Africa, freshwater and dragonflies
natural history and conservation in
the continent of change

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International Barcode of Life: “building a bioliterate world”

what is literacy of the living world (for me)?

1. life = species
2. language = species names
3. literature = species knowledge: what they look like, where and how they live, what they stand for
species knowledge’s new urgency

1. humanity’s last chance to obtain much of the knowledge
2. human awareness gives species the best chance to survive
3. knowledge can be gathered and shared better than ever
revolutions of species knowledge

1. names (language) provided access
2. classifications created context and structure
3. genetics increased objectivity and stability
4. informatics improved organization and efficiency
our capacity to distinguish between millions of varieties remains main impediment to access species knowledge.

Once identification is easier, data on species’ ecology, status, range, use etc. become much more relevant.

Future taxonomic priorities will be determined by potential to lower identification threshold and add value to groups.

DNA barcoding...
image recognition: greatest revolution since dawn of taxonomy?

emulates how we mostly engage with species, overcomes our inability to deal with diversity, and builds on a ‘taxonomic’ community
opportunities for under-appreciated groups

1. invertebrates were easy to ignore by small size and great diversity

2. reduction of nature asks for more local and approachable icons and indicators

3. notably insects (half of all species) now applied below their potential

4. nature is changing most where there is least access to species knowledge
the charted biosphere expressed as fraction of Earth’s land surface:

between 15% and 20% of 9 million animal, plant and fungus species estimated to exist have been named scientifically
the familiar biosphere expressed as fraction of Earth’s land surface:

80,000 species have enough data to assess status for IUCN Red List
29% of these are at risk of extinction
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“It makes sense, when surveying and mapping species for conservation practice, to focus first on those groups of which we have the greatest knowledge and can move most quickly to completion. Among them are the flowering plants, vertebrates, corals, butterflies, dragonflies and damselflies, spiders and mosquitoes.”

Nature Ecology & Evolution (1 Nov 2017)

Biodiversity research requires more boots on the ground

Our incomplete taxonomic knowledge impedes our attempts to protect biodiversity. A renaissance in the classification of species and their interactions is needed to guide conservation prioritization.

Edward O. Wilson
most precious thing on Earth

<1% of Earth’s water that, purified by interacting with land and air, allows everyone and most other species to live

climate change
water is Earth’s lifeblood

resource scarcity
freshwater may be most critical

biodiversity loss
32% at risk vs 24% on land
freshwater’s image problem

• 80% of freshwater animal species are ‘unspectacular’ insects

• including many disease vectors like mosquitoes…

easy to forget that 10% of animal species live only on less than 1% of Earth’s surface
freshwater’s superpower...

- luxuriant life cleans the system, while precipitation and flow continuously flush it through...

... is also its downfall

- this resilience is impeded by water extraction, pollution, dams, climate change etc.
symbol of freshwater’s resilience

• most aquatic species mirror their habitat’s purifying rebirth

• with flight can return as quickly when things improve as they vanished when it got bad
dragonflies and damselflies’ beauty and sensitivity stand for the state and needs of nature before our own

- they do not help us survive like bees, fish
- are not feared or persecuted mosquitoes, snakes
- are not proxies for our psyche or society ants, apes
730 dragonfly and damselfly species known in tropical Africa
100% threat-assessed; 90% collected; 80% DNA-barcoded; 80% field photo;
78 new species named
first continental Red List for tropical insect group

species assessed: 703
100 sp. (near) threatened: 14%


Conserving African dragonfly diversity
Human behavior and sustainability
Reserves as catalysts for landscape change
Conservation Ecology & Entomology, Stellenbosch, South Africa
funded by JRS Biodiversity Foundation 2013-2016

ADBI  African Dragonfly Biotic Index for environmental assessment

ADDO  African Dragonflies & Damselflies Online: maps, ecology, images, diagnoses and ADBI for all species

AFRESH1  1st African Freshwater Entomology Workshop (Feb. 2016): 70 entomologists from 20 African countries and Madagascar
Dijkstra, Kipping & Mézière 2015
*Sixty new dragonfly and damselfly species from Africa (Odonata)*
Odonatologica 232 pp

