TAXONOMY

& the Global Taxonomy Initiative

Belgian Focal Point to the GTI
Royal Belgian Institute of
Natural Sciences, Brussels

On earth

What is taxonomy?

How does taxonomy function?

What problems for taxonomy?

Solutions offered by Belgium!

Earth

Earth

In a perfect world…

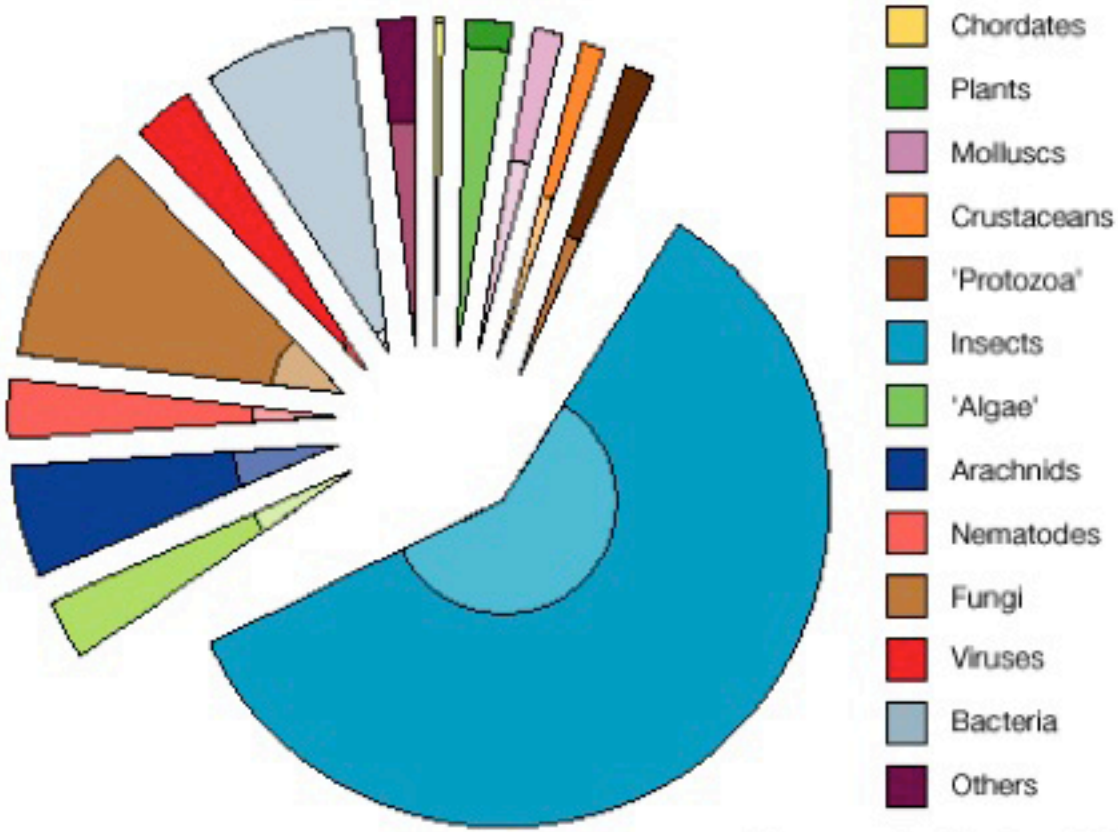
Global biota would be adequately described and understood

Extinction rates would occur only at natural time scales

A single dominant species would not have a catastrophic effect on global biodiversity

only1.7 to 1.9 x10^6 species have been diagnosed and validly named

10 to 30 x10^6 species yet to be recognized, described, classified and understood



(Source : after Hawksworth & Kalin-Arroyo, 1995)

Among currently accepted species of vascular plants in Madagascar, a staggering **17.5% are currently known only from the type locality, and about half of these are only known from the type specimen**. A project a few years ago to target a number of these and recollect them at the type locality or from similar nearby habitats, established that many of these really are very local endemics and that others are **likely exinct** since the localities where they once occured are now devoid of natural vegetation.

It is fortunate that earlier generations of botanists saw fit to describe these species on the basis of the limited herbarium material available, thereby drawing our attention to them, and it is surely for us and for subsequent generations to improve on the descriptions in terms of accounting for species variability and for other properties, and to provide threat analyses for all of them that still survive. I see no reason why the present generation of biologists shouldn't describe distinct entities as new taxa and provide work for future generations too!

Peter B. Phillipson Africa and Madagascar Department Missouri Botanical Garden *(posted on TAXACOM on 1 October 2008)*

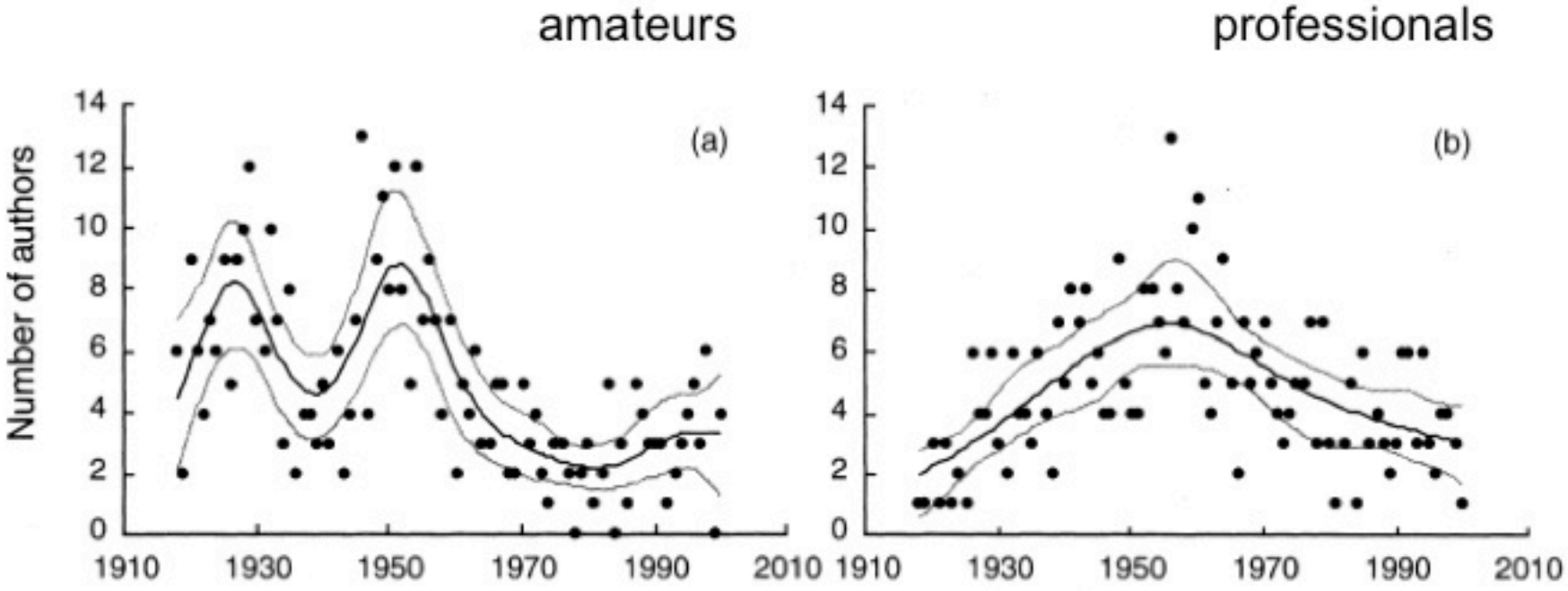
Taxonomic productivity clearly is too low

	New	Described	Total
Bacteria	120	10.000	1.000.000
Fungi	1.700	72.000	1.500.000
Algae	unknown	40.000	400.000
Plants	1.700	270.000	320.000
Nematodes	365	25.000	400.000
Mandibulata	7.200*	963.000	8.000.000
Birds	5	9.750	-
mammals	26	4.630	-
Total	± 13.000	± 1.750.000	± 14.000.000

Number of species described per annum, total number of species described, estimated number of species in the taxon

(Source : after Seberg, 2004)

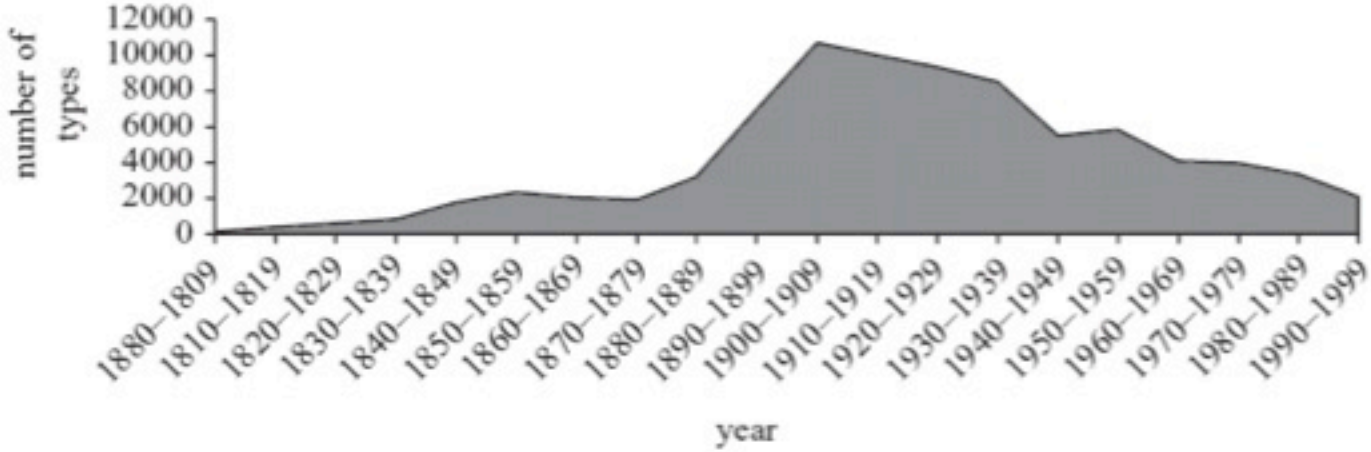
…and still declining



For instance the situation in the UK

(Source : Hopkins & Frecleton, 2002)

Taxonomic productivity seems to be staggering

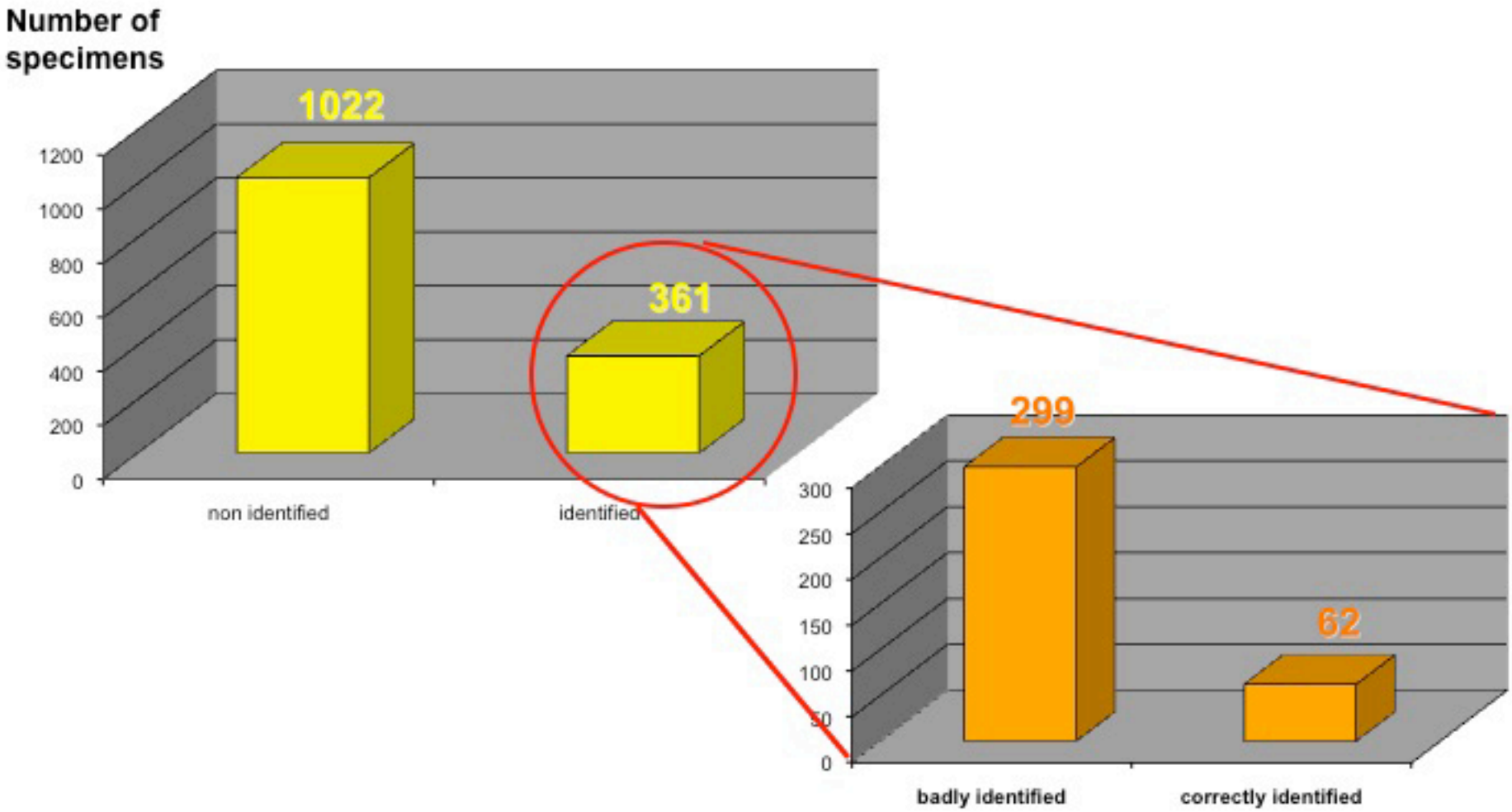


Rate of accumulation of type specimens in Kew Botanical Garden and the US National Herbarium (Smithsonian Institution) from 1880-1999 as an indirect measure of descriptive taxonomic activity

