterflies	77,000	20,065	26%	50,469	66%
Other Arthropods	1,000	271	27%	558	56%
Termites	2,000	62	3%	162	8%
Grand Total	**100,000**	**26,603**	**27%**	**64,480**	**64%**

Working Group 1.10: Polar Bio-surveillance					
Groups	**Species Targets**	**iBOL Q1 to Q5 Progress**		**Overall Progress to Target**	
		Species	Progress	Species	Progress
WG1.5 -Terrestrial Animal		359		1,659	
WG1.6 - Terrestrial Animal		586		1,090	
WG1.7 - Freshwater Animals		226		977	
WG1.9 - Terrestrial Animals		499		1,283	
Grand Total	**20,000**	**1,670**	**8%**	**5,009**	**25%**

Appendix VIII–2 Working Group Profiles

The following Working Group Profiles from Theme 1 were solicited in the fall of 2010.

WG 1.1 – Vertebrates	**Chair:** Eldredge Bermingham, Smithsonian Tropical Research Institute, Panama	**Vice-Chair:** George Amato, American National History Museum, USA

DELIVERABLE(S)	**Original goal:** 60,000 species (all known vertebrates) **Revised goal:** 40-50,000 species (including new, previously undescribed species)

ANNUAL TARGETS (CUMULATIVE TOTAL OF SPECIES BARCODES)

Year	2010	2011	2012	2013	2014	2015
Target (*Note: 2010 total includes more than 10,000 vertebrate barcodes which were produced prior to the start of iBOL)	15,000	20,000	25,000	30,000	35,000	40,000

ANNUAL MILESTONES

Ref	Description	2010	2011	2012	2013	2014	2015
	Establish management structure, outline general implementation strategy	X					

CURRENT REPORT

Amongst all working groups, this one, arguably, faces the greatest challenge. It is the only group that was originally charged with barcoding all known species and the consensus amongst members of the working group that this is not achievable. Of the 31,000 known species of fish on the planet, most of those that are easily obtainable have already been barcoded and obtaining the rare specimens will be expensive, laborious, and time consuming. Unfortunately, museum specimens will not be helpful in this case because they have generally been preserved in a DNA-unfriendly manner.

A similar situation is faced in the birds, where a third of known species have been barcoded, but museum specimens are arsenic-treated and are therefore inaccessible. In other groups, political problems are faced. The herptile community is still not very open to the DNA barcoding concept so more outreach is required. Some mammalian species are protected by CITES so the transfer of biological material is complicated, but the iBOL core facilities, such as the CCDB, have obtained the necessary permits to allow tissue exchange. In addition, adhering to iBOL voucher specimen standards is impractical in many cases (e.g., one cannot store a blue whale in a museum).

Despite the challenges, there are still many opportunities for this working group. In California, for example, there is a project to collect road kill and this could be a tremendous source of material for DNA barcoding as well. Approximately 50% of herptile collections are cryo-preserved, making them ideal for barcoding if curators can be convinced of its value. For fish, perhaps 75% of the world's species could be obtained through the involvement of Brazil and China, and through collection missions in South-East Asian coral reefs.

PLANNED WG ACTIVITIES BY NODE

Node	Activities
Australia	FISH-BOL
Canada	To assist in the completion of barcode databases for all vertebrates with a particular emphasis on fishes & mammals
Finland	All vertebrates reported from Finland - 256 breeding bird species (and as many as possible of 456 species ever seen in Finland) - 80 mammalian species - 102 fish species - 7 amphibian species 5 reptilian species

