



ASSAY

A NEWSLETTER ABOUT ACID SULFATE SOILS

No. 39 June 2006

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National Acid Sulfate Soil Knowledge Project

A new project is set to raise the nation's awareness of acid sulfate soils. The *National Acid Sulfate Soil Knowledge Project*, developed by the National Committee for Acid Sulfate Soil (NatCASS), will improve and integrate communication about acid sulfate soils at a national level. Proposed by Southern Cross University, the project has been funded under the Natural Heritage Trust's 'National Competitive Component'.

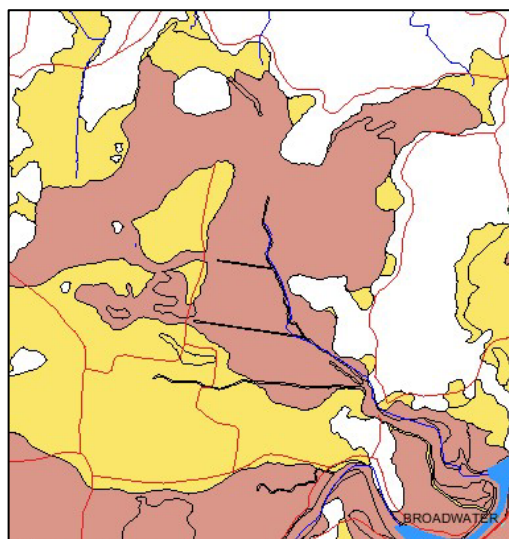
The project has two components

- 1) a national atlas (underway) and database, and
- 2) a national information service, which will include the publication of ASSAY.

National Atlas of Acid Sulfate Soils

Mapping is an important tool in managing acid sulfate soils. Land managers need to be able to identify areas where development is best avoided or areas that will need special management if disturbed. Mapping guards against the unintentional disturbance of acid sulfate soils, which can damage both infrastructure and the surrounding environment.

As a component of the *National Acid Sulfate Soil Knowledge Project* an atlas of Australia's acid sulfate soils has been developed. While some parts of the country were previously mapped, no consistent method or format was used across the states and territories. The project has compiled existing information and maps to produce a national atlas with a common legend. In Stage 2 this will be refined by acquiring more detailed information from representative soil case studies from regions around Australia.



The Tuckean Swamp, Northern NSW as it appears in the National Atlas

For more information on the National Atlas contact the Information Officer, Chrisy Clay on (02) 6626 1355 or christina.clay@dpi.nsw.gov.au or Dr Rob Fitzpatrick on rob.fitzpatrick@csiro.au

View Stage 1 of the National ASS Atlas on-line

Stage 1 of the National Acid Sulfate Soil Atlas can be viewed on the 'Australian Soil Resource Information System' website. All existing electronic map information has been collated and presented as a single, unified atlas of coastal acid sulfate soils. Over the next two years the atlas will be further developed, as map boundaries are refined and a database is added. The third and final stage will incorporate information about inland acid sulfate soils, with support from the CRC for Landscape Evolution and Mineral Exploration (LEME). View Stage 1 on-line at www.asris.csiro.au

Back again: ASSAY

After nearly a two year break in funding the acid sulfate soil newsletter, ASSAY, is back. A component of the *National Acid Sulfate Soil Knowledge Project*, ASSAY will be produced quarterly, highlighting recent findings, current projects and new management techniques.