(Source : Wheeler 2004)

Taxonomic knowledge is in an eroded state…

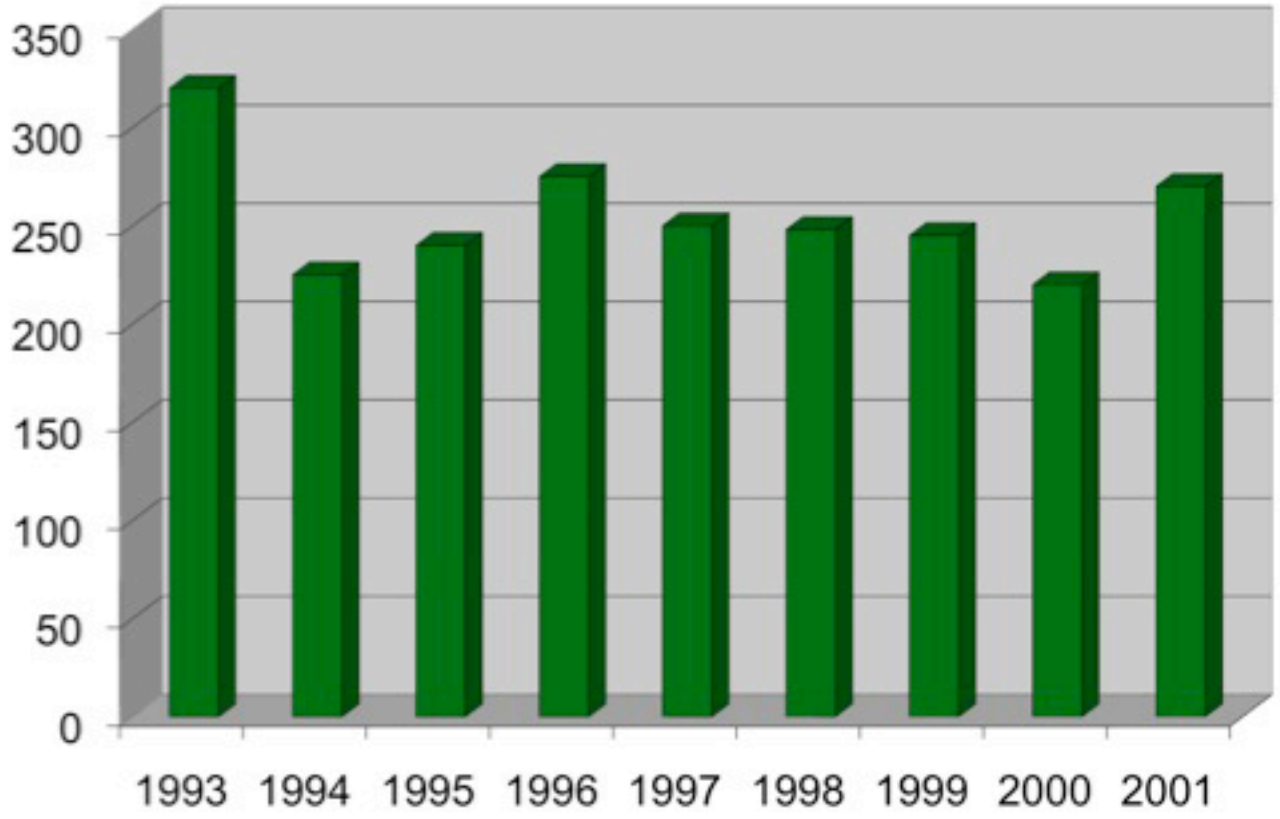
Example with a sample of 1383 specimens of Euscelidia *(Diptera) :*



(source : d'après Wheeler, 2004)

Taxonomy *sensu stricto* is often not considered 'sexy'…

Projects financed by the Systematics programme of the US NSF

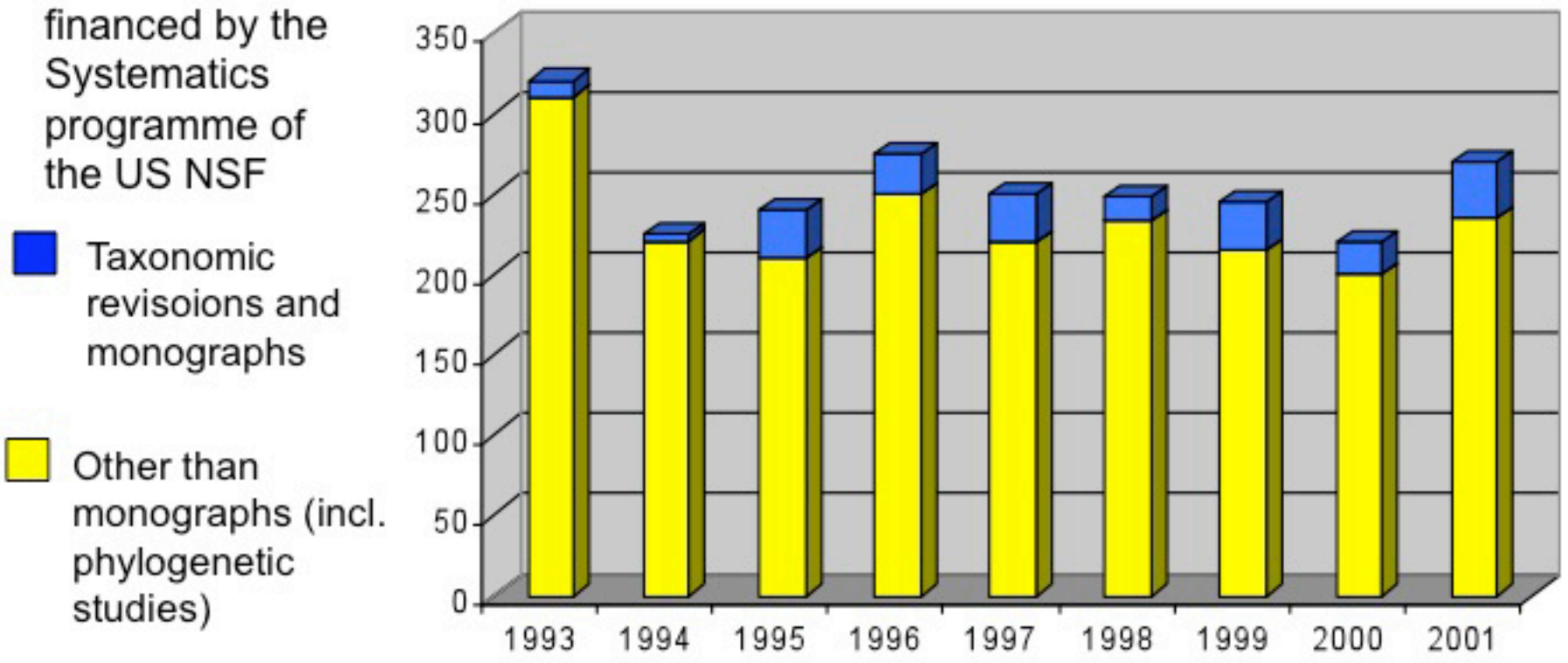


(source: after Wheeler, 2004)

Taxonomy *sensu stricto* is often not considered 'sexy'…

Financing goes predominantly to phylogenetic projects rather than to descriptive taxonomy

Projects financed by the Systematics programme of the US NSF



(source: after Wheeler, 2004)

On earth

What is taxonomy?

Earth

Taxonomy




Hypothesis driven

e.g. Darwin finches on different islands are not closely related

Taxonomy = Science

Considers only facts

e.g. voucher specimens, as labelled by Cpt. FitzRoy & crew

Continuing progress

e.g. separate, but closely related species; each endemic to 1 island

For instance: identification of cryptic species

2 species of bumble bees; polinators with an important ecological and economical role

Bombus hortorum

Bombus ruderatus

Necessity of a correct identification to attain appropriate conservation measures

(source: Ellis *et al.*, 2006)

For instance: identification of cryptic species

Morphological characters

Bombus hortorum
Ubiquitous

=

Bombus ruderatus
Threatened

(source: Ellis *et al.*, 2006)

For instance: identification of cryptic species

Molecular characters
(restriction enzymes)

≠

Bombus hortorum *Bombus ruderatus*

Importance of taxonomy in conservation biology

(source: Ellis *et al.*, 2006)

On earth

What is taxonomy?

How does taxonomy function?

Earth | Taxonomy | Functioning

Detection

Sampling

Taxonomy operates by

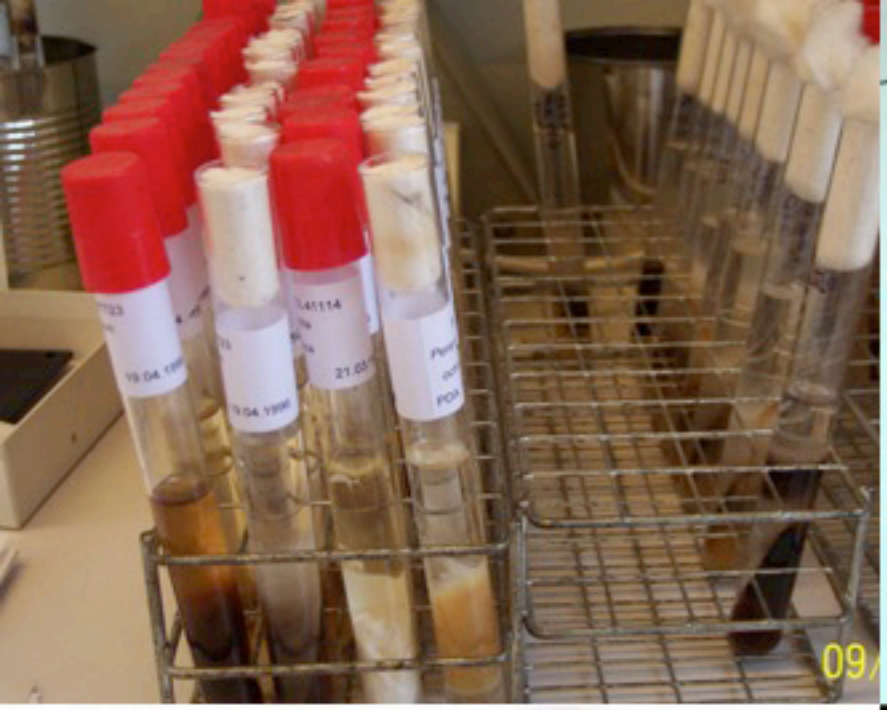
Identification

Characterisation of biodiversity

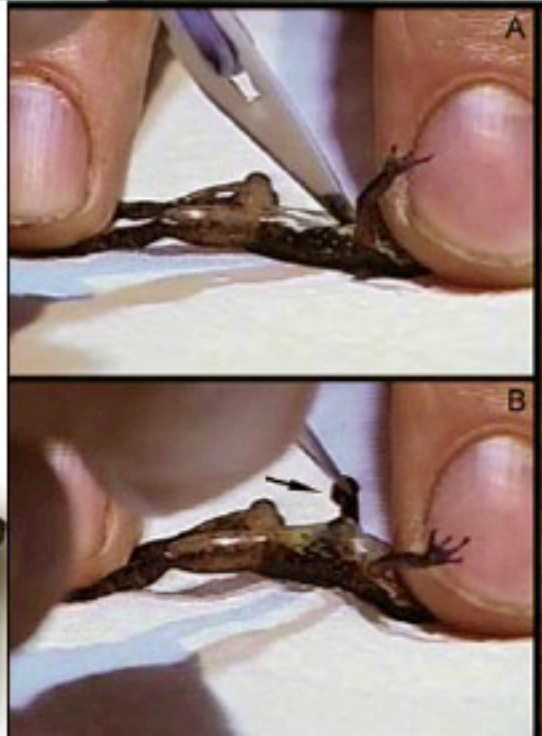
Ordering

Hierarchical categories (species, genus, family…)