Kenya	Mammals, birds and freshwater fish
Mexico	In Mexico collections should be registered in the environment ministry (SEMARNAT). Several vertebrate collections have already frozen tissue collections associated with them. We plan to barcode material from collections, whenever is possible to extract DNA from them. Within MEXBOL one of the working themes is mammals and the other is fish, because there are several researchers in these groups, but there are also ongoing projects with birds, and herps. Currently active collecting on fish are carried on, as material from collections is not possible to be barcoded
Norway	All vertebrates registered in Norway (862 species): - 42 freshwater fish species - 268 marine fish species - 6 amphibia species - 6 reptilia species - 90 mammal species 450 bird species breeding and visiting
Pakistan	Collections and processing for barcoding
Russia	Priority: DNA barcode library for rodents, DNA barcode library for taiga small mammals. Working group at the Zoological Institute RAS, laboratory of molecular systematic and Zoological museum of MSU (Leaders Dr.Abramson N., Dr.Lissovsky A. (Leaders Dr.Abramson N., Dr.Lissovsky A.
United Kingdom	Mobilise major collections of samples for DNA barcoding, undertake DNA barcoding in focal groups

WG 1.2 – Land plants	Chair: Peter Hollingsworth, Royal Botanic Gardens, Edinburgh, UK	Vice-Chair: De-Zhu Li, Chinese Academy of Sciences, China

DELIVERABLE(S) **Original goal:** 100,000 species

ANNUAL TARGETS (CUMULATIVE TOTAL OF SPECIES BARCODED)

Year	2010	2011	2012	2013	2014	2015
Target	5000	10,000	20,000	40,000	70,000	100,000

ANNUAL MILESTONES

Ref	Description	2010	2011	2012	2013	2014	2015
1	Establish management structure, outline general implementation strategy	X					
2	Enhance protocols for matK barcodes		X				
3	Hold plant barcoding symposium at IBC, and organise an iBOL WG 1.2. steering committee meeting at the symposium		X				
4	Submission of funding proposals		X				
5	Finalisation of implementation plan		X				
6	Establish supply chain for 100,000K species		X				
7	Secure sufficient funding to complete the 100,000K species			X			

CURRENT REPORT

Funding is already in place to allow the collection of specimens representing more than 60K different land plant species. Ongoing taxonomic projects, major taxonomic institutes, botanic gardens, and targeted bioblitzes/sampling of forest plots will enable the collection of an additional 40K species, ensuring that the 100K target is reached. As a consequence, the sample supply chain considered to be secure. A draft set of priority projects/areas/taxa has been identified. This list needs refining, further prioritising, and an implementation plan developing.

The key factor that is limiting rapid progress toward barcode coverage for these 100K species is sequencing capacity. The working group is confident that the samples can be provided to sequencing facilities, but there was a concern that greater opportunities need to be established for processing and sequencing plant samples. As a short-term solution, the CCDB has been requested to direct more effort toward the analysis of plant samples.

Two other major limiting factors are (a) informatics support for plant barcodes, and (b) thedevelopment of better primer sets for one of the two plant barcode markers, matK. An informatics wish list for plant barcoding has been prepared, as well as a strategy for encouraging data deposition in BOLD. A project has been funded by the Moore Foundation to tackle primer development for matK.

PLANNED WG ACTIVITIES BY NODE

Node	Activities
Australia	GrassBOL, TreeBOL
Canada	To further refine the interim methodology for plant barcoding, complete the barcode database for the North American flora, aid the completion of the global land plant library and to apply plant barcoding to pollen samples obtained from pollinators
Costa Rica	1. ACG: 2,000 samples/year 2. INBIO: 2,000 samples/year/funded module
Finland	Establish a vascular plant barcoding project (3550 species) by the end of 2011 Establish a bryophyte barcoding project (892 species) by the end of 2011
Germany	ABA-project (Ecuador)
Kenya	Medicinal plants, orchids, marine macroalgae

Mexico	There are important herbaria and botanical gardens in Mexico. We intend to barcode all possible material from these two sources. Botanists are undertaking complete barcoding of floras starting in 2010, examples are Calakmul, Los Tuxtlas, and Chamela
Norway	Vascular plants in Norway (2962 species registered) Vascular plants in Svalbard (238 species registered) Bryophytes in Norway (1071 species registered)
Pakistan	Collecting and barcoding native plant species/ flowering plant, plants of medicinal value
United Kingdom	Lead WG, mobilise major collections of plant samples for DNA barcoding, undertake DNA barcoding in focal groups, develop barcoding protocols and infra-structure

