CHANGING TIMES: BIODIVERSITY, FRESHWATER QUALITY & PROTECTION

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Presentation content

1. Macroinvertebrates & benefits
2. Challenges to macroinvertebrates
3. Strategies of management
4. Public Engagement & Citizen Science
5. Conclusion

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WHAT ARE THEY?

- Benthic macroinvertebrates- inhabit bottom sediments for part of their life cycles & are retained by a 200µm to 500µm mesh.
- Indicators of pollution

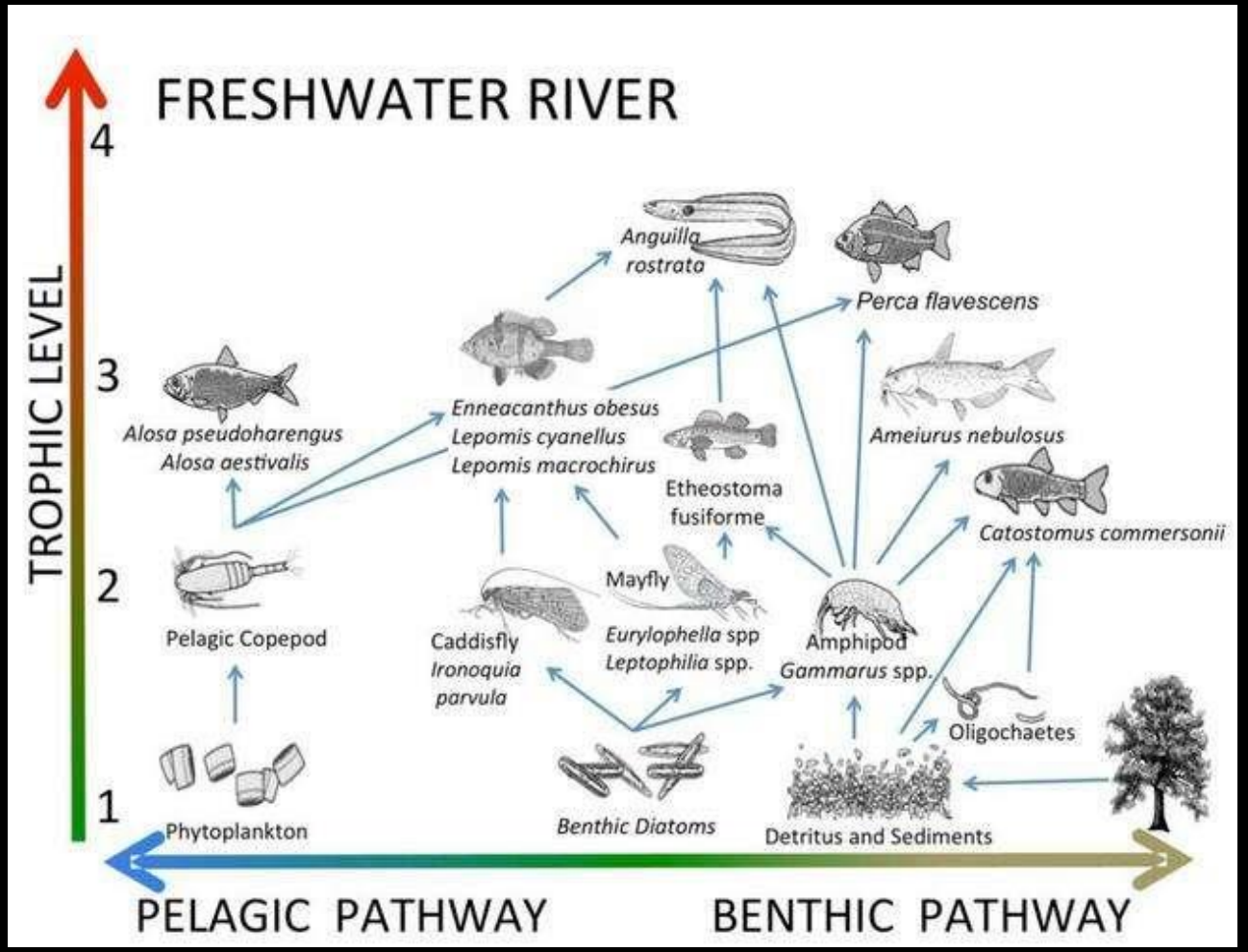
Heptageniidae

See Li, Zheng & Liu (2010) for more information

Gammaridae

FRESHWATER FOOD WEB

They are key components of aquatic food webs that link organic matter and nutrient resources



CHALLENGES TO AQUATIC BIODIVERSITY

Climate change

Article rank | *6 Aug 2018* | *The Guardian*

Survey reveals alarming decline of invertebrates in rural streams

'Rarer, specialised organisms are starting to decline, and that's consistent with the signals of climate change' Steve Ormerod Ecologist

One of the longest-running studies of streams in the world, covering 14 brooks that tumble through a remote Welsh mountain landscape, has exposed a troubling loss of riverine wildlife. Ecologists working on the Llyn Brianne Observatory project in mid-Wales, which has been in operation for almost 40 years, have flagged the disappearance and decline of invertebrates from the streams.