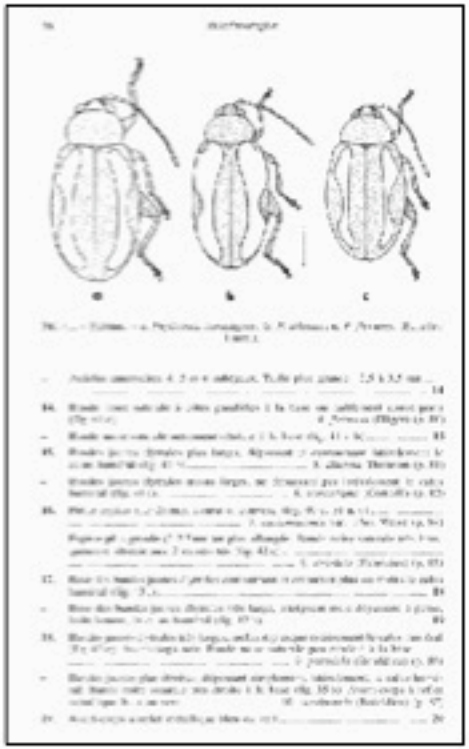

Detection

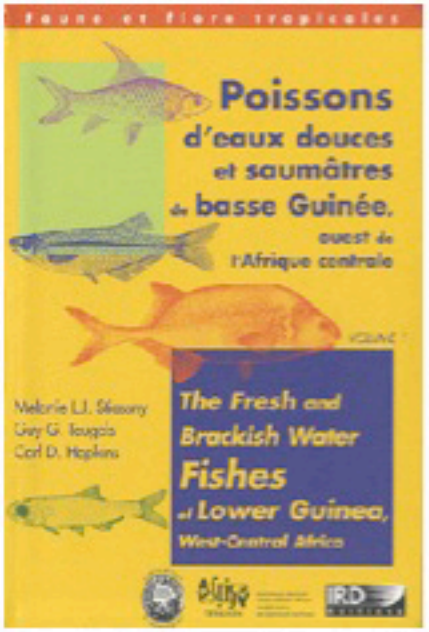



Sampling
HERBIER
UNIVERSITAIRE
DE LA
REUNION


A
B

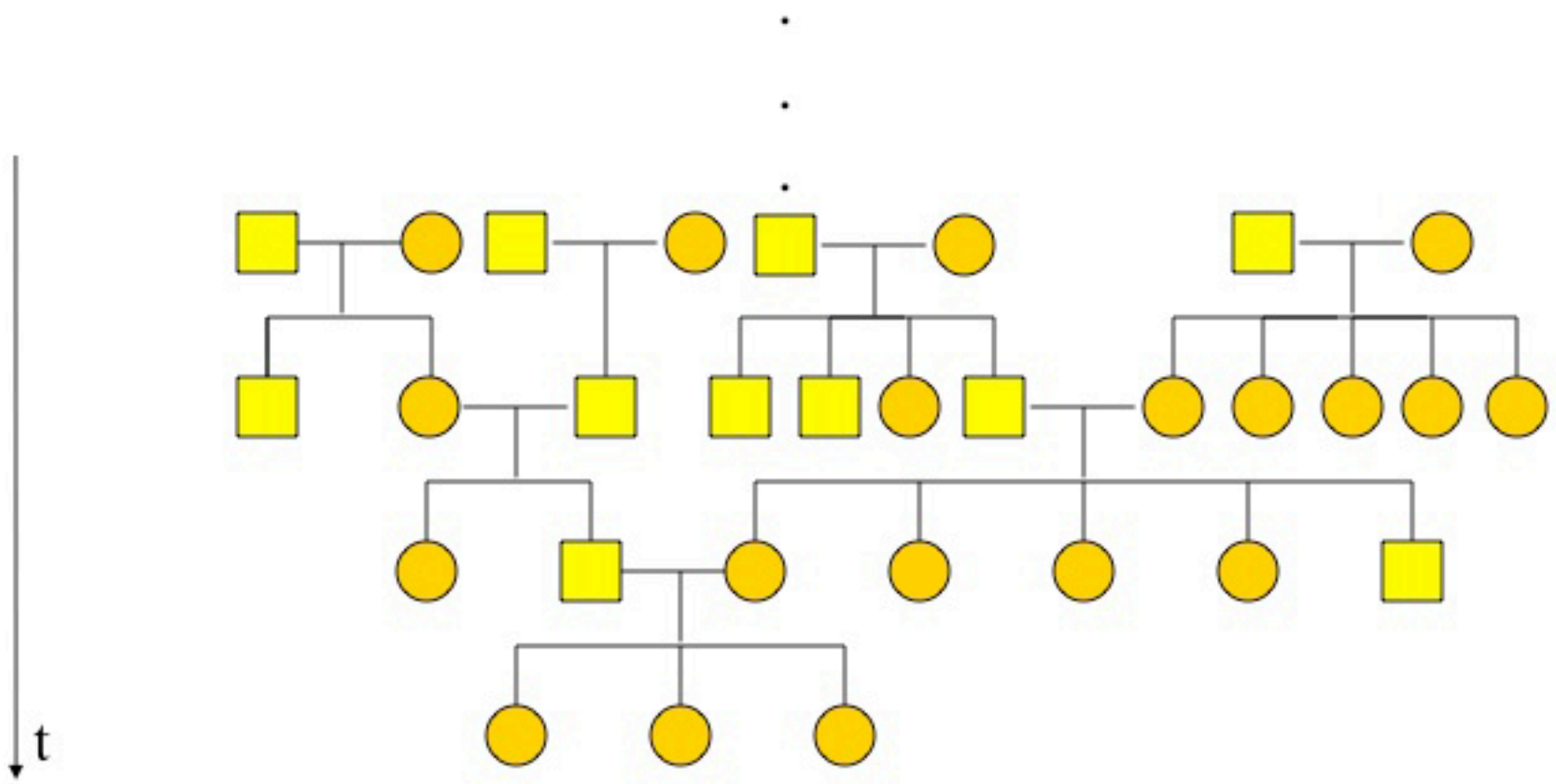
Identification





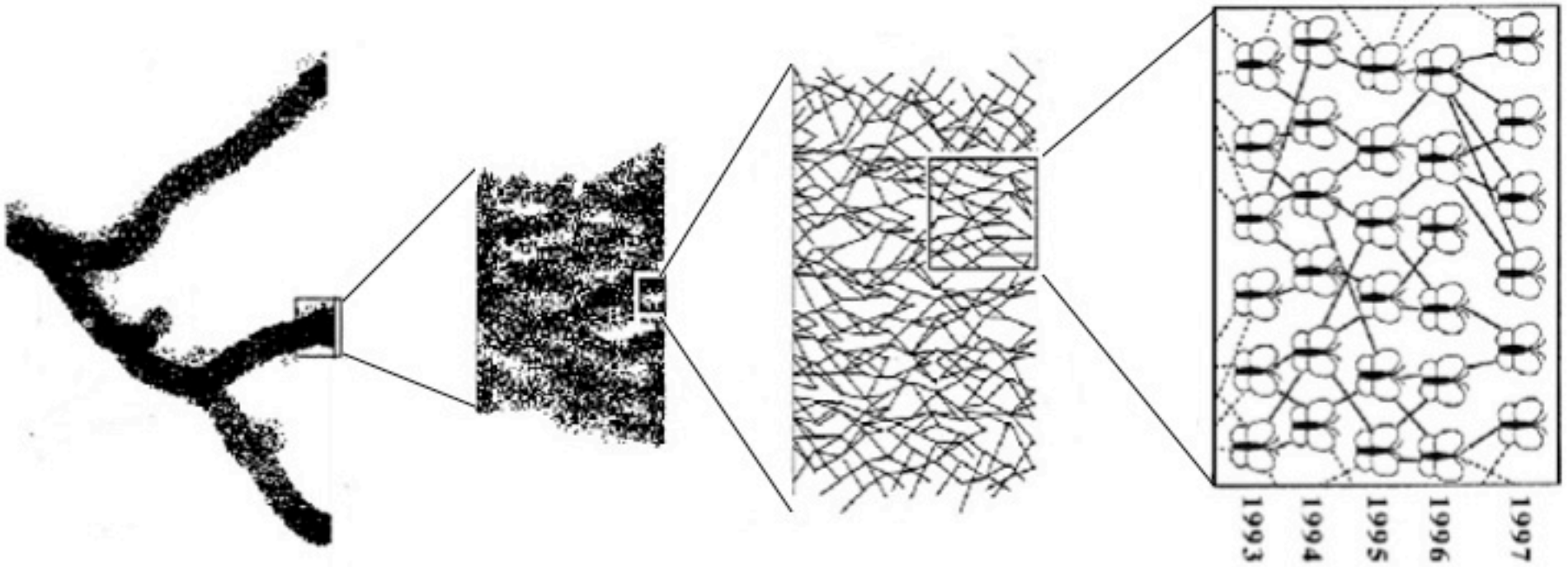
Classification - *Natural relationships*

Compare with a family tree that aims at tracing back ancestry



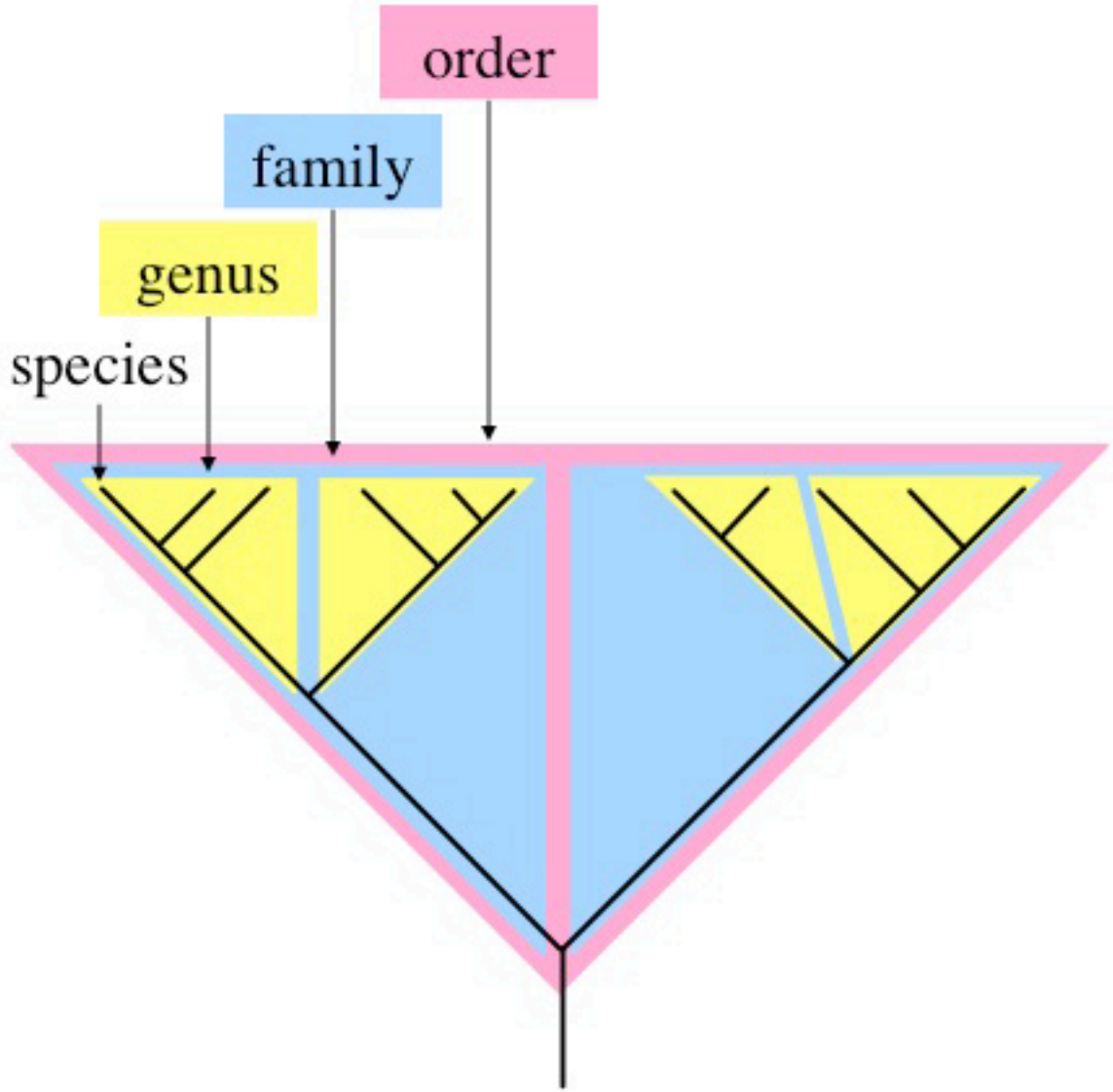
Classification - *Natural relationships*