WG 1.3 – Fungi	Chair: Pedro Crous, CentraalbureauvoorSchimmelcultures, Utrecht, Netherlands	Vice-Chair: Keith Seifert, Agriculture &Agrifood Canada, Ottawa, Canada

DELIVERABLE(S) **Original goal:** 10,000 species

ANNUAL TARGETS (CUMULATIVE TOTAL OF SPECIES BARCODED)

Year	2010	2011	2012	2013	2014	2015
Target	-	1,000	2,000	4,000	6,000	10,000

ANNUAL MILESTONES

Ref	Description	2010	2011	2012	2013	2014	2015
1	Establish management structure, outline general implementation strategy	X					
2	Establishment of DNA barcode loci for Oomycota		X				
3	Establishment of DNA barcode loci for yeasts		X				
4	Establishment of initial barcode locus for Eumycota		X				
5	Additional barcode loci to be chosen for Eumycota			X	X		
6	Publication on initial barcode locus recommendations		X				
7	Barcoding of indoor Mycota (IM-BOL)		X				
8	Barcode culture collections (Culture-BOL)				X	X	X
9	Mushroom-BOL				X	X	X 2000 spp
10	Medical Mycology – ISHAM-BOL			X	200 spp		

CURRENT REPORT

The challenge for the Fungi Working Group has been the selection of barcoding loci. Fortunately, a great deal of work has been performed over the past several years evaluating different markers in different fungal groups. The good news is that consensus seems to be emerging for several major fungal groups, and papers describing these markers and the logic behind their choices are expected to be published in 2011. Once markers are chosen, obtaining specimens for 10,000 species will not be a problem—and culture collections in particular are low-hanging fruit. As noted above, there are a large number of barcoding campaigns on fungi that will either be launching soon or that are already progressing. There is a lot of momentum behind fungal barcoding.

PLANNED WG ACTIVITIES BY NODE

Node	Activities
Canada	To develop a proposal for an internationally accepted fungal barcode marker schema and to expand barcode coverage of socio-economically relevant fungi in Canada
Finland	Establish a fungal barcoding project (5584 species) by the end of 2011 Establish a lichens barcoding project (1832 species) by the end of 2011
Germany	ABA-project (Ecuador)
Kenya	Pteridophytes & bryophites
Mexico	We started to barcode fungi hosted in collections of Mexico. There is a strong interest among Fungi taxonomist in Mexico to participate in this campaign.
Norway	Fungi in Norway (4989 species registered) Lichens in Norway (1985 species registered)
United Kingdom	Mobilise major collections of fungal samples for DNA barcoding, undertake DNA barcoding in focal groups, contribute towards selection of fungal barcode

WG 1.4 – Animal Pathogens,Parasites and Vectors	Chair: Daniel Masiga, Centre for Insect Physiology and Ecology, Nairobi, Kenya	Vice-Chair:

DELIVERABLE(S)	10K species, including mosquitoes (3K species), sandflies (1K), blackflies (2K), fleas (2K) and ticks (1K)

ANNUAL TARGETS (CUMULATIVE TOTAL OF SPECIES BARCODED)

Year	2010	2011	2012	2013	2014	2015
Target	500	1,000	2,000	4,000	7,000	10,000

ANNUAL MILESTONES

Ref	Description	2010	2011	2012	2013	2014	2015
1	Establish management structure, outline general implementation strategy	X					
2	Access to museum collections negotiated			X			

CURRENT REPORT

Since the start of the iBOL project, 1400 specimens representing 382 species have been collected and barcoded for this Working Group. Without a substantial infusion of funds to support new collection programs, this Working Group will only be able to achieve its overall goal by analyzing specimens in current museum collections. Fortunately most of these specimens are preserved as dry collections and the prospects of DNA recovery will be strong so long as specimens are less than 40 years of age. However, funding is required for technicians to perform the tissue sampling, photography, and databasing. If these resources are available, there is a strong prospect that this WG will meet its analytical targets.