- Pollution (point & diffuse)
- River channel canalisation
- Changes to land cover patterns **Medupin et al. (2020) *Water*, *12*, 848**

UK GUARDIAN NEWSPAPERS

Diluting English river standards a backward step, campaigners warn *Sandra Lavill*

Investment needed to achieve target of 75% rivers rated good, Environment Agency told

Fri 21 Aug 2020 07.00 BST

How clean are England's rivers? The latest report makes for uncomfortable reading *Rachel Salvidge*

Fri 25 Sep 2020 09.00 BST

The government is looking the other way while Britain's rivers die before our eyes *George Monbiot*

Wed 12 Aug 2020 07.00 BST

PROTECTION OF FRESHWATER DIVERSITY

- **UN Sustainable Development Goals** 6 (6.5, 6.6); 14

- **Environmental Regulation**
  - EU and National standards
  - Environmental Enforcement

- **Monitoring and assessment**
  - Physical, chemical and biological variables

- **River Classification**
  - EU Water Framework Directive (EU WFD,2000)-"Good Ecological Status"; WFD requires both water chemistry & ecological classification to be "good" for river compliance

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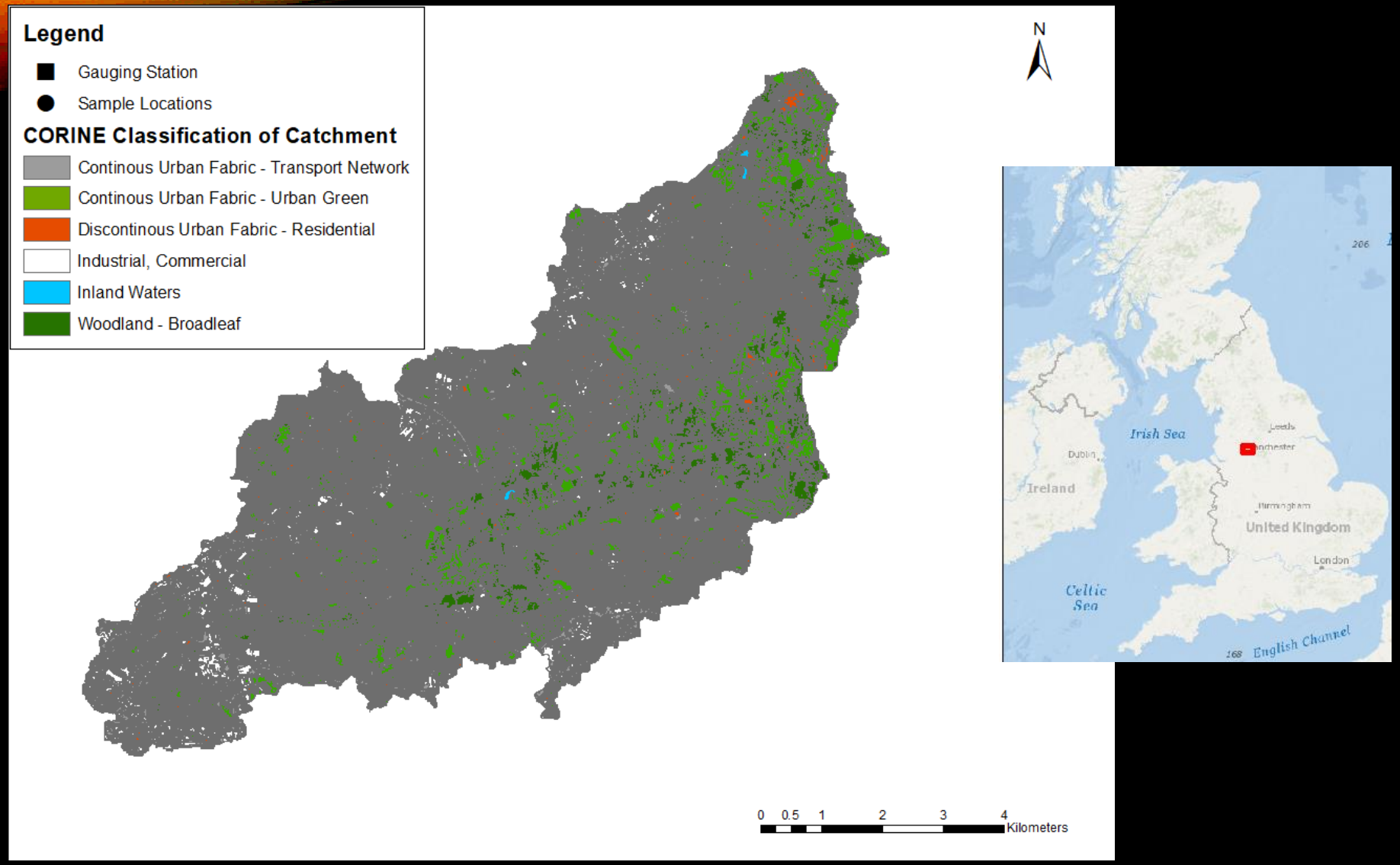