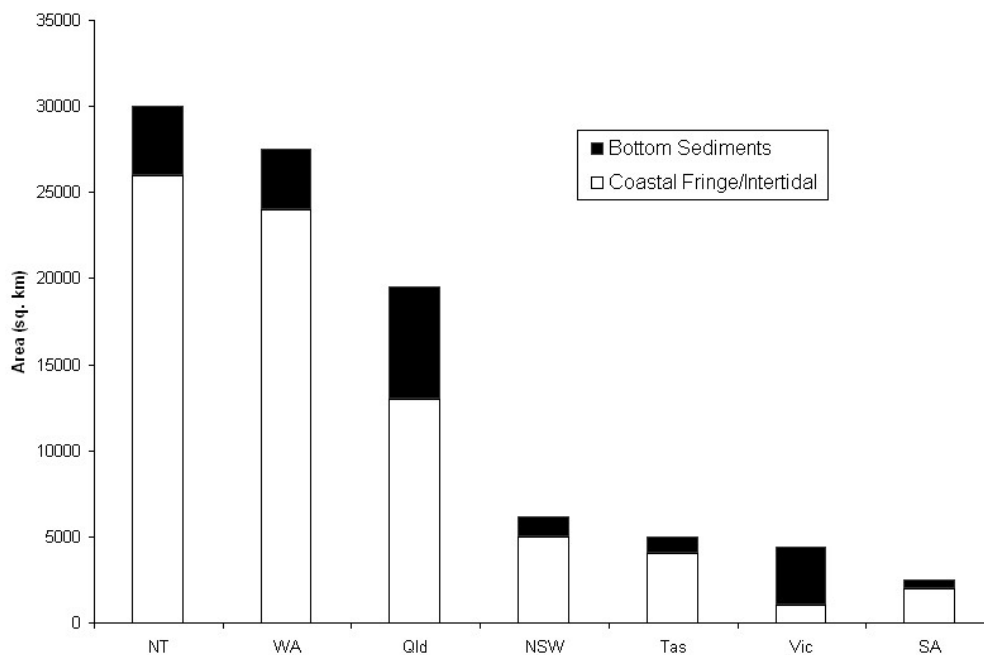
FACT SHEET

A fact sheet providing more information on the National Acid Sulfate Soil Atlas will soon be available. Contact Information Officer, Chrisy Clay on (02) 6626 1355 or christina.clay@dpi.nsw.gov.au

New mapping shows wider distribution of ASS

The national estimate of coastal acid sulfate soils has doubled. Originally estimated at 40,000km², Stage 1 of the National Atlas suggests there is approximately 95,000km² of coastal acid sulfate soils located around Australia.

During Stage 1 where existing data was inadequate or not available, coastal vegetation and digital elevation maps were used to predict acid sulfate soil distribution. Also, for the first time in a national mapping exercise, bottom sediments submerged below the low tide mark were included. The inclusion of bottom sediments recognises their potential impact on water quality through activities such as dredging.



The Northern Territory is now thought to contain the most acid sulfate soils of any state or territory.

ASS Remediation Guidelines

The NSW Department of Natural Resources is developing a set of Guidelines to assist with acid sulfate soil remediation projects. The Guidelines will be a comprehensive publication providing advice on how to develop and run remediation projects, including the formation of organisations to progress projects, funding, information requirements, consents and approvals, land management agreements, and monitoring.

People wishing to contribute material for the guidelines or to be involved in reviewing draft material should contact Mitch Tulau on (02) 6562 0720 or mitch.tulau@dnr.nsw.gov.au

National Information Service

As a component of the *National Acid Sulfate Soil Knowledge Project* a new information service will be available to stakeholders.

The service is a central location for enquiries about acid sulfate soils, which will connect stakeholders and distribute current information. A national communication network will be established to assist with the timely distribution of information.

An information officer, Chrysy Clay, has been appointed to run the service, as well as publishing ASSAY and developing a national website.

Contact Chrysy Clay on (02) 6626 1355 or christina.clay@dpi.nsw.gov.au

NR CMA invest \$1.28 million in floodplain management

The Northern Rivers Catchment Management Authority has made a significant investment in the health of North Coast estuaries. Since 2004 \$1.28 million has been spent on reducing acid discharge and rehabilitating floodplain wetlands across the region.

Catchment Management Authorities are statutory bodies established in NSW during 2004 to engage regional communities in natural resource management. The Northern Rivers Catchment Management Authority covers an area of approximately 50,000 square kilometres from the Camden Haven River in the south to the Queensland Border and 160 kilometres inland.

Characterised by its large coastal rivers and expansive floodplains, the North Coast contains over 1,490 square kilometres of high risk acid sulfate soils. Most of NSW's acid sulfate soil hotspots are located on the North Coast, including well known areas such as the Tuckean Swamp, Shark Creek and McLeods Creek.