PLANNED WG ACTIVITIES BY NODE

Node	Activities
Canada	To advance the Health-BOL campaign internationally via the assembly of new funding proposals
Finland	Simuliidae of Finland (55 species) Culicidae of Finland (ca 40 species) Ticks and lice All covered by terrestrial projects
Kenya	Disease vectors and pathogens (mosquitoes, tsetse flies, snails, ticks)
Mexico	We will start with the Health ministry to work on mosquito identification and barcoding
Norway	All Simuliidae in Norway (ca 50 species) Ticks, lice, mosquitoes, parasitic worms
United Kingdom	Obtain samples and undertake DNA barcoding

WG 1.5 – Agricultural and Forestry Pests & their Parasitoids	**Chair:** Robert Foottit, Agriculture & Agrifood Canada, Ottawa	**Vice-Chair:** Jean-Yves Rasplus, INRA-CBGP, Montferrier-sur-Lez, France

DELIVERABLE(S)	**Original goal:** 25K species, including aphids (4K), thrips (3K), true fruitflies (2K), scale insects (3K), sawflies (2K), and gall wasps (2K)

ANNUAL TARGETS (CUMULATIVE TOTAL OF SPECIES BARCODED)

Year	2010	2011	2012	2013	2014	2015
Target	8,000	15,000	20,000	25,000		

ANNUAL MILESTONES

Ref	Description	2010	2011	2012	2013	2014	2015
1	Establish management structure, outline general implementation strategy	X					

CURRENT REPORT

More than 19,000 pest specimens from 92 different countries and regions have now been DNA barcoded since the start of the iBOL project. As a result, this working group is well on-track to meeting its goal of barcoding 25,000 species and may reach this target before the end of 2013. At that point, the Working Group will not only extend the reference library, but will increasingly turn its attention to applications of this library for the purposes of pest management, identification of invasive species, and customs/border protection. The research programs carried out by this WG have gained substantial momentum in Europe as a result of a major award in support of the Quarantine Barcode of Life Project. There is also much interest in aiding this work in other geographic regions as a result of the huge practical importance of the results in protecting agriculture and forestry.

PLANNED WG ACTIVITIES BY NODE

Node	Activities
Australia	Insect pests and parasitoids of concern to Australia
Canada	To lead the development of a global checklist for agricultural and forestry pests of quarantine significance and to advance completion of the pest/parasitoid library in collaboration with QBOL
Costa Rica	1. ACG: of the 18,000 arthropod samples/year from ACG, at least 500 will be pests, biocontrol agents, or their near relatives. 2. INBio: of the 8,000 arthropod samples/year from INBio, at least 500 will be pests, biocontrol agents, or their near relatives.
Finland	All insect pests, covered by terrestrial projects
Germany	Fauna Bavarica project (ZSM)
Kenya	Plant pests (e.g. fruit flies, food storage pests), animal pests (ticks)
Mexico	We have several groups starting to work on this. *Anastrepha* fly is already been worked. One group is starting with parasitoids , and another with thrips (fruiting trees pests)
Norway	Coleoptera in commercial food items All Symphyta in Norway (483 species) All ants in Norway (53 species) Parasitoid wasps (3257 species registered) All bark beetles in Norway (68 species)
Pakistan	Collection, preservation of vouchers and barcoding insect and other pest species

WG 1.6 – Pollinators	**Chair:** Laurence Packer, York University, Canada	**Vice-Chair:** Fernando Silveira, Universidade Federal de Minas Gerais, Brazil

DELIVERABLE(S)	**Original goal:** 50,000 species, including 20,000 bees **Revised goal:** 35,000 species, including 15,000 bees and 20,000 others (e.g. Diptera, Coleoptera)

ANNUAL TARGETS (CUMULATIVE TOTAL OF SPECIES BARCODED)

Year	2010	2011	2012	2013	2014	2015
Target (Bee Species)	2,500	6,000 (30% of all species, 75% of all genera)	7,000 (35% of total, 80% of all genera)	8,000 (40% of total, 85% of all genera)	12,000 (60% of total, 90% of genera)	15,000 (75% of total, 99% of all genera)
Target (Other pollinator species)	1,000	3,000	6,000	10,000	15,000	20,000

ANNUAL MILESTONES

Ref	Description	2010	2011	2012	2013	2014	2015
1	Establish management structure, outline general implementation strategy	X					

CURRENT REPORT

Pollinator insects are well represented in museum collections and most specimens are stored dry, aiding barcode recovery. Members of the WG are confident that the specimens needed for analysis will be available, but support is needed to process this material.Some funding has been obtained in the USA that is allowing access to major bee collections that will provide an excellent diversity of barcodes .A project is also underway to barcode the bees of Chile. While these projects serve as useful models, they need to be expanded.