1 species added to every 12 known in Africa to disprove three misconceptions:

1. most of Earth’s species known

2. unknown species are hidden, detectable only by genetics

3. enough effort is made to uncover unknown in time

- found all across a continent
- none noted first in the lab
- most recognisable from photo

Swordbearer Emperor
*Anax gladiator*
Zambia
each species has its story of discovery
first noted on photo taken 32 years earlier in eastern DR Congo
26 years later found 1500 and 4500 km further west in Gabon and Sierra Leone
flashy species flies in wet season, when hard to access forest swamps

Red-veined Basker
*Urothemis venata*

Nimba
Liberia
conservation

all world’s 6000 species live in freshwater

however rare, species cannot be added to IUCN Red List without a name

these new species only live at crystal clear streams on sandy plateau on border of Gabon and Congo
conservation

Africa’s great lakes are famous for wealth of unique fish species. Insects emerge to mate and did not profit from underwater niches as fish did. Exceptional new species is unique to such a freshwater sea.
a name is the first step to familiarity

“You don’t notice them until you know they can have a name!”

was lost from 1920 until found at single site near Cape Town in 2003

new genus name *Spesbona* given is 2013 is Latin for ‘Good Hope’

second site discovered 330 km east in 2017!
names best be meaningful!

just like birds, jewel damselflies impress mates and rivals with colourful displays

why this species’ male can have blue, yellow or red tip remains a mystery

Moyabi, Gabon

Polychrome Jewel
Africocypha varicolor
... or grab attention!

new *Umma* species named for classic rock album

said to be slang for making love
importance of specialisation

each new species is taken on trust until contrary evidence arises

credibility is built on experience in field and collections; not in lab or behind computer

60 new species authors:
localities visited by
- K.-D.B. Dijkstra
- J. Kipping
- N. Mézière

and
- all other Odonata records in ODA
All Odonata Barcode Initiative at Naturalis Biodiversity Center

- foremost Odonata collection in world (e.g. 90% of African species)
- 9365 DNA-barcodes (COI) for 1700 of 6000 species worldwide
- 4260 barcodes of 585 of all 730 tropical African species (80%)
- 91% of morphologically identified African species have unique haplotypes
4260 DNA-barcodes of 80% of 730 tropical African species do help...

Firebelly (*Eleuthemis buettikoferi*) male in full sun lures female with his purely orange belly

male in shade on same river shows black-and-yellow underside

Angolan male has hues like clouds in a dawn sky on upperside

“sunrise” Angola

“shadow” Liberia

Johnsonville, Liberia
4260 DNA-barcodes of 80% of 730 tropical African species do help... lab results support field findings
years of experience needed to notice small differences

almost identical species are found side by side

Ikelenge, Zambia

Band-eyed Citril
Ceriagrion banditum

Spikerush Citril
Ceriagrion junceum
species discovery and naming: basis of research, conservation and appreciation of nature

many people may think that is what most biologists do

3 specialists found 60 new species:

- 33 species found while working as environmental consultant
- 18 species by teacher Nicolas Mézière in south-eastern Gabon
- only 9 species while employed by university or museum
- not one by African specialist...

Blue-spotted Pricklyleg *Porpax mezierei*
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“Each species is a world parallel to our own, evoking a sense of being among equals.”

Dijkstra, 2016. Nature 533

Klaas-Douwe B. Dijkstra has named a new dragonfly after David Attenborough to mark the broadcaster’s 90th birthday — and to honour the importance of knowing the natural world.

Acisoma attenboroughi
we study biodiversity to instil ‘sense of species’

a consciousness of the existence and impact of all species — from plankton to cattle and including mankind
innovation bares (rather than fills) the gap in species knowledge

- input in identifications tools (DNA-barcoding, computer vision)
- support expanding citizen science
- run ground operation for urgent exploration of life
- validate and interpret deluge of emerging information
many thanks for the invitation!
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