The Catchment Management Authority provides funding for remediation activities such as opening floodgates, installing groundwater control weirs, re-vegetating scalds and restoring floodplain wetlands. Remediation works are done in partnership with local government and non-government organisations, with the cooperation of participating landholders.

Since 2004, 37 floodgates/water control structures have been modified or installed and over 500 ha of coastal floodplain have been rehabilitated, involving 120 landowners. The Northern Rivers Catchment Management Authority's investment in acid sulfate soils is set to continue with \$515,000 allocated to floodplain management in the 2006/2007 financial year.



Floodgates are being modified with the help of funding from the Northern Rivers CMA.

Hotspot Booklets on-line

They are no longer available in print, but the NSW Hotspot Booklet series can be downloaded off the internet. All booklets are a wonderful source of background information on NSW's Hotspots.

http://www.dlwc.nsw.gov.au/care/soil/as_soil/hotspots.html

15th NSW Coastal Conference

This year's NSW Coastal Conference will be held at Coffs Harbour, 7-9 November. The Conference theme is 'coasting towards a sustainable future' which will highlight issues such as the health of coastal lakes and waterways.

www.coastalconference2006.com

Promoting sustainable agriculture on coastal floodplains

A new extension program, funded by the National Landcare Program, will help North Coast graziers using low lying floodplain areas become more sustainable. On the NSW North Coast the lowest lying floodplain areas are predominantly grazed. While these areas were important historically to the grazing industry as drought refuges, they also provide valuable fish and bird habitat. Flood mitigation works, completed in the 1950's and 60's, have made these low lying areas more reliable for agriculture but have drained large areas of acid sulfate soils as well.

During an eight-session extension program, graziers identify issues relevant to their property along with a range of potential management options. Initially piloted in the Richmond Catchment, the program will run in the Macleay area over the next 8 months. For more information on the project contact Lyn Andersen, NSW Department of Primary Industries on (02) 6626 1215 or lyn.andersen@dpi.nsw.gov.au



Floodplain
GRAZING PROJECT

Richmond River experiences massive 'blackwater' event

De-oxygenated water from rotting floodplain vegetation is thought to be the cause of a massive 'blackwater' event in the Richmond River late January 2006. Dissolved oxygen levels as low as 0.4 mg/L were recorded in parts of the estuary (6-8mg/L is thought to be ideal for aquatic life).

Although not considered as disastrous as the 2001 fish kill, also caused by de-oxygenated water, the event has sparked community debate. A public forum entitled "2001 – five years on, what's changed?" was held in March 2006 and attended by around 70 commercial fishermen, tourist operators, representatives from the cane industry, local councils and state government.

At the forum presenters discussed the causes of poor water quality and current remediation programs that will improve the health of the Richmond River. Attendees were encouraged to identify priority areas for management which will form a strategy to improve water quality in the Richmond River.

Rank water kills fish at Wardell

Rotting vegetation starves river of oxygen

POOR water quality has decimated the food chain in the Richmond River near Wardell, with local fishermen estimating around 1000 fish have been killed.

The Department of Primary Industries puts the figure at 100 dead on Wednesday and another 100 yesterday.

The fish kill watching John Callaghan said local residents had done a big clean up before DPI officers were out in force.

"There's been a lot more since 2001," said Mr Callaghan, former chairman of the Redfern Fishermen's Club.

The food chain has been decimated. The blood screws and the yabbies are all dead and hanging in the mangroves like grapes in vines.

Mr Callaghan called the fish kill a disaster and said a meeting of all commercial river fishers had been called for Monday.

However the situation was not as bad as a major fish kill

in 2001 when the Richmond River was closed to commercial netting for six months, while beach netting and hand netting from Lemon Head to Evans Head was also shut down.

Marcus Ritchie, from the DPI, said river water samples taken yesterday were pretty bad. At 5m below the surface there was only 0.4mg of oxygen per litre of water. Normal conditions were between six to eight mg/L.

"Anything below one mg/l is pretty bad," he said.

What caused it

■ Being exposed to winds along the coastal floodplains combined with high temperatures lower the amount of dissolved oxygen in warm water.