PLANNED WG ACTIVITIES BY NODE

Node	Activities
Canada	To complete the DNA barcode database for the bee, flower flies and other insect pollinators of Canada and to obtain DNA barcodes from as many of the world's bee, hover fly and other pollinator species as possible
Costa Rica	1. ACG: of the 18,000 arthropod samples/year from ACG, 10,000 will be pollinators (Lepidoptera, flies, wasps). 2. INBio: of the 10,000 samples/year from INBio, currently, 500 will be pollinators (Lepidoptera, flies, wasps) but the proportion can be changed dramatically in future modules if funded.
Finland	All insect pollinators, covered by terrestrial projects, barcoding of Syrphidae in progress
Germany	Fauna Bavarica project (ZSM)
Kenya	Bees, birds, butterflies, moths
Mexico	The insects group will promote this work. Currently we have good results with Lepidoptera, bees, wasps, and aquatic insects.
Norway	All bees and bumblebees in Norway (234 species)
Pakistan	Collection, preservation of vouchers and barcoding insect pollinators on flowering plants and crop plants
United Kingdom	Obtain samples and undertake DNA barcoding

WG 1.7 – Freshwater Bio-surveillance	**Chair:** Bern Sweeney, Stroud Water Research Centre, Avondale, USA	**Vice-Chair:** Ian Hogg, University of Waikato, Waikato, New Zealand

DELIVERABLE(S)	**Original goal:** 25K species, including caddisflies (15K), mayflies (5K), odonates (5K) and stoneflies (5K). **Revised goal:** 25K species, including caddisflies (9K), mayflies (5K), odonates (3K) stoneflies (3K), crustaceans (2K), rotifers (1K), gastropoda (1K) and dipterans (1K)

ANNUAL TARGETS (CUMULATIVE TOTAL OF SPECIES BARCODED)

Year	2010	2011	2012	2013	2014	2015
Target	3,000	5,000	10,000	15,000	20,000	25,000

ANNUAL MILESTONES

Ref	Description	2010	2011	2012	2013	2014	2015
1	Establish management structure, outline general implementation strategy	X					

CURRENT REPORT

Large-scale collection programs on freshwater macroinvertebrates are active in many nations because of the use of these organisms as a foundation for water quality monitoring programs. For example, four organisations in New Zealand (NIWA, Cawthron, Environment Waikato, Landcare)and many organizations(EPA, USGS, state departments of environmental protection) in the USA sustain active sampling programs. However, taking full advantage of these programs will require significant effort.

Significant challenges are as follows:

1. Effective preservation of samples is a large challenge. Although many agencies collect specimens, preservation techniques (e.g. use of formalin) are often not conducive to DNA preservation. Getting organizations to shift to preservation with ETOH may require providing some resources to compensate for the added expense.
2. The use of “survey specimens” from routine monitoring programs will certainly aid accomplishment of the analytical target for this WG. However, the need to limit barcode coverage to fewer than 10 specimens per species means that specimens must be identified prior to analysis. Obtainingidentified vouchers for barcoding will be aided if agencies receivefeedback that is helpful to their monitoring efforts, such as an independent test of how well they are doing on their identifications. Secondly, the library of sequences and identifications that relate to water quality should ultimately lead to better “pollution tolerance” values for taxa -----and hence better water quality assessments.
3. The key to securing specimens collectedacross varied nations is the need to barcode specimens at no charge since collaborators need to incur costs to get specimens preserved and organized. It is likely that the additional steps involved in preparing specimens for barcoding (photography, tissue sample, data entry) will also need to be supported.. Fortunately, these costsare very small compared to those involved in making the collections, sorting specimens and identifying them.
4. To meet these challenges, there needs to be a place or places where specimens destined for barcoding for the IBOL project can be properly preparedand we need to assure collaborating agencies that if specimens donated for analysis will be barcoded at no charge.
5. Once these challenges are resolved, it will time to recruit the specimens. If we could do that, not only could we enter into agreements with many of the major state and federal players in the USA, but we could do a call for specimens among researchers (funded by state and federal money) who are doing this kind of work (but maybe even consulting firms). I believe that we would have the high class problem of trying to pick and choose what specimens we are willing to accept rather than where can we get the specimens.

