



**Bibliographic database on controlling
benthic algae relevant to New Zealand**

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Bibliographic database on controlling benthic algae relevant to New Zealand

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Prepared for

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Summary

Biosecurity New Zealand has responsibility for managing New Zealand's response to the invasive freshwater diatom, didymo (*Didymosphenia geminata*), which recently infested a number of flowing water habitats in the South Island. NIWA was engaged to:

- compile a comprehensive database of literature describing techniques, experience and environmental effects of controlling algae (particularly benthic algae) and their relevance to New Zealand, for use as a resource base for developing control strategies;
- provide guidelines on how best to access and retrieve citations;
- and consider options for maintaining currency of the database.

Relevant international databases and websites were interrogated (including Aquatic Sciences and Fisheries Abstracts, Environmental Science & Pollution Management, Web of Knowledge including Current Contents, and AGRICOLA), from which nearly 3,000 of the citations were reviewed for relevance. A detailed bibliography of citations was then compiled, categorised by subject and searchable electronically.

This comprehensive literature review found little information on didymo generally and even less information on didymo control techniques. This plus the broader information on other diatoms, algae and aquatic micro- and macro- organisms has been prioritised and categorised in 13 different folders and integrated with Biosecurity New Zealand's Refworks database.

The RefWorks database allows searching within or across folders. NIWA recommends using the advanced search feature and an "anywhere" search within specific folders. Results can be displayed and exported to meet individual requirements.

Currency of the database could be maintained by regular (monthly or less frequent) updates, using the same BNZ and NIWA sources used to date, but perhaps using only those that have automatic notification facilities.

1. Introduction

There is high potential for the invasion of New Zealand's marine and freshwater environments by foreign benthic algae as has recently been demonstrated with *Undaria* and the invasive freshwater diatom, didymo (*Didymosphenia geminata*). Such invasions are impacting on the native biodiversity of our aquatic environments. It is important that New Zealand develops a better knowledge of what possible control measures could be used to contain or eradicate such invasive species, whilst minimising damage to indigenous biota. The particular focus of this report is the invasive alga didymo (*Didymosphenia geminata*) with the objective of controlling its spread and possibly eradicating it from New Zealand.

Biosecurity New Zealand has responsibility for managing New Zealand's response to didymo (*Didymosphenia geminata*). To date there is a paucity of information on didymo generally and particularly in relation to control techniques (Kilroy 2004). Biosecurity New Zealand therefore engaged NIWA to search the literature to:

- compile a comprehensive database of literature describing techniques, experience and environmental effects of controlling algae (particularly benthic algae) and their relevance to New Zealand, for use as a resource base for developing control strategies,
- provide guidelines on how best to access and retrieve citations,
- and consider options for maintaining the currency of the database.

2. Scope

Citations have been gathered from all appropriate sources, primarily available online. Each citation was included in its fullest format and included:

- Full citation
- Abstract
- Keywords
- URL & availability where applicable

3. Search process

Citations were initially acquired from a selection of internationally recognised databases. These are listed below. A range of websites were also scanned. Sample search strategies used are shown:

Search 1 Algicid*

Search 2 (Weed control or Plant control) *(as descriptor or keyword where applicable)* AND (sea* or water* or Marine* or freshwater or fresh water or stream* or river* or lake*) NOT **Search 1**

Search 3 (alga* or diatom* or periphyton*) *(as descriptor or keyword where applicable)* AND (control* or suppress* or eradic*) NOT (algicid* or plant control)

Search 4 (introduc* OR invas*)*(as descriptors or keywords where applicable)* AND (alga* or diatom* or periphyton*) *(as descriptor or keyword where applicable)* NOT (algicid* or plant control)

* indicates wildcard or truncated search

Other terms used for cross checking:

mitigation	removal	limiting factors	
regulate	protocol	bloom	management
reduction	mediate	degradation	environment

Databases searched included:

Aquatic Sciences and Fisheries Abstracts (ASFA)

Environmental Science & Pollution Management (ESPM)

ISI databases (including Current Contents)

AGRICOLA (AGRICultural OnLine Access USDA).

Other reputable websites scanned for additional material were:

GrayLit Network Full-text technical reports from the US Department of Energy, Department of Defense, Environmental Protection Agency, NASA JPL and NASA Langley

Defense Technical Information Center (DTIC) Technical Reports Collection This full-text collection provides access to unclassified, unlimited documents. It is a growing subset of over 127,000 reports referenced and available in STINET, which dates back to 1974. Subject areas consist of those associated with defense research and basic sciences including biological and medical sciences; environmental pollution and control; behavioral and social sciences; and patents and patent applications.

