Algae of Mangarakau wetland

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The following is a brief account of what we currently know about algal diversity in Mangarakau wetland, Tasman district, as supporting information for a community-led application for RAMSAR designation of the wetland. Summary results of a survey carried out by NIWA in 2004 are presented. Because algal community composition is strongly influenced by water chemistry (especially pH and nutrient concentrations), these data are also presented and discussed.

Methods

Algae samples were collected from six sites in Mangarakau wetland, all south of Mangarakau village. All sites were open water, covering a range of area and water depth. At each site, algae was sampled from a range of surfaces, including submerged plants, material floating on the water surface ("floc"), and benthic detritus from both marginal and deeper areas. Water pH and conductivity were measured at each site, and water samples were collected for subsequent analysis of dissolved nutrients.

In the laboratory, sub-samples of the algae were examined microscopically at magnifications up to x1000 and all algae taxa encountered were identified to species level where possible, otherwise to genus level. Selected subsamples were acid-cleaned to enable closer examination of the diatoms present. Acid-cleaning removes organic material from the sample so that the silica diatom frustules (cell walls) can be viewed clearly. The shape and markings of the frustules are used to distinguish species. All taxa were assigned a relative abundance estimate: dominant, abundant, common, occasional, or rare.

Results

Water chemistry

The six sites varied in water quality (Table 1). For example, pH ranged from 5.8 to 7.2, conductivity from 79 to 125 μS/cm, total dissolved nitrogen (TDN) from 130 to 275 mg/m^3, and total dissolved phosphorus (TDP) from 2 to 6.5 mg/m^3. Concentrations of dissolved nitrate-N and inorganic P were low at all sites (<5 and <1 mg/m^3, respectively). The largest pool sampled (site 2) had highest pH, conductivity, TDN and TDP.

Table 1. Locations and water chemistry details for six sites in the Mangarakau wetland sampled for algae and invertebrates in 2005. Nutrient concentrations are given in ppb (mg/m^3). See text for explanations of abbreviations.

Site	Water type	E	N	pH	Cond (μS/cm)	Temp	NO_3-N	NH_4-N	TDN	DRP	TDP
1	Large pond	2466270	6062270	6.95	104	16.0	2.4	15.3	249	0.9	4.7
2	Large pond	2466080	6062330	7.23	125	17.8	3.6	10.0	275	0.8	6.5
3	Lead	2466280	6062090	5.95	81	20.3	3.2	8.0	130	0.9	2.0
4	Small pond	2466200	6061970	6.21	79	17.9	4.5	5.6	176	0.3	2.3
5	Lead	2466190	6062150	5.83	84	17.1	3.8	8.2	235	0.2	4.0
6	Channel	2466690	6062530	6.01	113	10.3	3.5	8.0	183	0.5	3.0

Algae

Eighty-one algal taxa were identified (Table 2). Diatoms were represented by the highest number of taxa (36), followed by Cyanobacteria (18), Chlorophytes – desmids (15), Chlorophytes – other (12). Most taxa were encountered at a single site only, with only 18 (22%) occurring at two or more sites. About 27% of all taxa could not be identified with certainty, as indicated by numbered species (sp.) or morphotypes (mt), and species names preceded by cf. ("compare with") in Table 2.

Table 2. List of algal taxa identified from samples taken from 6 sites in Mangarakau wetland. Abundance refers to the relative abundance of taxa in individual samples, averaged across samples where

Genus	species	variety	Type	Abundance in samples	No. sites
Cyanobacteria					
Calothrix	cf. fusca		trichomes	common	1
Jaaginema	cf. gracile		trichomes	common	1
Leptolyngbya	frigida		trichomes	common	1
Lyngbya	martensiana		trichomes	occasional	2
Lyngbya	sp.		trichomes	dominant	1
Nostoc	commune		trichomes	common	1
Nostoc	punctiforme		trichomes	occasional	1
Oscillatoria	curviceps		trichomes	common	3
Oscillatoria	simplicissima		trichomes	rare	2
Stigonema			trichomes	rare	1
Tolypothrix	sp. 2		trichomes	occasional	1
Tolypothrix	sp. 3		trichomes	occasional	1
Tolypothrix	sp. 6		trichomes	common	1
Apanocapsa	grevillei		unicells	rare	1
Apanocapsa	parasitica		unicells	rare	1
Chroococcus	turgidus		unicells	occasional	2