PLANNED WG ACTIVITIES BY NODE

Node	Activities
Canada	To advance the barcode library for North American freshwater indicator species as well as the regions of the world from where invasive species arrive
Costa Rica	1. ACG is planning a freshwater barcode-based biodiversity inventory and

	biomonitoring process for 6 rivers flowing through Sector Mundo Nuevo and next to the anticipated geothermal electricity project, but that will be initiated likely in mid? 2011. 2. INBio has extensive collections of aquatic insects, and can get a lot more if minimal funding is available. Additionally, the Stroud Water Research Center near Wilmington, Delaware has a major aquatic research program on several Costa Rican rivers, has been introduced to barcoding by iBOL (via Dr. Bern Sweeney, the SWRC director, who is also a technical advisor to iBOL), and is incorporating barcoding in their stream biodiversity monitoring in Costa Rica as a consequence of ACG and INBio involvement.
Finland	All aquatic groups below to be barcoded as comprehensively as possible Chironomidae of Finland (755 species), covered by terrestrial projects Psychodidae of Finland (57 species), covered by terrestrial projects Plecoptera of Finland (36 species) Ephemeroptera of Finland (55 species) Trichoptera of Finland (216 species) Odonata of Finland (55 species) All aquatic Lepidoptera (5 species), covered by terrestrial projects All aquatic Coleoptera covered by terrestrial projects Aquatic Crustacea covered by terrestrial project Aquatic Mollusca covered by terrestrial project
Germany	Fauna Bavarica project (ZSM)
Kenya	Macroinvertebrates
Mexico	Currently freshwater zooplankton is among the most advanced groups in the world.
Norway	Chironomidae in Norway (>500 species registered) Psychodoidea in Norway (30 species registered) All Plecoptera in Norway (35 species) All Ephemeroptera in Norway (48 species) Trichoptera in Norway (200 species registered) All freshwater red algae in Norway (ca 20 macro algae species)
Russia	Copepodes and benthic crustacean, fishes

WG 1.8 – Marine Bio-surveillance	**Chair:** Gary Saunders, University of New Brunswick, Fredericton, Canada	**Vice-Chair:** Phillippe Bouchet, Muséum National d'Histoire Naturelle, Paris, France

DELIVERABLE(S)	**Original goal:** 100,000 species **Revised goal**: 70,000 species

ANNUAL TARGETS (CUMULATIVE TOTAL OF SPECIES BARCODED)

Year	2010	2011	2012	2013	2014	2015
Target	3,000	10,000	25,000	40,000	60,000	70,000

ANNUAL MILESTONES

Ref	Description	2010	2011	2012	2013	2014	2015
1	Establish management structure, outline general implementation strategy	X					

CURRENT REPORT

At the recent Scientific Steering Committee meeting, there was general consensus that 100,000 species was an ambitious goal for WG1.8. There was a recognition that most of those species will have to be marine invertebrates, and unfortunately no strong leader has emerged to represent those groups. In addition, it is known that the COI locus is difficult to amplify in some groups, so help on primer design and other R&D experiments will be required from WG2.3. It is known that COI is not a DNA barcoding marker for a few groups of marine invertebrates (e.g. corals, sponges), and a supplemental marker region will have to be chosen—again requiring substantial lab work.