Over longer time frames these explain natural relationships



Several species Species Population Individuals

Natural relationships rendered to categories



TAXONOMY

delivers

SCIENTIFIC NAMES

stores these in a

CLASSIFICATION

that allows

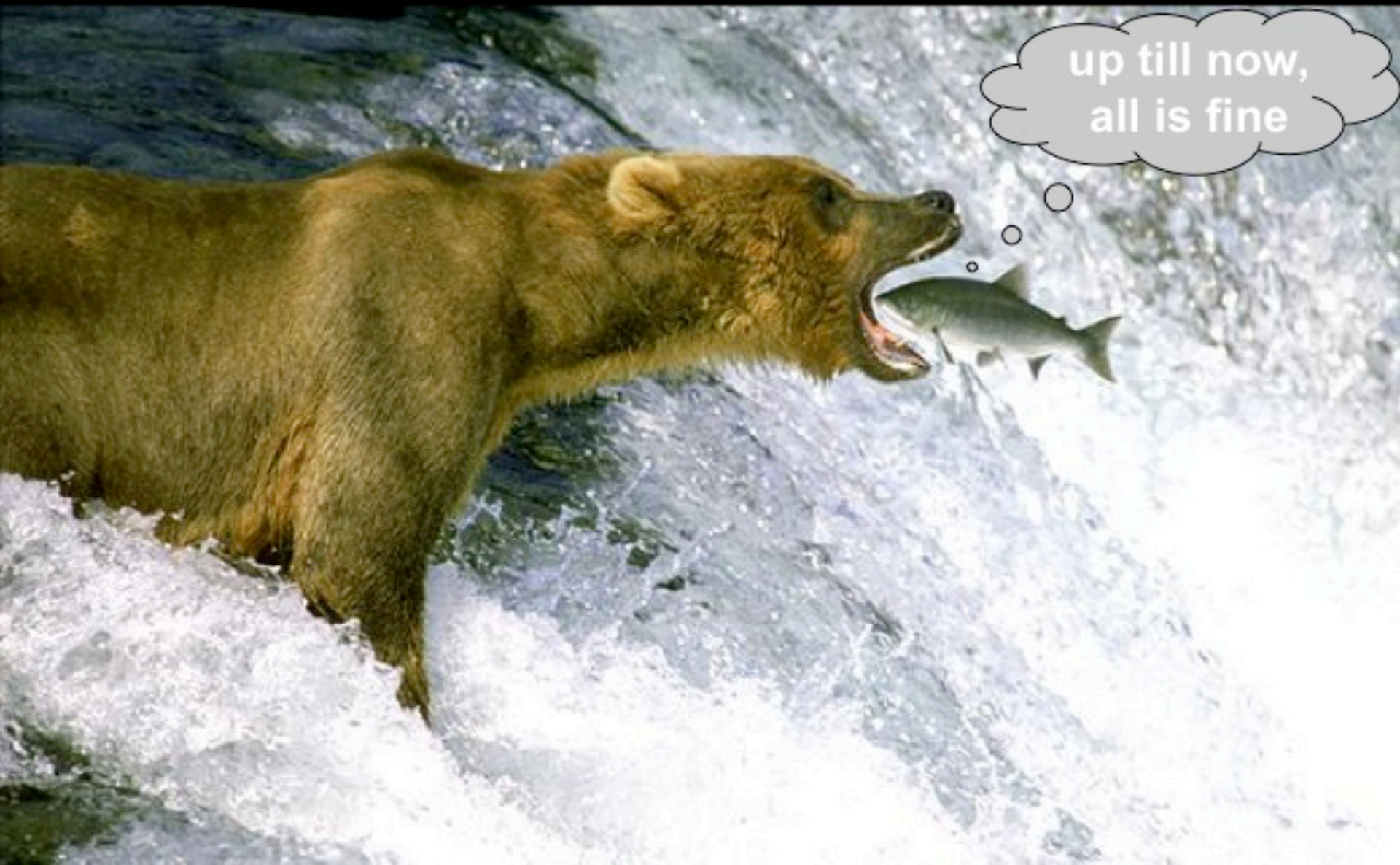
UNDERSTANDING

TAXONOMY develops

SCIENTIFIC TOOLS for:

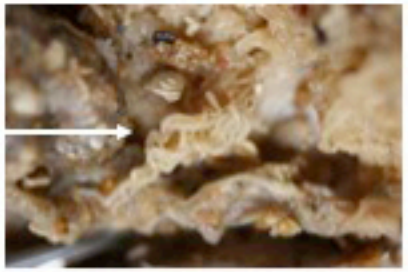
RECOGNITION (e.g. key, barcode)
CLASSIFICATION (e.g. ToL)
COMMUNICATION (e.g. from monographies to EoL)

So WHERE'S THE PROBLEM?



The taxonomic impediment

- Knowledge gaps in the taxonomic system (e.g. taxon bias, concepts, characters,…)



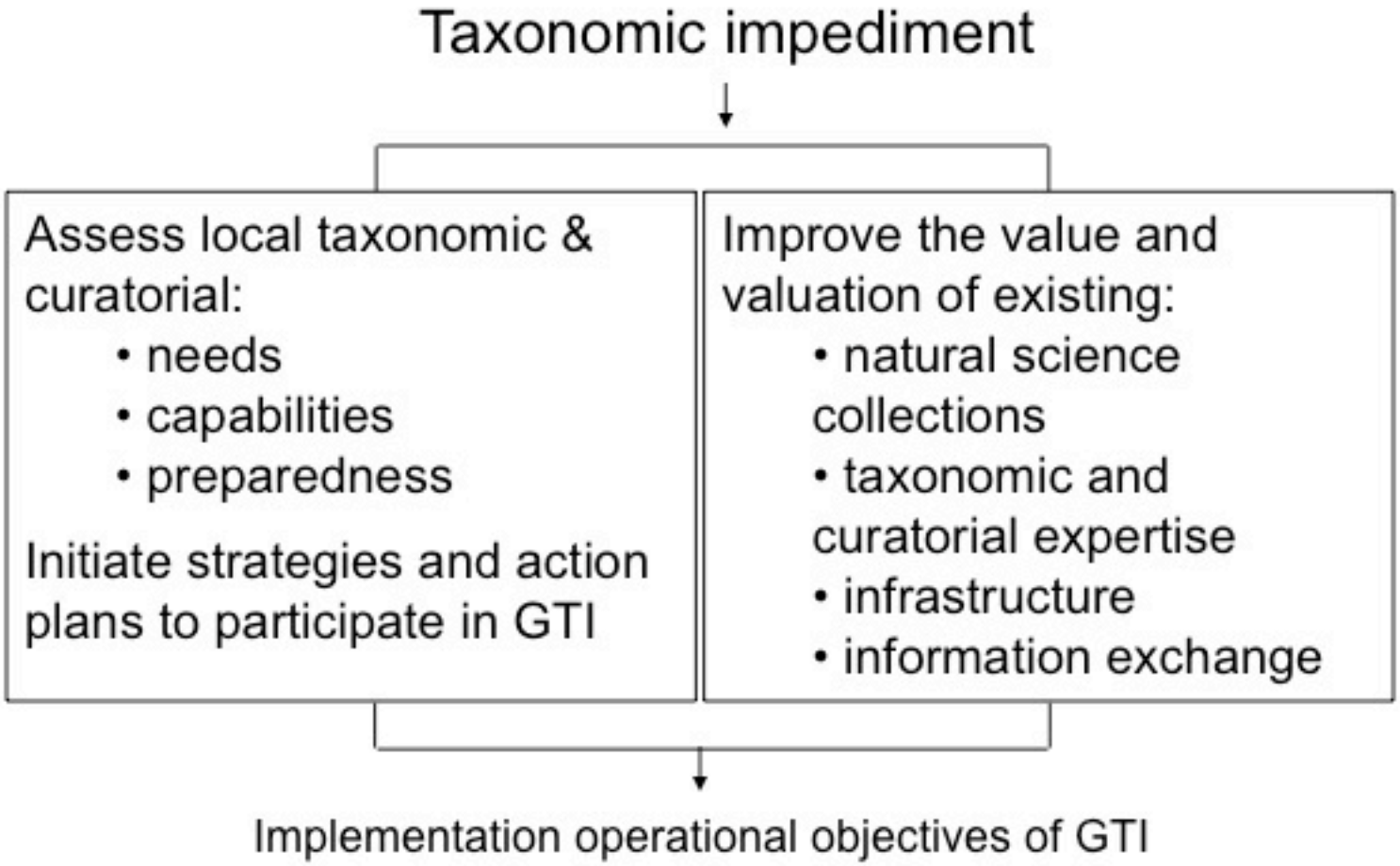

- Acute shortage of well-trained collectors, curators & taxonomists



- Limited or outdated infrastructure


- Limited access to collections and collection-based information


Easing of taxonomic impediment by



But with an **operational**

POW

NEEDS-driven

Enhance **HUMAN & INFRASTRUCTURAL RESOURCES**

GENERATE & ACCESS taxonomic data

ENHANCE importance through **IMPLEMENTATION**

Getting a nearly complete census
is thought to be technically
feasible within a single generation

(cf. Wilson, 2003)

Face lift through NEW TRICKS

Challenges for taxonomy

The discipline will have to reinvent itself if it is to survive and flourish.

H. Charles J. Godfray

Taxonomy, the classification of living things, has its origins in ancient Greece and in its modern form dates back nearly 250 years, to when Linnaeus introduced the binomial classification still used today. Linnaeus, of course, hugely underestimated the number of plants and animals on Earth. As subsequent workers began to describe more and more species, often in ignorance of each others' work, the resulting confusion and chaos threatened to destroy the whole enterprise while still in its infancy. In today's jargon, we might call this the first bioinformatics crisis. Using the tools then available, nineteenth-century taxonomists solved this crisis in a brilliant way that has served the subject well since then. They invented a complex set of rules that determine how a species should be named and associated with a type specimen; how generic and higher taxonomic categories should be handled; and how conflicts over the application of names should be resolved. All these rules revolved around publications in books and scientific journals, and their descendants form the current codes of zoological and biological nomenclature.

But today much of taxonomy is perceived to be facing a new crisis — a lack of prestige and resources that is crippling the continuing cataloguing of biodiversity. In the United Kingdom, a Parliamentary Select Committee is currently conducting an enquiry into the health of the subject for the second time in 10 years, and similar concerns are being expressed around the world. In this article I shall first explore why descriptive taxonomy is in such straits (in contrast, its sister subject, phylogenetic taxonomy, is flourishing). Then, after this essentially negative exercise, I will argue that taxonomy can prosper again, but only if it reinvents itself as a twenty-first-century information science. It needs to adopt some of the solutions that molecular biologists have developed to cope with the second bioinformatics crisis: the huge explosion of sequence, genomic, proteomic and other molecular data.

The problem

Why can't descriptive taxonomy attract large-scale funds in the same way as other big programmes like the Human Genome Project or the Sloan Digital Sky Survey? All three projects are enabling science: not in themselves generating new ideas or testing hypotheses, but allowing many new areas of research to be opened up.

One reason is that taxonomists lack clearly achievable goals that are both realistic and relevant. Of course it would be great to describe every species of organism on Earth, but we are still monumentally uncertain as to how many species there are (probably somewhere between 4 million and 10 million); this goal is just not realistic at present. There are various projects aimed at listing, for example, all the valid described species of animal in Europe, or butterflies on Earth (see Box 1, overleaf). These aims are eminently achievable and very worthwhile, but the results are like raw, unannotated DNA sequences: unexciting and of relatively little value in themselves to non-specialists. Taxonomists need to agree on deliverable projects that will receive wide support across the biological and environmental sciences, and attract public interest.

A second problem is part of the legacy of more than 200 years of systematics. Many taxonomists spend most of their career trying to interpret the work of nineteenth-century systematicists: deconstructing their often inadequate published descriptions, or scouring the world's museums for type material that is often in very poor condition. A depressing fraction of published systematic research concerns these issues. In some taxonomic groups the past acts as a dead weight on the subject, the complex synonymy and scattered type material deterring anyone from attempting a modern revision. As Frank-Thorsten Krell pointed out in Correspondence (*Nature* 415, 957; 2002), "original descriptions have to be referred to for ever, independent of the paper's quality".

The problems do not always lie in the past. Even today, many species are being described poorly in isolated publications, with no attempt to relate a new taxon to existing species and classifications. Many of these 'new' species will have been described before, so sorting out the mess will be the headache of the next generation of taxonomists. It is not surprising if funding bodies view much of what taxonomists do as poor value for money.

One of the astonishing things about being a scientist at this particular time in history is the vast amount of information that is available, essentially free, via one's desktop computer. I can download the sequences of millions of genes, the positions of countless stars. Yet, with a few wonderful exceptions, the quantity of taxonomic information available on the web is pitiful, and what is present (typically simple lists) is of little use to non-taxonomists. But surely taxonomy is made for the web: it is an information-rich subject, often requiring copious illustrations. At present, the output of much taxonomy is expensive printed monographs, or papers in low-circulation journals available only in specialized libraries. These are not attractive 'deliverables' for major research funders.

> This discipline is made for the web: it is information-rich and often requires copious illustrations.

From paper to screen: is it time for taxonomy to break with tradition and sally on the Internet?

Two models of taxonomy

The taxonomy of a group of organisms does not reside in a single publication or a single institution, but instead is an ill-defined integral of the accumulated literature on that group. The literature is bound together and cross-references itself using the venerable rules of taxonomy encapsulated in the codes. But this is not the only way to organize a taxonomy. The taxonomy of a particular group could reside in one place and be administered by a single organization. It could be self-contained and require reference to no other sources.

