What drives growth and biodiversity of algae in the Okavango Delta?

Luca Marazzi, A.W. Mackay - University College London

Introduction

This study is the first comprehensive assessment of all the algae in the Okavango Delta (Botswana), a pristine subtropical wetland. Algae, together with bacteria, are the base level of the Delta's food webs on which subsistence fisheries rely.

Aims and methods

The aim of this poster is to present new baseline data on the biodiversity of algae in the Delta and their spatial distribution. 132 algal samples were collected in 2006-2007 (Mackay et al., 2011) and 2009-2010 from 53 sites with different flooding frequency (Fig. 1) alongside a suite of physicochemical variables.

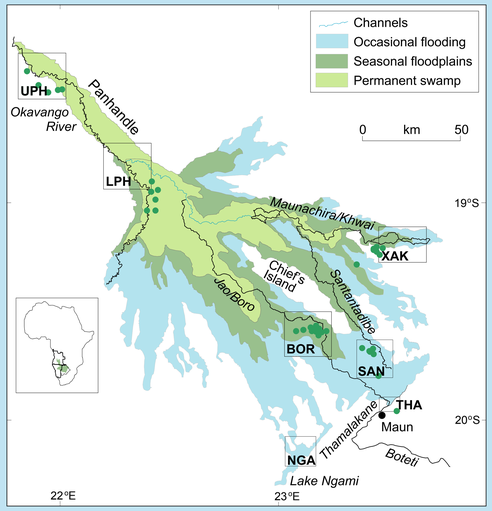


Fig. 1. Map of the sites sampled - main regions: UPH=Upper Panhandle, LPH=Lower Panhandle, BOR= Boro, XAK=Xakanaxa, SAN=Santantadibe.

Results

In seasonal floodplains (SF) the species richness of algae was not significantly higher than in permanently (PF) and occasionally flooded areas (OF); more diatom species were found in the PF than SF and OF (ANOVA, p=0.023 & p=0.004) while green algal species richness was higher in SF than PF sites (ANOVA, p=0.024) (Fig. 2).

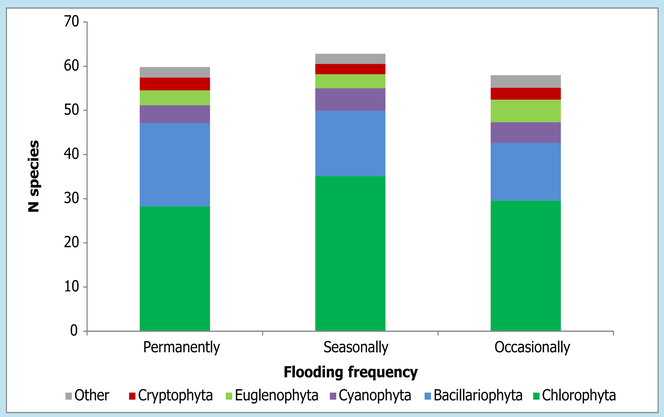


Fig. 2. Mean number of algal species in sites with different flooding frequency.

Almost 50,000 algal units (cells, colonies and filaments) were identified and counted by means of an inverted microscope (Utermohl technique). About 600 species of algae have been found in the Delta so far, of which 330 spp. of green algae (Chlorophyta) and 130 spp. of diatoms (Bacillariophyta) (Fig. 3).