Medupin, C.; Bark, R.; Owusu, K (2020) *Water* **2020**, *12*, 848

DIVERSITY AND DOMINANCE

- Low DO, including and substrates e.g. sand & slit decrease diversity and increase dominance tolerant taxa:
- E.g. invertebrates - non-canalised: 21 taxa, canalised 6 taxa
- upper reaches 12 ± 23 chironomids per 0.25m²; lower reaches 255 ± 160 chironomids per 0.25m²

Upper reaches

Gammarus
(freshwater shrimp)

Ecdyonurus
(mayfly)

Aeshna
(dragonfly)

Lower reaches

Chironomus
(blood 'worm')

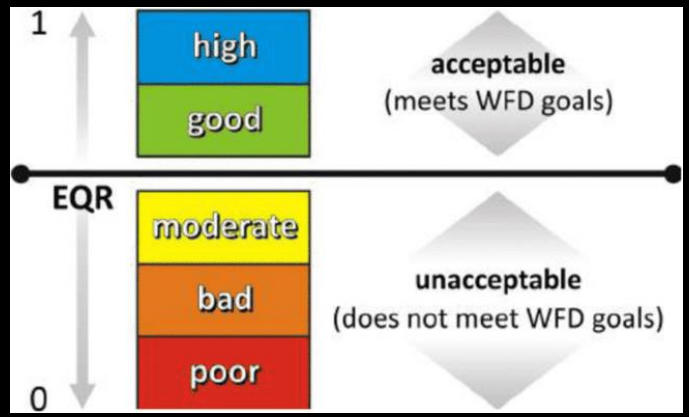
Lymnea
(pond snail)

Asellus
(water louse)

Medupin, 2020- *Environ Monit Assess* 192, 84

COMPLIANCE WITH THE EU WATER FRAMEWORK DIRECTIVE

- Benthic invertebrates & biotic indices = "Moderately polluted"
- Concentration of biochemical oxygen demand, ammonia & nitrate (mg/L) – Good
- Phosphate concentration (mg/L) = Not good
- Compliance to WFD classification = **Not compliant**



Medupin, C. (2020) Environ Monit Assess **192,** 84
Medupin, C. (2019) SN Applied Sciences 1:544

WHAT IS THE FUTURE?

OTHER ISSUES E.G. BREXIT UNCERTAINTIES?

- Short term= Operational risks? Job losses?
- Long term? == Will the catchment management be sustainable?
- Changing policies, increased urbanisation, climate change? Funding?
- UK 25 year Environmental Plan– All surface water quality expected to be good

Written evidence: Science and Technology Select Committee 'Brexit: Science and Innovation summit' (Parliament Publications)
http://data.parliament.uk/WrittenEvidence/CommitteeEvidence.svc/EvidenceDocument/Science%20and%20Technology/Brexit%20science%20and%20innovation/written/77921.html

PROTECTION OF BIODIVERSITY THROUGH CONNECTION

- People, Planet, Prosperity: **Leave no one behind**
- Communication; Partnerships; Public Engagement; Citizen Science

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CITIZEN SCIENCE

CITIZEN SCIENCE

Anglers' Riverfly Monitoring Initiative (ARMI): A UK-wide citizen science project for water quality assessment

Stephen J. Brooks[1,5], Ben Fitch[2,6], John Davy-Bowker[3,7], and Soraya Alvarez Codesal[4,8]

[1]Life Sciences, Natural History Museum, London, SW7 5BD, UK
[2]The Riverfly Partnership, c/o The Ferry Landing, Far Sawrey, Ambleside, Cumbria, LA22 0LP, UK
[3]Freshwater Biological Association, River Laboratory, East Stoke, Wareham, Dorset, BH20 6BB, UK and Life Sciences, Natural History Museum, London, SW7 5BD, UK
[4]Freshwater Biological Association, The Ferry Landing, Far Sawrey, Ambleside, Cumbria, LA22 0LP, UK

- **Brooks** et al. (2019) Freshwater Science 38(2):270–280

- **Moolna** et al. (2020) Citizen science and aquatic macroinvertebrates: public engagement for catchment-scale pollution vigilance- *Écoscience*, 27:4, 303-317

UN Sustainable Development Goals 4, 14, 17

ALWAYS CONNECT: CHILDREN~ *CATCH THEM YOUNG*

UN Sustainable Development Goal 4

ALWAYS CONNECT
E.G. SCIENCE FESTIVAL, MANCHESTER,UK

Emily: better if creatures were alive

> I liked that you could research what bugs you picked
> good way to learn
> I learnt that we have leeches in England and they have little teeth. If we have lots of flies we have clean rivers.
> I enjoyed finding different things and finding out what each one was. - Simone
> I liked looking through the magnify glass when I was looking for bugs.