SYNTHESYS

Synthesis of systematic resources

International Commission on Zoological Nomenclature

ICZN

ZooBank

GBIF

Partnerships for Enhancing Expertise in Taxonomy

eol

Encyclopedia of Life

EDIT

European Distributed Institute of Taxonomy

Species 2000

Integrated Taxonomic Information System

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Blogger

del.icio.us

ZOHO

science commons

slideshare BETA

Web 2.0


ZAZZLE
Tailrank
TagWorld
nuvvo
dogear
yakalike
grouper
ODDPOST
QOOP
iNods
Lulu
BA
blish
flagr
FireAnt
simply hired
Veoh
theadcloud
rbloc.com
pixagogo
gather
Agatra
browsr
oyogi
cafepress
Renkoo
standpoint
meebo
EXTRA TASTY!
last.fm
YEDDA
Jotapot
Frappr!
jeteye
dabble
db
Writeboard
SHOUTWIRE
iKarma
BaNoodle
AirSet
tech.memeorandum
CalendarHub
Suprglu
PIECING YOUR WEB TOGETHER
pando
zigtag
Findory
backfence
clipmarks
wayfaring
gOFFICE
AllPeers
orb
Rallypoint
Zoozio
blogbeat
Ziggs
zooto
vSocial
Boltfolio
wink
riya
Audible Wordcast
Opinity
Because your reputation matters!
reddit
measure map
gumroo
bluepulse
imvu BETA
STREAMLOAD
Freedom for Your Digital Lifestyle
Ta-da Lists
FeedSky
jellyBam.INC
PubSub
nativetext
BETA
CONGOO
PODZINGER
RSS MAD
FeedTier
phanfare
Fruitcast
WIKIPEDIA
The Free Encyclopedia
yubnub
AC
dPolls
flickr
Ning
Ookles
Strongspace
zoominfo
CASTPOST
ALPHA
BLOOP
BETA
ProjectSpaces
FeedBurner
Bloglines
purevolume.com
FOTOLOG
ourmedia
Yub.com
Spot Runner
myspace
a place for friends
NewsAlloy
Allmydata.com
gabbr.com
a social news community
Gcast
blinkx
openomy
riffs
ajchat alpha
jambo
NETWORKS
ROLLYO
ClipShack
beta
chatsum
PANDORA
looklater beta
PROTOPAGE
squishr
WebJay
PLAZES
Noodly
30 BETA
windir
diigo
box
Jots
Xdrive
vizu beta
digg
del.icio.us
omni drive
AlmondRocks
Tagyu
30 GIGS.com
writely
Simpy
Gtalkr
TRUVEO
egoSurf
Quimble
pegasus
remember the milk
SQUIDOO
picturecloud .com
newsvine
Clipfire
mozy
Basecamp
My Videokaraoke

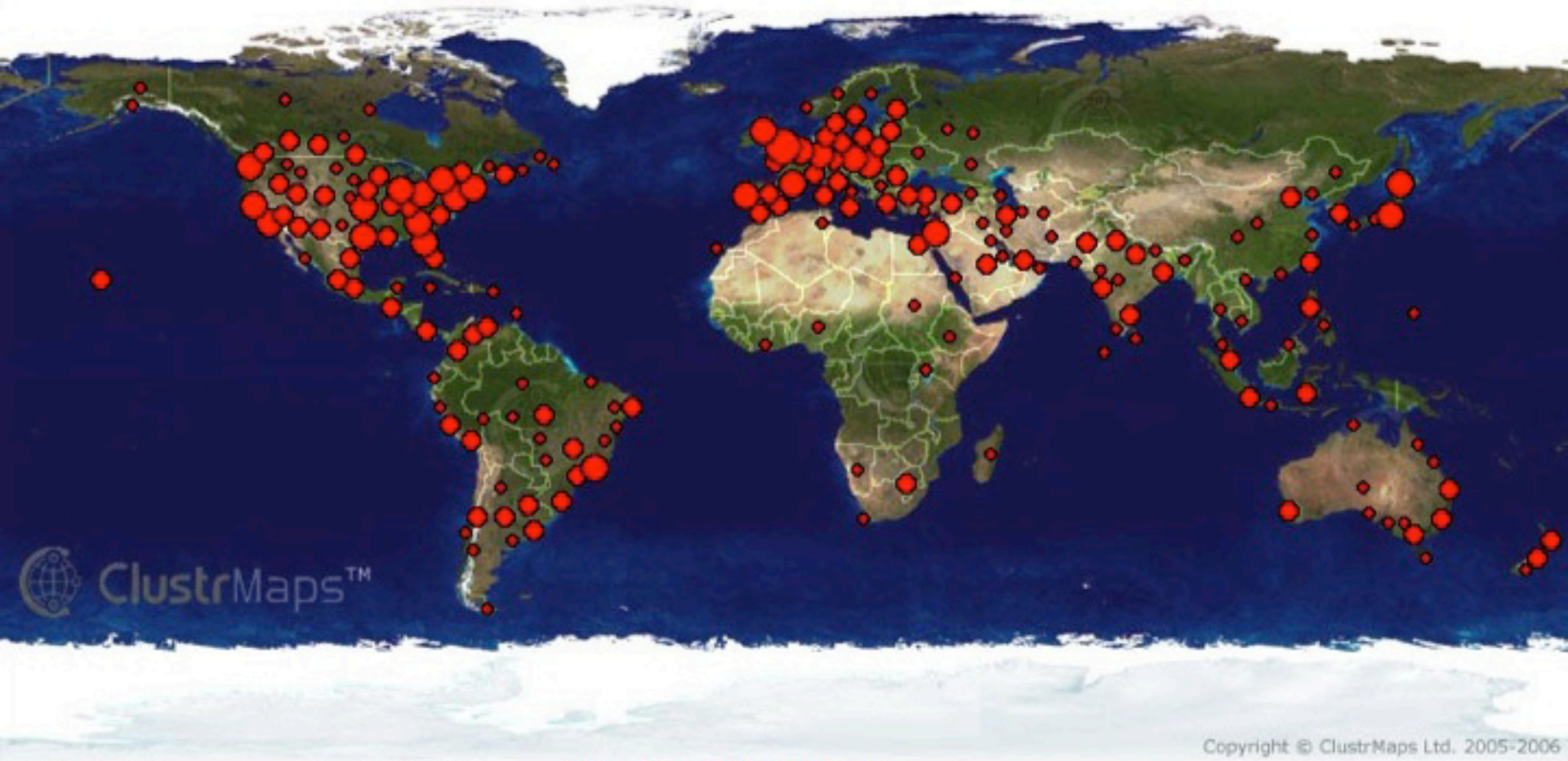
International Institute for Species Exploration

ARIZONA STATE UNIVERSITY

http://www.species.asu.edu/

Done?

For most of US or yEU



Clickable **map of all visitors: http://vsmith.info/**

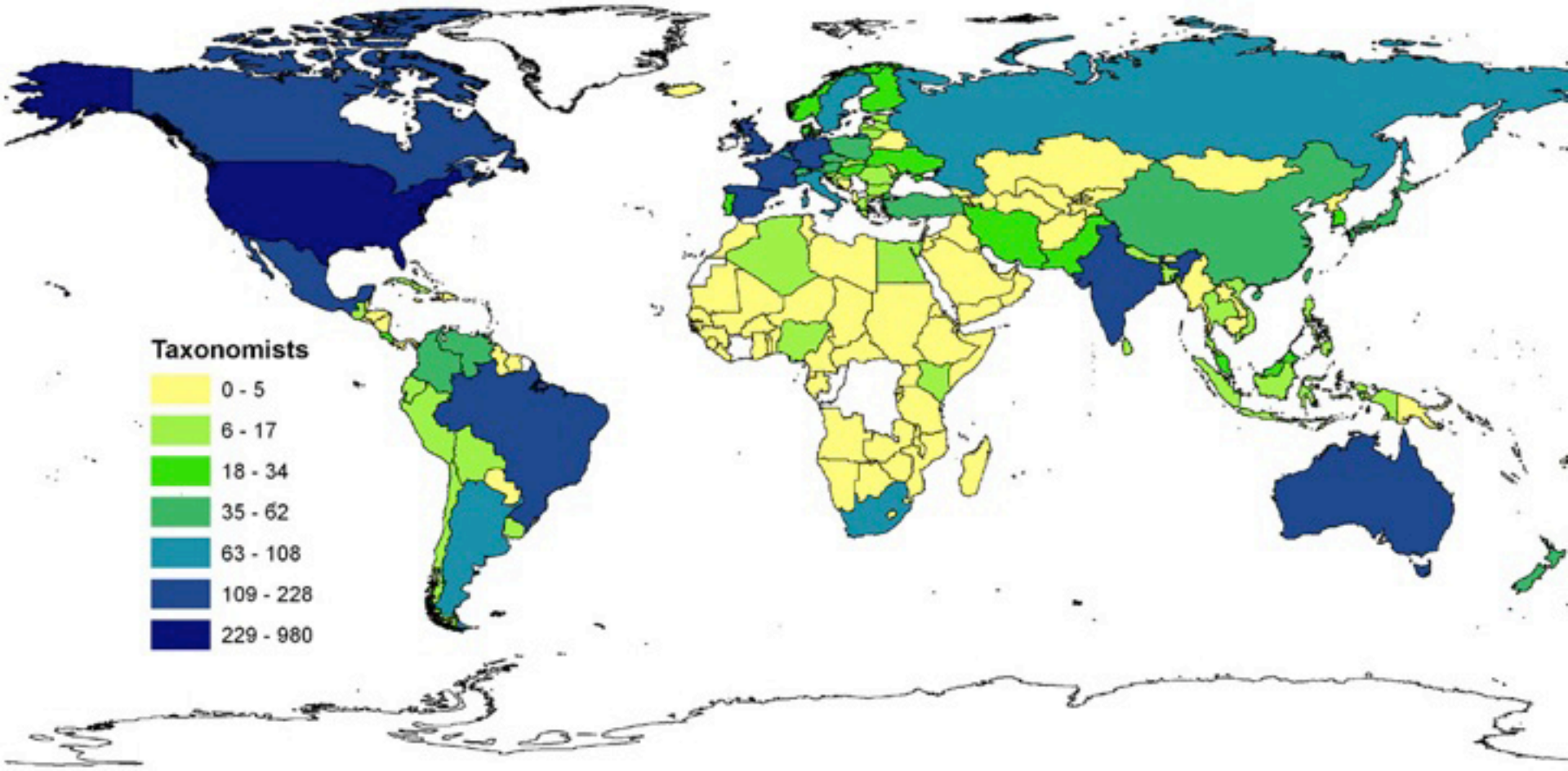
Another INCONVENIENT TRUTH

North

GAP BETWEEN THE RESOURCE-RICH, BUT BIODIVERSITY-POOR **NORTH** AND THE RESOURCE-POOR BUT BIODIVERSITY RICH **SOUTH**

South

Little expertise / expertise limitée



(*ETI*, XI.2005)

Countries accounting for 80% of the named species have only 6% of the world's specialists

(cf. Wilson, 2003)


N
olution

Point Focal National Belge pour
l'Initiative Taxonomique Mondiale


OS!
perational
ystem

The Belgian PROGRAMME

2001: the Royal Belgian Institute of Natural Sciences (Brussels) is designated as Belgian National Focal Point to the GTI

2003: the Belgian Development Cooperation (DGDC) and the RBINS sign a five year specific convention, with as focus area, *i.a.*, CBD's GTI programme

2008: second five year framework convention running

Close cooperation agreed with:

- Royal Museum for Central Africa (Tervuren)
- National Botanic Garden (Meise)

… but also interaction with other competent taxonomic institutions

ULTIMATE GOAL?

arm the developing world with sufficient taxonomic capacity to enable them to inventor, monitor and sustainably manage their biodiversity

Least Developed		Other Low-Income	Lower Middle-Income		Upper Middle-Income
Afghanistan	Madagascar	Cameroon	Algeria*	Palestinian	Botswana
Angola	Malawi	Congo, Rep.	Belize	Administered	Brazil
Bangladesh	Maldives	Côte d'Ivoire	Bolivia*	Areas	Chile
Benin*	Mali*	Ghana	China	Paraguay	Cook Islands
Bhutan	Mauritania	India	Colombia	Peru*	Costa Rica
Burkina Faso	Mozambique*	Indonesia	Cuba	Philippines	Dominica
Burundi*	Myanmar	Kenya	Dominican	South Africa*	Gabon
Cambodia	Nepal	Korea, D.R.	Republic	Sri Lanka	Grenada
Cape Verde	Niger*	Mongolia	Ecuador*	St Vincent &	Lebanon
Central African	Rwanda*	Nicaragua	Egypt	Grenadines	Malaysia
Republic	Samoa	Nigeria	El Salvador	Suriname	Mauritius
Chad	Sao Tome &	Pakistan	Fiji	Swaziland	Mayotte
Comoros	Principe	Papua New	Guatemala	Syria	Nauru
Congo, D.R..*	Senegal*	Guinea	Guyana	Thailand	Panama
Djibouti	Sierra Leone	Viet Nam*	Honduras	Tokelau	St Helena
Equatorial Guinea	Solomon Ids	Zimbabwe	Iran	Tonga	St Lucia
Eritrea	Somalia		Iraq	Tunisia	Venezuela
Ethiopia	Sudan		Jamaica	Wallis and	
Gambia	Tanzania*		Jordan	Futuna	
Guinea	Timor-Leste		Marshall		
Guinea-Bissau	Togo		Islands		
Haiti	Tuvalu		Micronesia,		
Kiribati	Uganda*		Federated		
Laos	Vanuatu		States		
Lesotho	Yemen		Morocco*		
Liberia	Zambia		Namibia		
			Niue		