Obtaining specimens will also be a challenge for this Working Group. Many museum collections havebeen fixed using formalin—a chemical that crosslinks DNA, impeding PCR amplification. This necessitates new collecting missions, which can be very expensive since they require access to ship time. As a consequence, the overall goal for this WG has been reduced to 80,000 species.

Despite the challenges, there is generally a positive outlook for WG1.8. A recent collecting mission out of the Natural History Museum in Paris has generated 100,000 samples that are available if the funds can be secured for tissue sampling. Similarly, the Center for Models of Life has a large collection of fresh marine samples that could also be exploited.

PLANNED WG ACTIVITIES BY NODE

Node	Activities
Argentina	"Digitizing Argentina´s marine resources: towards constructing a DNA library of South Atlantic coastal sea life". An Argentinean-Canadian joint research cruise will be carried out along the Buenos Aires Province coast on board the Comodoro Rivadavia Hydrographic vessel. The aim of the proposed research effort is to take advantage of the expedition's mandate to sample the marine biota in the northeastern part of the coast of Argentina and to preserve tissue samples from representatives of the species of eukaryotic marine organisms collected
Canada	To complete the red algal library worldwide and to complete the marine library for Canadian fauna in the North Pacific, Arctic and Atlantic Oceans
Finland	Establish a marine life project by the end of 2012
Germany	North Sea project (Senckenberg), Sponge Barcoding (LMU Munich)
Kenya	Macroalgae
Mexico	We started the work on polychaetes, pteropoda, and amphipoda, with good results. We have material from NOAA cruises in the Caribbean, and we'll start to work with it. There is also a project with Sponges being started in the Pacific Coast.
Norway	All Nudibranchs in Norway (90 species) Polychaetes (612 species registered) Amphipods (539 species registered) Decapods (119 species registered) Ophiuroidea (36 species registered)
Pakistan	Collection and barcoding fish
Russia	Chitons, fishes
United Kingdom	Obtain samples and undertake DNA barcoding

WG 1.9 – Terrestrial Bio-surveillance	**Chair:** Daniel Janzen, Area de Conservacion Guanacaste, Costa Rica	**Vice-Chair:** Brian Fisher, California Academy of Sciences, San Francisco, USA

DELIVERABLE(S)	**Original goal:** 100,000 species **Revised goal:** 150,000 species

ANNUAL TARGETS (CUMULATIVE TOTAL OF SPECIES BARCODED)

Year	2010	2011	2012	2013	2014	2015
Target	60,000	90,000	120,000	150,000	180,000	200,000

ANNUAL MILESTONES

Ref	Description	2010	2011	2012	2013	2014	2015
1	Establish management structure, outline general implementation strategy	X					

CURRENT REPORT

The 2008 proposal focused on three groups of terrestrial arthropods as sentinel groups for organisms with different ecological roles - butterflies/moths, ants/termites, and earthworms. However, since that time our network of collaborators has expanded and initial lab work has indicated that DNA barcoding can—and should—be applied to a broader spectrum of organisms. As something of a "catch-all" working group for organisms that don't comfortably fit elsewhere, since July 2009 we have barcoded more than 160,000 specimens received from 175 countries/regions, representing more than 60,000 species from 37 distinct taxonomic orders. Thissuccess has led us to propose a great increase in scope for WG1.9, to include representatives from all major groups of *all* terrestrial invertebrates. This includes not only insects, but also spiders, mites, scorpions, centipedes, millipedes, and many other important groups. This expansion in scope also comes with revised goals: we believe we can now obtain DNA barcodes for at least 200,000 species.

Because they were among the first groups heavily barcoded and the network of collaborators is well-developed, we expect roughly half of these DNA barcodes to come from order Lepidoptera—moths and butterflies. This group is frequently used as a model organism for evolutionary studies and has an active curatorial staff in most of the world's major natural history museums. We have found that such individuals play a key role in provoking network expansion. These individuals share the positive results of their DNA barcoding studies on Lepidoptera, and this encourages their colleagues—who are experts in other taxonomic fields—to explore DNA barcoding for their research.