Genus	species	variety	Type	Abundance in samples	No. sites
Gloeocapsa	aff. decorticans		unicells	occasional	1
Gloeothece	cf. membranacea		unicells	rare	1
Chlorophyta, Desmids					
Bambusina	brebissonii		filaments	common	1
Closterium	cynthia		unicells	rare	1
Closterium	dianae	pseudodianae	unicells	occasional	1
Closterium	intermedium		unicells	common	2
Closterium	kuetzingii	kuetzingii	unicells	occasional	1
Closterium	lineatum		unicells	occasional	2
Closterium	rostratum		unicells	rare	2
Cosmarium	candianum		unicells	rare	1
Cosmarium	pseudopyramidatum		unicells	common	1
Desmidium	occidentale	concatenatum	unicells	occasional	1
Euastrum	didelta	bengalicum	unicells	rare	1
Gonatozygon	monotaerium		unicells	common	1
Netrium	digitus	digitus	unicells	rare	1
Staurodesmus	pseudotetracerum		unicells	rare	1
Tetmemorus	laevis	laevis	unicells	occasional	1
Xanthidium	variabile	variabile	unicells	rare	2
Chlorophyta, other					
Bulbochaete	mt 1		filaments	abundant	4
cf. Cylindrocapsa			filaments	common	2
Cylindrocapsa	cf. conferta		filaments	rare	1
Mougeotia	mt 4		filaments	common	1
Oedogonium	mt 2		filaments	dominant	1
Oedogonium	mt 3		filaments	common	1
Ulothrix	mt 1		filaments	occasional	1
Zygnema	mt 1		filaments	rare	1
Chlorella	sp.		unicells	occasional	1
Gloeocystis	ampla		unicells	occasional	1
Palmella	cf. mucosa		unicells	occasional	3
Scenedesmus	opoliensis	contacta	unicells	rare	1
Diatoms					
Achnanthes	pusilla		unicells	common	1
Brachysira	brebissonii		unicells	common	3
Brachysira	wygaschii		unicells	common	1
Cyclotella	stelligera		unicells	rare	1
Cymbella	kappii		unicells	common	1
Cymbella	naviculiformis		unicells	occasional	1
Diploneis	elliptica		unicells	occasional	1
Encyonema	gracile		unicells	rare	1
Eunotia	bilunaris		unicells	common	1
Eunotia	bilunaris	mucophila	unicells	common	1
Eunotia	cf. exigua		unicells	occasional	1
Eunotia	cf. serpentina		unicells	occasional	1

Genus	species	variety	Type	Abundance in samples	No. sites
Eunotia	implicata		unicells	rare	1
Eunotia	incisa		unicells	occasional	2
Eunotia	minor		unicells	common	1
Eunotia	praerupta		unicells	common	1
Eunotia	rhombiodea		unicells	occasional	1
Eunotia	sp. 1		unicells	rare	1
Fragilaria	vaucheriae		unicells	rare	1
Frustulia	crassinerva		unicells	abundant	2
Frustulia	cassieae		unicells	dominant	2
Frustulia	rhomboides		unicells	common	3
Gomphonema	angustum		unicells	occasional	1
Gomphonema	truncatum		unicells	rare	1
Kobayasiella	sp.		unicells	common	2
Navicula	sp. 1		unicells	occasional	1
Navicula	sp. 2		unicells	common	1
Pinnularia	cf. nobilis		unicells	occasional	1
Pinnularia	microstauron		unicells	common	1
Pinnularia	nobilis		unicells	occasional	1
Pinnularia	subcapitata		unicells	common	1
Sellaphora	pupula		unicells	rare	1
Stenopterobia	curvula		unicells	occasional	3
Surirella	linearis		unicells	rare	1
Synedra	rumpens		unicells	occasional	1
Tabellaria	flocculosa		filaments	dominant	2

Commentary

Spatially variable water chemistry across wetlands is expected, and is attributable to hydrological factors and to pond size (e.g., Kilroy et al. 2006, 2008). The inter-site differences seen at Mangarakau would be expected to lead to variability in local algal community composition, thereby contributing to the overall algal biodiversity of the wetland. Compared with other wetlands on the West Coast (Mahinapua, Shearers and Kakapotahi wetlands) sampled at the same time and in a similar manner, algal diversity at Mangarakau is high, and this is very likely a result of the comparatively wide range of water chemistry conditions.

The taxa found are mostly characteristic of slightly acidic waters, particularly the desmids and diatoms. Without further study, it is difficult to comment on the significance of the 27% of taxa that could not be identified with certainty. It should be noted that some green algae cannot be identified to species level without observations of the entire life cycle (e.g., Novis 2003, 2004), which was not possible in the present survey. Recent studies on diatoms have indicated that undisturbed wetlands and tarns tend to support higher proportions of distinctive endemic diatom taxa than more disturbed environments (Kilroy et al. 2007), and this may be the case at Mangarakau. For example, the distinctive diatom *Frustulia cassieae* was recorded as dominant in two samples. *Frustulia cassieae* was first described from wetlands farther

south on the West Coast by Beier and Lange-Bertalot (2007), who considered the species to be endemic to New Zealand and suggested that it might be "generally rare". Therefore its occurrence in Mangarakau as a dominant may be significant.

Acknowledgements

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