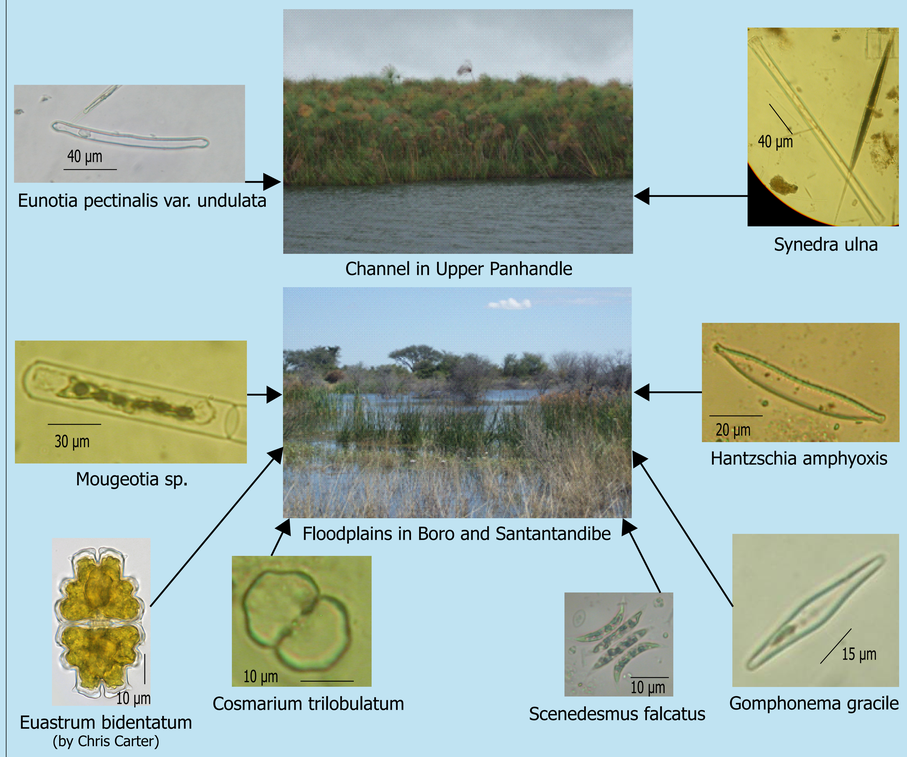
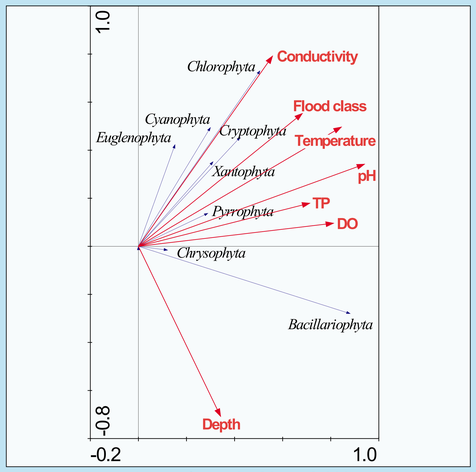


Fig. 3. Some algal species and the environments where they were most abundant.

Abundances of Chlorophyta increased with conductivity and temperature, and were higher in seasonally or occasionally flooded sites (flood class= 2-3) while Bacillariophyta prevailed in deeper sites with higher Dissolved Oxygen (Fig. 4).



Eigen value = 0.539, p=0.002

Fig. 4. Redundancy Analysis of algal phyla abundances (%) and environmental variables.

Chlorophyll a and TP concentrations were higher in the inundated grasslands than in open water and sedges in the lower Delta (Fig. 5, Chl a - ANOVA, p=0.002 and p=0.050); Unrein (2002) observed similar trends in the lower Parana' floodplain in Argentina.
Species richness was higher in grasslands than in open water habitats - ANOVA, p=0.011 (Fig. 5). Hence nutrient availability may drive the algal biodiversity and biomass at habitat level.

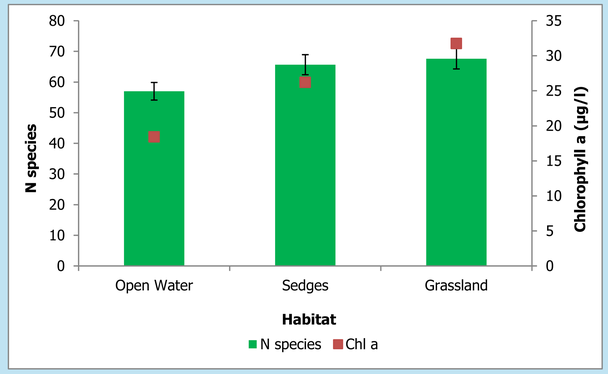


Fig. 5. Mean number of species and Chl a concentrations in floodplain habitats.

Key messages

- Algal species richness in the Okavango Delta (600 spp.) is relatively similar to that recorded in other key wetlands, e.g. 700 species in the Kakadu National Park (Junk et al., 2006)
- Flooding frequency may exert a lesser influence than that of habitat diversity on the number of algal species
- This work provides new baseline data for the assessment of possible hydrological changes in the Okavango Delta and Basin.

Future work

The analysis of annual and seasonal trends will help understand the role of the flood-pulse in shaping the algal successions in the Delta. Biovolume estimates will help make conclusions on main drivers.

Integrating data on algae with those on zooplankton and fish (Siziba, 2011) can assist the investigation of food web dyanmics.

References:
Mackay et al. (2011): Ecohydrology; Unrein (2002): Hydrobiologia; Junk et al. (2006): Aquatic Sciences; Siziba et al. (2011): African Journal of Ecology

This research is the product of a self-funded part-time Ph.D. project.

Acknowledgments
Nqobizitha Siziba, Lars Ramberg, Okavango Research Institute (ORI), UCL Graduate School, Royal Geographical Society, Darwin Initiative
Contact details: Luca Marazzi, UCL, l.marazzi@ucl.ac.uk