ALWAYS CONNECT: WP STUDENTS

E.G. BRITISH ECOLOGICAL SOCIETY SUMMER SCHOOL MALHAM TARN, YORKSHIRE

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UN Sustainable Development Goals 4,6, 10,17

CONNECT WITH STUDENTS

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https://lsmanchesterblog.wordpress.com/2016/01/20/national-trust-work-experience-launches/

ALWAYS CONNECT WITH COMMUNITIES E.G. MOSS SIDE, UK

UN Sustainable Development Goals 4,6,14,10,17

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ALWAYS CONNECT WITH COMMUNITIES
E.G. BLASTFEST, ALEXANDRA PARK, MANCHESTER, UK

UN Sustainable Development Goals 4,10,17

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ALWAYS CONNECT WITH ADULTS E.G. COMMUNITY ARTS PROJECT, EAST SALFORD, UK

Tearing Stuff Apart, Community Arts Project, Salford,UK

UN Sustainable Development Goals 4,10, 16,17

ALSO CONNECT WITH TEACHERS

Teaching the teachers

ALWAYS CONNECT TO OLDER ADULTS E.G. RIVER GUARDIANS, HAZEL GROVE-STOCKPORT

UN Sustainable Development Goals
4,10,17

ALWAYS CONNECT: FAITH-BASED COMMUNITIES E.G. CHURCH FAMILY FUN DAY

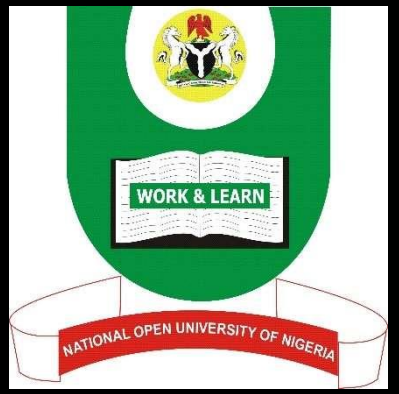
UN Sustainable Development Goals
4,6, 10,17

Medupin, C (2020) The Green Christian **Magazine, Spring 2020 Issue 89**

GLOBAL NORTH-SOUTH CONNECT

National Research Fund (NRF) of the Tertiary Education Trust Fund (TETFund) of Nigeria

1. University of Port Harcourt, Nigeria
2. Ekiti State University, Ado-Ekiti, Nigeria
3. University of Ibadan, Nigeria
4. Osun State University, Nigeria
5. Obafemi Awolowo Institute of Agricultural Research and Training, University, Ile-Ife, Nigeria
6. National Horticultural Research Institute, Nigeria
7. University of Ghent, Belgium
8. International Institute of Tropical Agriculture (IITA), CGIAR



GLOBAL NORTH-SOUTH CONNECT MANDALAY & YANGON, MYANMAR

Red Canal, Mandalay, Myanmar

Strategic Partnerships for Higher Education Innovation and Reform

https://www.spheir.org.uk/partnership-profiles/transformation-innovation-distance-education

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ALWAYS CONNECT: WOMEN

Women in Environmental Sciences conference, 2019 @in_sciences,

UN Sustainable Development Goals 4,5,10

Medupin, C (2020) *Sustainability 12*, 7116.

CONCLUSION

1. **The times are changing & our biodiversity is changing too**
2. Changing times require changing strategies
3. Need to **connect-** researchers, policy makers, individuals, partnership groups & all those who work on biodiversity & environmental protection & management
4. Consider **integration & inclusion** with the overall goal to protect and sustain the only planet *homo sapiens* is ever likely to live on.
5. If we do not do this, we may not be living on this one for very much longer.

Thank you

ACKNOWLEDGEMENT

- BLASTFEST
- British Ecological Society
- Community Perspectives, UK

- The University of Manchester, UK

- Manchester Science Festival & Manchester Museum, UK
- River Guardians, UK
- Saints Joseph & Edward Catholic Church, Manchester, UK

- Tearing Stuff Apart, Community Arts Project, Salford
- Transformation by Innovation in Distance Education (TIDE), Myanmar
- National Committee for Engaging Environment

National Biodiversity Network