PLANNED WG ACTIVITIES BY NODE

Node	Activities
Australia	Lepidoptera of Australia
Canada	To expand the global libraries for Lepidoptera and to initiate more global campaigns for specific taxonomic groups of terrestrial life
Costa Rica	1. ACG: 18,000 samples/year Lepidoptera, Diptera, Hymenoptera 2. INBio: 8,000 samples/year all orders
Finland	All terrestrial groups below to be barcoded as comprehensively as possibleAlso other Palearctic insect species deposited in Finnish collections to be barcoded as comprehensively as possible
Germany	Lead Lepidoptera section (800K specimens, 80K species: ZSM), Fauna Bavarica project (40K specimens, 10K species: ZSM)

Norway	All Lepidoptera in Norway (2208 species) All Orthoptera in Norway (30 species) All Blattodea in Norway (10 species) All Dermaptera in Norway (4 species) Red-listed Coleoptera of Norway (829 species) All Mycetophilidae in Norway (589 species) Staphylinidae in Norway (>1000 species registered) Megaloptera in Norway (5 species registered) Neuroptera (58 species registered) Spiders in Norway (564 species registered) All earthworms in Norway (19 species)
Pakistan	Collection and barcoding arthropods and other terrestrial life
United Kingdom	Mobilise major collections of animal samples for DNA barcoding, undertake DNA barcoding in focal groups,

WG 1.10 – Polar Life	**Chair:** Torbjørn Ekrem NTNU Museum of Natural History & Archaeology, Trondheim, Norway	**Vice-Chair:** Peter Smith National Institute of Water & Atmospheric Research Ltd New Zealand

DELIVERABLE(S) **Original goal:** 20K polar species

ANNUAL TARGETS (CUMULATIVE TOTAL OF SPECIES BARCODED)

Year	2010	2011	2012	2013	2014	2015
Target	3,000	5,000	10,000	15,000	18,000	20,000

ANNUAL MILESTONES

Ref	Description	2010	2011	2012	2013	2014	2015
1	Establish management structure, outline general implementation strategy	X					

CURRENT REPORT

Our first challenge is to get a proper overview of ongoing barcoding efforts in polar regions and assemble contact information for all project leaders. It is imperative that the communication between projects and project leaders increases and we will use the new WG1.10 website, our e-mail listserver and the barcode community site to promote communication and collaboration.

Another important challenge will be to energize new collaborators to participate in PolarBOL and encourage them to send specimens for analysis. Upcoming conferences and meetings will be an effective way to speak about the project and promote participation, while sharing preliminary results from an already-established database.

Planning of future sampling locations/efforts with broad geographic coverage will be important. Joining ongoing freighter trips (e.g. aboard the CCGS Amundsen which conducts research in the Canadian and Alaskan Arctic) and taking full advantage of established research facilities (such as the White Sea Biological Station in Russia) will enable specimen targets to be met. We will consider to arrange teams targeting particular regions and taxonomic groups, particularly towards the end of the project period.

There are multiple projects that currently have generated barcode data that so far are not submitted to BOLD. We would like to find the reasons for the delay in getting sequences registered in BOLD and provide the help we can to aid this process.

A strong focus will have to be on species rich taxonomic groups. There are several ongoing projects in the arctic that are bound to generate substantial material of terrestrial and aquatic insects. The major challenge for the first two years will be to have the manpower to sort, sample, register and store specimens of different morphotypes and get these samples sequenced. We will try to obtain resources to meet this challenge.

Bryophyta is a species rich group in polar regions. For mosses it will be a challenge to develop working primers for mat-K and in general to find a marker that is variable enough to distinguish between closely related species. An ongoing study (NTNU, Trondheim) has shown that rbcL lacks this capacity. Assistance to develop primers and find suitable markers are needed from larger barcoding research communities/labs.

PLANNED WG ACTIVITIES BY NODE

Node	Activities
Canada	To complete the DNA barcode database of the Arctic flora and fauna
Costa Rica	Not relevant, but would love to compare with the arctic barcoding.
Germany	Sponge Barcoding (LMU Munich)
Norway	(Covered by PolarBOL/T. Ekrem)
United Kingdom	Obtain samples and undertake DNA barcoding