Source: OECD

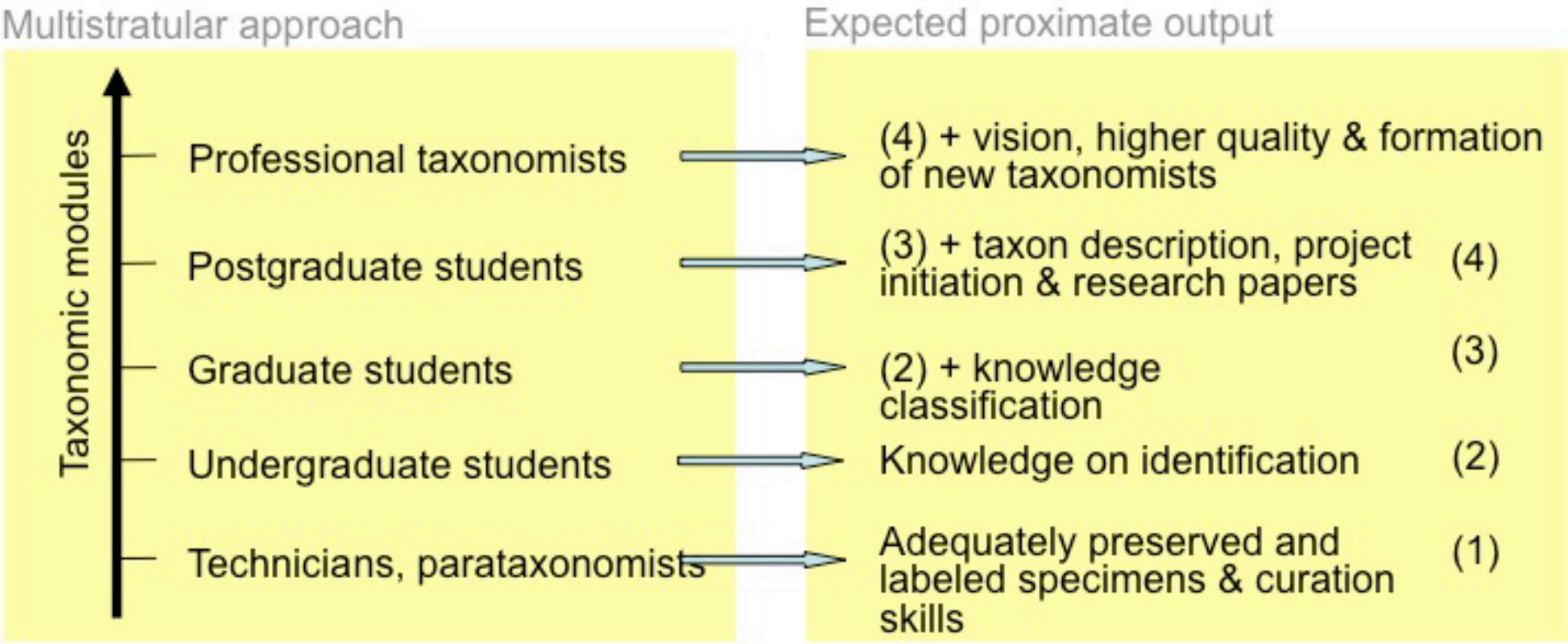
From 2008 onwards

Afrique du Sud
Algérie
Bangladesh
Bénin
Bolivie
Bresil
Burkina Faso
Burundi
Cambodge
Cameroun
Chine
Colombie
Côte d'Ivoire
Cuba
Equateur
Ethiopie
Guatemala
Guinée
Haiti
Inde
Indonésie
Kenya
Madagascar
Mali
Maroc
Mozambique
Nicaragua
Niger
Ouganda
Pérou
Philippines
R.D. du Congo
Rwanda
Salvador
Sénégal
Suriname
Tanzanie
Territoires palestiniens
Vietnam.
Zambie
Zimbabwe

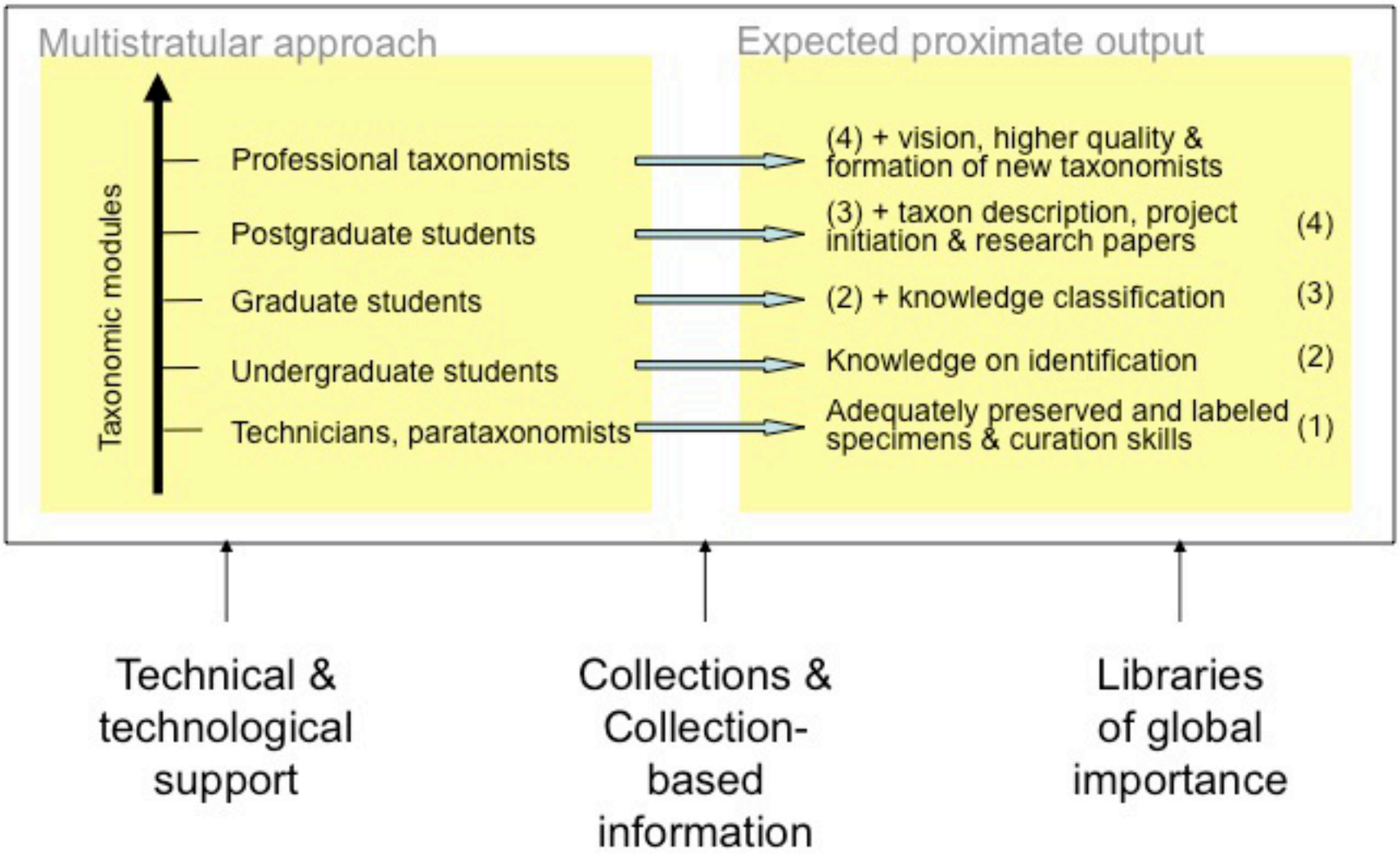
NEEDS-DRIVEN, expertise - & collection dependent CAPACITY BUILDING

General taxonomic training

Belgium and the GTI – our philosophy



Belgium and the GTI – our philosophy



Theoretical Training Course in Contemporary Taxonomy

Many habitats worldwide are under threat by ever-increasing human activities. The impact of various factors, from changes in land and water use, to wide spread abuse and overexploitation of natural resources is undermining the value and sustainability of the world's ecological capital, and is hiking the risk of sudden, drastic changes in ecosystem functioning. This pressure on ecosystems is especially harming developing nations where people directly depend on provisioning (including food, water, fuel, fiber and medicine), regulating (prevention of soil erosion and flooding) and supporting (e.g. soil formation, nutrient cycling) ecosystem services that healthy ecosystems provide them. Combating poverty, hunger and sociocultural imbalance thus entails restoring and protecting the ecological functioning of healthy ecosystems. To achieve this, scientists rely primordially on such basic information as local, regional and global taxonomic inventories that tell them what is living where. Yet, in the 21st century the so-called taxonomic impediment, *i.e.* the lack of taxonomic (inclusive of genetic) information, taxonomic and curatorial expertise and infrastructure in many parts of the world, makes that getting even this baseline information remains extremely difficult. To alter this trend, the Global Taxonomy Initiative (GTI) was set up under the Convention on Biological Diversity (CBD). Its main objectives are to remedy the knowledge gaps in our taxonomic system, the shortage of trained taxonomists and curators and, thereby, to improve decision-making in conservation.

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Acknowledgments

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Finally, I thank Irena (Reen) Tallon for her help in the technical aspects behind this reader. Without her, the reader would have been made on a type writer and the slides would have been drawn on a blackboard. To all, sincere thanks for your support!

Theoretical Training Course in Contemporary Taxonomy

Background

What is nomenclature?

Taxonomic names face a dual problem:

- each name represents a volatile scientific hypothesis that should be modifiable if evidence suggest so
- scientific names serve to unlock biosystematic information and thus should be as stable as possible.

To rime this duality, the international codes of nomenclature are used. These codes act as objective rule-books that govern and provide clear instructions on how organisms get their correct scientific name which must have maximun universality and continuity. The nomenclatural rules of the codes are tools that are designed to provide the maximum stability compatible with taxonomic freedom.

back to top

Why do we need nomenclature?

In order to avoid confusion over the identity of a taxon, each taxon must have one unique name that is the same throughout the world. This appears rather trivial but it has happened on numerous occasions that multiple names have been proposed for the same taxon (synonyms) or that different taxa were given the same name (homonyms). In order to avoid and, if already too late, resolve these problems universally accepted rules for name-giving must be installed: the codes of nomenclature.

Ruling principles of nomenclature

Sorts of types (in the species group)

Original designation
(fixed in the original publication)

Holotype: the single specimen upon which a new species-group taxon is based in the original publication

Paratypes: remaining specimens of the original type series (see also allotype, isotype)

Syntypes: specimens of a type series that collectively constitute the name-bearing type

Hapantotypes: (special case for protistans; see Art. 73.3)

Subsequent designation
(fixed in a subsequent publication)

Lectotype: a syntype designated as the single-name bearing type specimen, after the establishment of a nominal species or subspecies (except hapantotypes)

Paralectotypes: each specimen of the former syntype series remaining after lectotype designation (see also isolectotype)

Neotype: the single specimen designated as the name-bearing type when no name-bearing type specimen (i.e. holotype, lectotype, syntype or prior neotype) is believed to be extant.

Theoretical Training Course in Contemporary Taxonomy

Read more

Reprints

Alroy J. 2002. How many named species are valid? PNAS 99: 3706-3711.

Dayrat B. 2005. Towards integrative taxonomy. Biological Journal of the Linnean Society 85: 407-415.

Dayrat B. 2005. Advantages of naming species under the PhyloCode: An example of how new species of Discodoridídae (Mollusca, Gastropoda, Euthyneura, Nudibranchia, Doridina) may be named. Marine Biology Research 1: 216-232.

Dellaglio F., Felis G.E., Germond J.-E. 2004. Should names reflect the evolution of bacterial species? International Journal of Systelatic and Evolutionary Microbiology 54, 3 pp.

Forey P.L. 2002. PhyloCode - pain, no gain. Taxon 51: 43-54.

Knapp S., Lamas G., Lughada N., Novarino G. 2004. Stability or stasis in the names of organisms. Philosophical Transactions of the Royal Society, London B, 359: 611-622.

Laurin M., Cantino P.D. 2004. First international Phylogenetic Nomenclature Meeting: a report. Zoologica Scripta 33: 475-479.

Lughadha E.N. 2004. Towards a working list of all known plant species. Phil. Trans. R. Soc. Lond. B. 359: 681-687.

Massin C. 1993. On the taxonomic status of the genus Parathyone (Echinodermata, Holothurioidea, Dendrochirotida). Bulletin van het Koninklijk Belgisch Instituut voor Natuurwetenschappen Biologie 63: 257-258.

NEEDS-DRIVEN, expertise - & collection dependent CAPACITY BUILDING

General taxonomic training

Specific taxonomic training

Fig. 3. La formation en taxonomie, assurée par un des deux taxonomistes associés, comprenait, notamment, (A) un cours théorique et (B et C) des visites sur le terrain (B : champ de maïs en bordure directe de la forêt). (D) Quatre mois après la formation, le promoteur a rencontré les stagiaires lors de la mission d'évaluation. (Photos : A à C tirées de l'Annexe 1, D par S. Tchibozo)