DOE Information Bridge Report Collection This site performs full-text searching across over 85,000 reports and over 4.3 million pages. Bibliographic citations are also available. Subject areas include physics, chemistry, materials, biology, environmental sciences, energy technologies, engineering, computer and information science, renewable energy, and other topics. Full text is available for reports from 1995 forward.

EPA - National Environmental Publications Internet Site (NEPIS) This site offers an increasing number of archival and current EPA documents online. Subject areas include water quality, wastewater, pesticides, ecological issues, wetlands, and many more environmental-related areas. With over 10,000 documents, NEPIS is EPA's largest electronic documents site.
<http://nepis.epa.gov/>

OSTI an Energy, Science, & Technology Information Resource from the US Department of Energy (DOE)
<http://www.osti.gov/>

Environment Canada
http://www.ec.gc.ca/search_e.html

National Sea Grant Library
<http://nsgl.gso.uri.edu/>

Freshwater Biological Association
<http://www.fba.org.uk>

4. Filtering process

Stage 1: Initial database searching and input of all citations meeting the search criteria as outlined above. The resulting database was amalgamated with the existing citations from Biosecurity New Zealand's Refworks database and checked to delete obviously non-relevant citations and duplicates.

Stage 2: Abstracts were assessed from the first-cut selection of citations (over 2,800) for relevance to the New Zealand didymo context and prioritised and categorised. Subject folders have been created in Biosecurity New Zealand's Refworks database reflecting this. The folders are :

Didymosphenia those citations immediately applicable to didymo control (*Descriptor = Extremely relevant to didymo*) ~30 refs

Didymo ** - those citations which may be useful to didymo control (*Descriptor = Relevant to didymo*) ~90 refs

Didymo* - those citations with limited relevance to didymo control (*Descriptor = Somewhat relevant to didymo*) ~400 refs

Allelopathy – those citations identified primarily from the didymo folders ~50 refs

Benthic ~30 refs

Biological Control ~700 refs

Chemical Control ~400 refs

Environmental Algal Eradication ~40

Eutrophication ~200

Freshwater (term search of whole database) ~2000 refs

General Algae Eradication – ~300 refs

Marine (term search of whole database) ~700 refs

Physical control (harvesting, shade, irradiation) ~270 refs

Note that many citations appear in multiple folders.

Stage 3: Key citations (from the didymo folder) have been obtained and will be used to plan didymo control trials. Their reference lists have been used and random authors' other works scanned, to confirm that the original searches were sufficiently comprehensive.

The breadth of this search meant much of the literature originally acquired was not relevant; for example many of the search strategies pulled citations on using plants/weed for control [of heavy metals, phosphates etc]. Another large segment of the material related to eutrophication and techniques and solutions which would be predominantly inappropriate for use in oligotrophic environments. This material has been included for completeness and has been placed in the eutrophication folder.

Some older material can only be found in the bibliographies listed in the database. Because of their age these citations had to be individually added.

5. Guidelines for searching the database

Biosecurity New Zealand's RefWorks® database uses multiple views or folders to classify citations. We recommend using the advanced search feature and "anywhere" searches within specific folders to locate citations. Searching by descriptors, while useful if the exact term is already known, is otherwise slow and unwieldy. RefWorks® does not offer truncated descriptors within the advanced search feature and terms must be selected and searched individually.

A more general search can be made using the **Search RefWorks** box. This feature searches all fields and folders. But search terms are connected by the Boolean connector **OR** and it searches for embedded terms, i.e., if you search for "art" you will retrieve references with "heart", "part" etc.

The **My List** feature allows you to select references while searching and place them in a temporary folder for printing, exporting, editing or deleting. This folder is only available during the current RefWorks® session.

Results can be displayed in three formats and are easily exported into alternative packages. A range of formats are available for export.

6. Maintaining the currency of the database

Options for maintaining the currency of the database would involve the use of commercial “Alert” services. The current search strategies and sources BNZ have used to compile the initial citations and the search strategies and sources NIWA has used could be maintained to expand the database. These results could be collated and imported on a regular basis (weekly, monthly or longer).

Those databases and websites which do not have automatic notification facilities, would require labour intensive manual searching and therefore a less frequent search regime may be preferred if they are to be included.

Loading citations via NIWA’s endnote database would eliminate most duplicates. In the RefWorks® database all duplicates would have to be manually checked and removed.

7. References

Kilroy, C. (2004) A new alien diatom, *Didymosphenia geminata* (Lyngbye) Schmidt: its biology, distribution, effects and potential risks for New Zealand fresh waters. NIWA Client Report CHC2004-128. 34p. <http://www.biosecurity.govt.nz/pests-diseases/plants/didymo/didyo-schmidt-report.pdf>

RefWorks® provides an excellent help facility:
<https://www.refworks.com/Refworks/help/Refworks.htm#>