NEEDS-DRIVEN, expertise - & collection dependent CAPACITY BUILDING

General taxonomic training

Specific taxonomic training

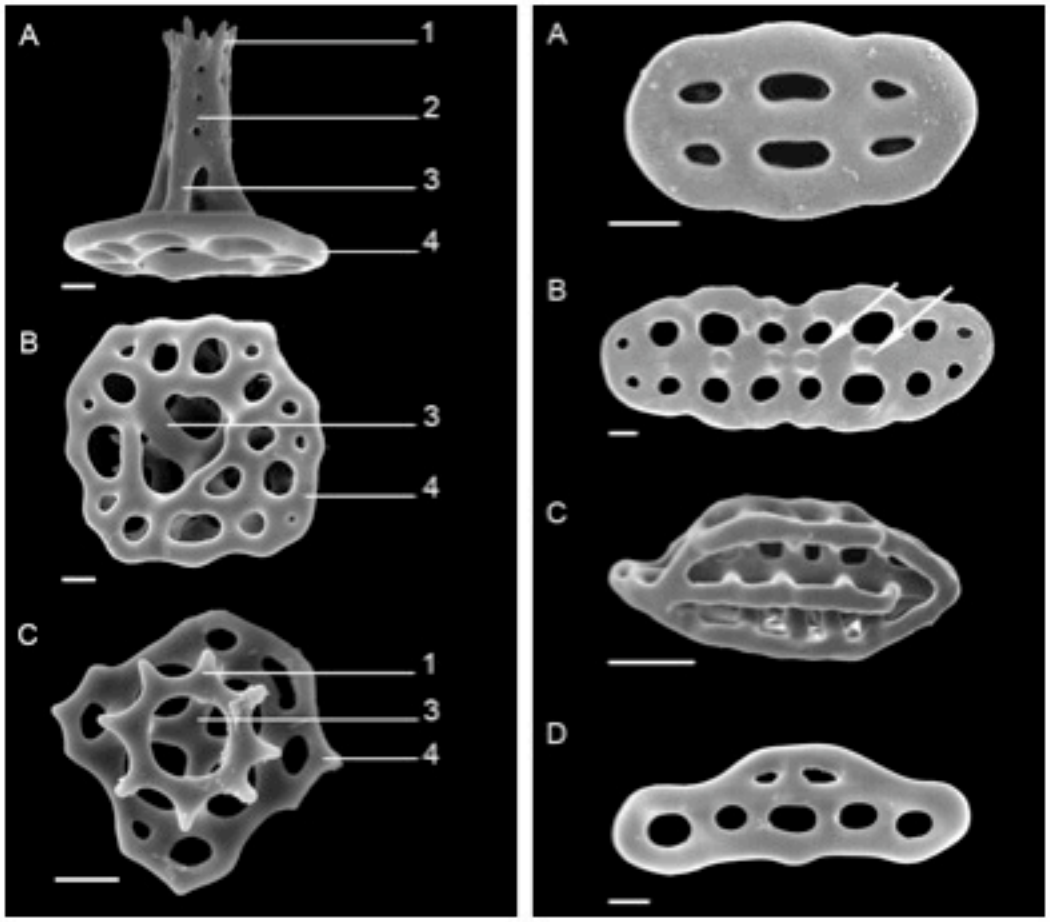
Liberation of taxonomic know-how

AbcTaxa

… exemplified

AbcTaxa

… exemplified



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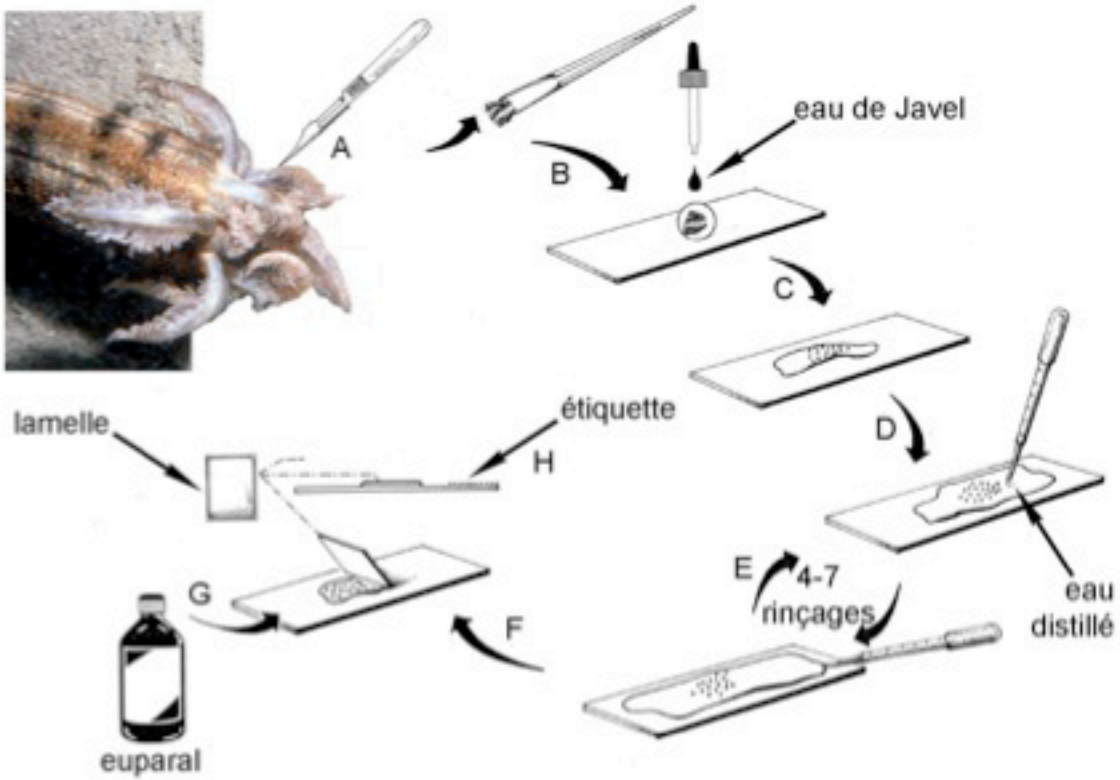

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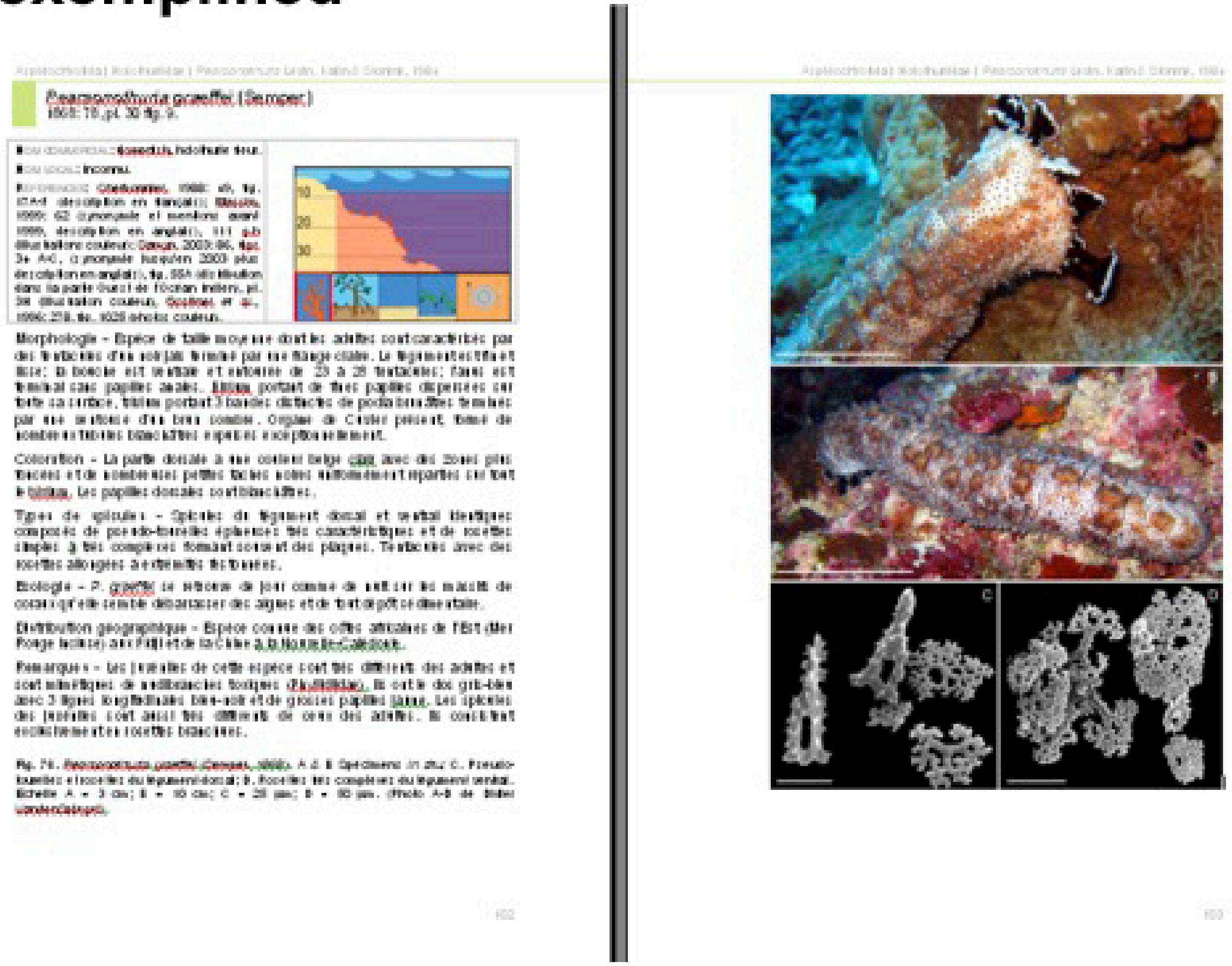

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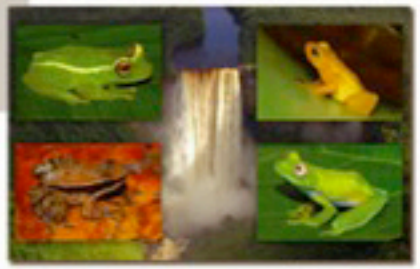
Philippe J. R. Kok
Michelle Kalamandeen



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causes, conséquences et traitement

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Guía taxonómica de los anfibios de Cuba

Luis M. Díaz y Antonio Cádiz

Volume 4 (2008)

NEEDS-DRIVEN, expertise - & collection dependent CAPACITY BUILDING

General taxonomic training

Specific taxonomic training

Liberation of taxonomic know-how

Generation of taxonomic data

Zootaxa 1238: 35–61 (2006)
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ZOOTAXA
ISSN 1175-5334 (online edition)

1238

A new species of *Colostethus* (Anura: Dendrobatidae) with maternal care from Kaieteur National Park, Guyana

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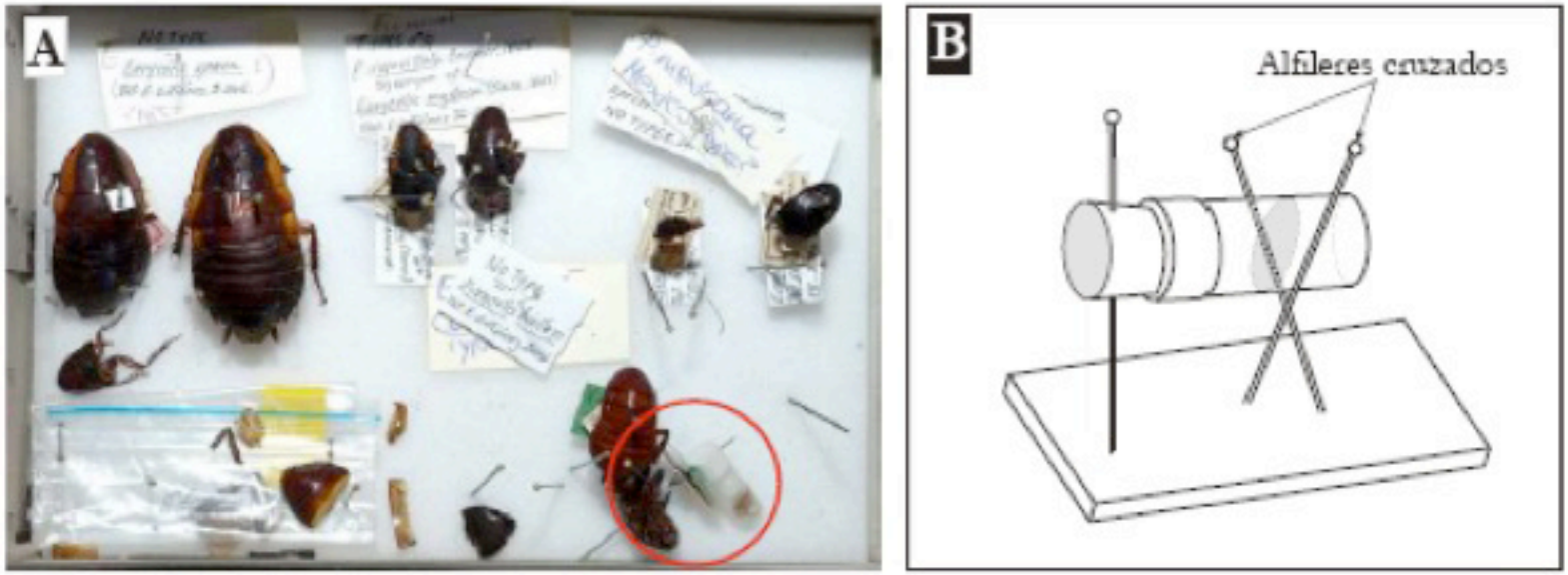
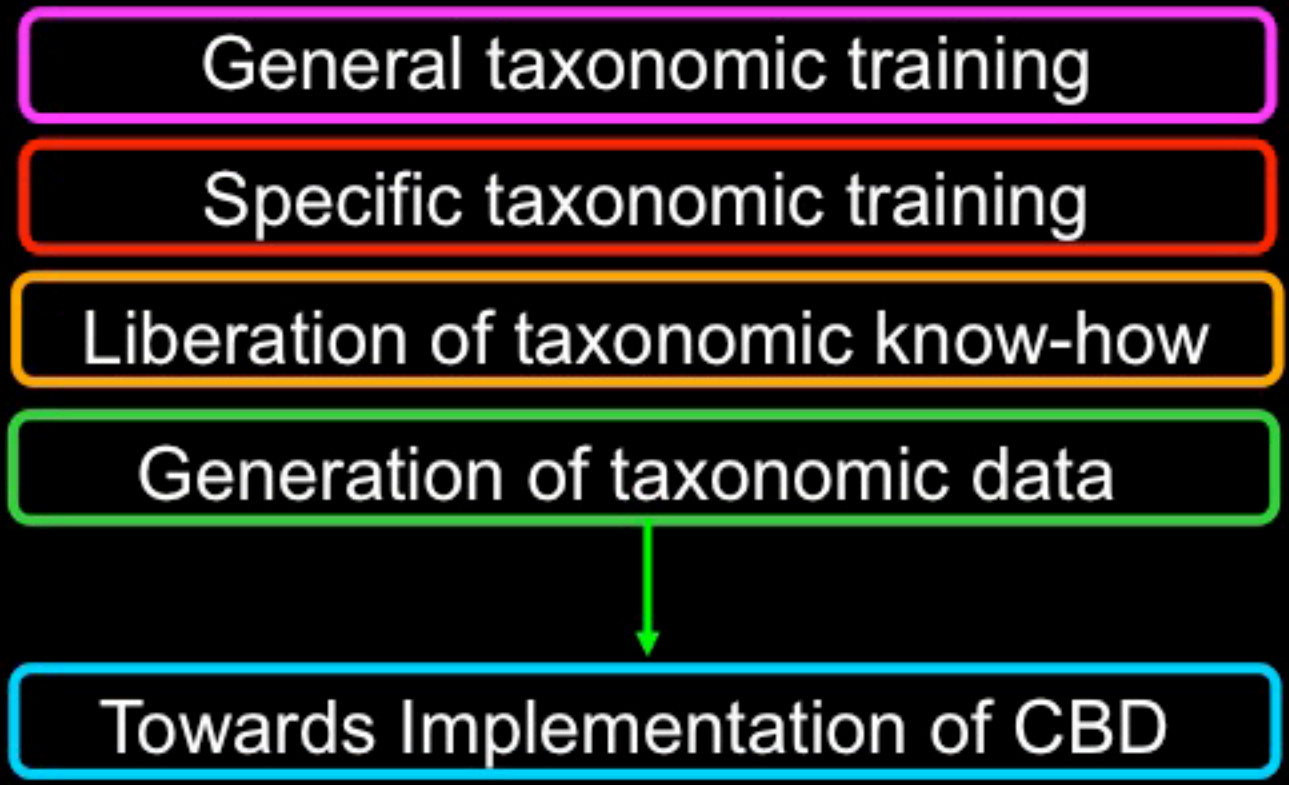


Fig. 1A-B. Ejemplares provenientes del Museo de Historia Natural de Viena, Austria, dañados durante su transportación. A, el círculo rojo indica el ejemplar causante de la destrucción de ejemplares vecinos al safarse del fondo de la caja; B, forma correcta de transportar viales con estructuras morfológicas, separados del ejemplar y fijados con alfileres extras, nunca en el mismo alfiler torácico del ejemplar al que corresponden dichas estructuras.

NEEDS-DRIVEN, expertise - & collection dependent CAPACITY BUILDING



In situ long-term capacity building program

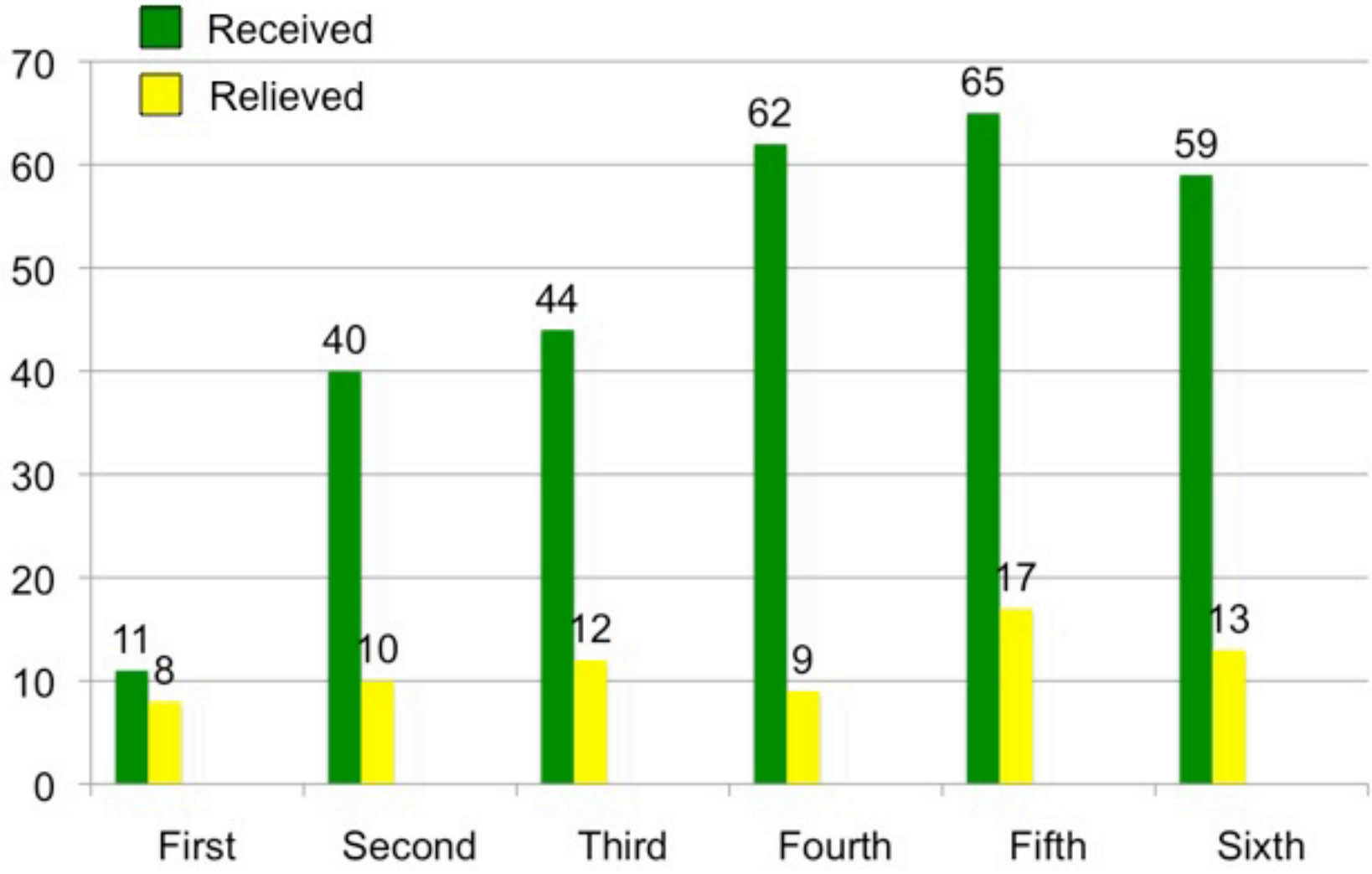
aims @ implementation

Guyana - March 2004 to March 2008

A Belgian taxonomist heads surveys of the herpetofauna of Kaieteur Falls. During these scientific missions he simultaneously trains local actors in the basics of herpetological taxonomy. To stimulate further taxonomic work, he leaves behind a reference collection as well as didactic material. Training done in the partner country only.

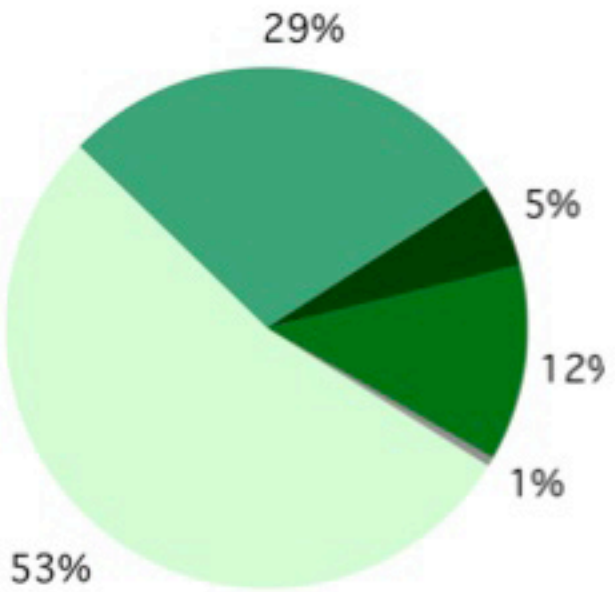
Impact?

INDIVIDUAL projects | by numbers

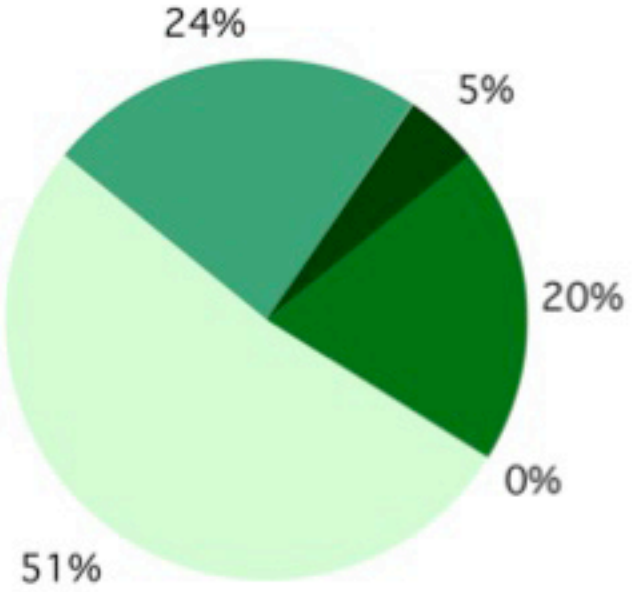


INDIVIDUAL projects | by continent

captured needs (5 calls, 222 projects)



relieved needs (5 calls, 56 projects)



Africa | Asia | South America | Central America | Europe

So also for

AFRICA

ASIA

CENTRAL AMERICA

SOUTH AMERICA

In conclusion

- Intensified human action profoundly affects the planet and leads to loss of biodiversity
- This loss is an immediate threat to biodiversity-based livelihoods and also endangers ecosystem services
- Taxonomy detects, describes, identifies and classifies organisms and thus allows predictions that lead to sustainable management and more equitable development
- The Belgian GTI National Focal Point is committed to building taxonomic capacity in the South

the future embedded in
DECISION IX/22 - COP 9

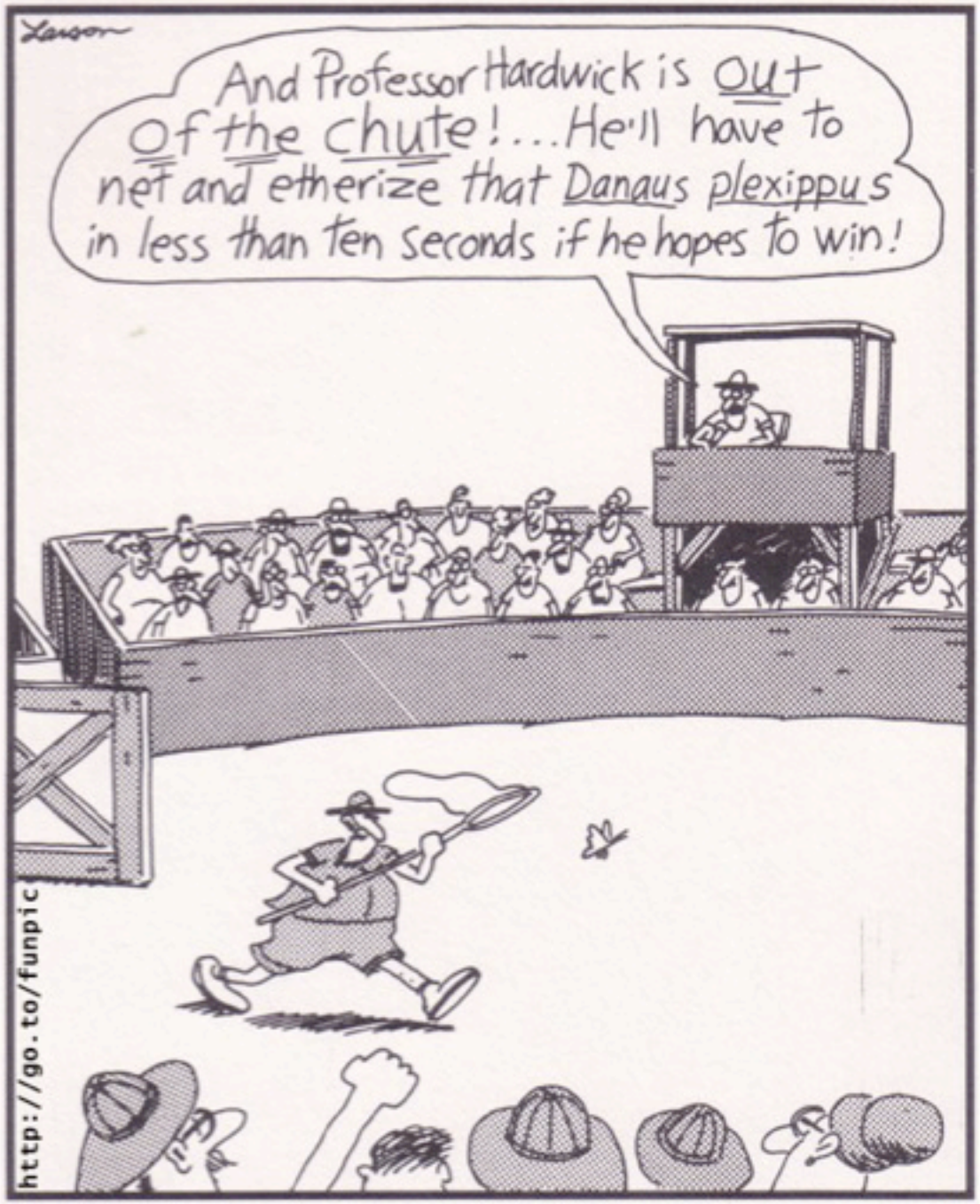
Timed, outcome-oriented deliverables

For instance:

- produce keys to all genera of bees of the world by 2012
- Produce a guide to the major groups of marine algae by 2012
- establish an inventory of species with economic and ecological values for dry and sub-humid lands by 2015

Acknowledgment

Thank you
for your attention



Entomological rodeos