■ The water can drain quickly into the river following heavy rain.



ON PATROL: Department of Fisheries personnel monitor water at Wardell yesterday, following reports of fishkill in the area. PHOTO: JACQUELYNE BRADY

Oxygen levels as low as 0.4mg/L were recently recorded in the Richmond River.

Acid sulfate soil champion wins McKell Medal

Tweed Valley sugar cane grower, Robert Quirk, has won the 16th McKell Medal for excellence in natural resource management. The prestigious McKell Medal is awarded annually by the Australian, State and Territory governments to recognise outstanding achievements in land and water management. Robert was chosen from a field of 21 candidates for his contribution to acid sulfate soil management.

When acid sulfate soils were first discovered on the Tweed floodplain in the mid-late 1980's, Robert Quirk knew little about them. Fifteen years later, Robert is now recognised as a leader in the field.

Robert's initial willingness to understand the acid sulfate soil problem has seen his property become an internationally renowned study site. Robert invited leading scientists from the Australian National University, University of New South Wales and CSIRO to inspect his farming practices and asked their graduate students to undertake research on his property. To date, 11 PhD students have studied soil and water interactions on the 200ha Duranbah cane farm.

Research undertaken on Robert's property has identified a range of management options that cane growers can use to reduce acid discharge. For Robert, laser levelling, filling in drains and managing his watertable has reduced acid discharge by 80% and increased his productivity by 38%.



McKell Medal winner, Robert Quirk.

18th World Congress of Soil Science

The 18th World Congress of Soil Science will be held during July at Philadelphia, USA. This year the Congress has included a symposium on acid sulfate soils and their management.

Over 40 different papers on acid sulfate soils will be presented at the Congress, many of them originating from Australia.

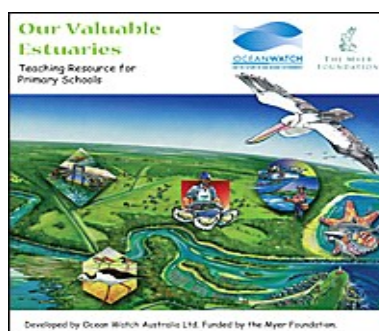
To browse the program and accepted papers log on to -

www.18wcso.org

Our valuable estuaries

OceanWatch Australia, supported by the Myer Foundation and the NSW Department of Primary Industries, has produced an environmental education resource called *Our Valuable Estuaries*, an interactive CD-Rom for primary school students (focusing on Stage 2, NSW Human Society and Its Environment Syllabus).

It outlines the importance of healthy catchments, aquatic habitats and water quality for sustainable and productive fisheries, human impacts and ways to reduce these impacts. For copies call (02) 9660 2262.



New CD-Rom for primary schools is available.

Restoring the Balance, available on-line

The popular 'Restoring the Balance' guidelines are now available to download from the internet. Check out the new fact sheet series highlighting the basic principles of drain management. Log on to www.dpi.nsw.gov.au/reader/floodgate-guidelines

Australian Standards for Analysis of Acid Sulfate Soil

Over recent years considerable advances have occurred in the analysis of acid sulfate soil and the development of standard methodology. Following on from the publication of the 'Acid Sulfate Soils Laboratory Method Guidelines', the Standards Australia committee EV-009-02-01, Analysis of Acid Sulfate Soil, has been working towards making many of these methods Australian Standards.

After a recent inter-laboratory sample exchange program used to validate the methods and to derive repeatability and reproducibility data, a series of Standards on acid sulfate soil methods are now completed and will be issued for public comment within the next month. If you would like to comment on these drafts, they can be downloaded (free of charge) from Standards Watch.

As some of these drafts are not released yet, the best way to stay informed is to register with Standards Watch. This can be done at:

<http://www.sai-global.com/shop/Script/AboutSWatch.asp>

Development applications increase from Nth Qld

Requests from North Queensland for advice on acid sulfate soil planning and assessment have increased dramatically. Development applications requiring advice have risen from 30 in 2004 to over 100 in 2005. The demand for planning advice from the region now equals that of the South-East corner (Brisbane/Gold Coast).

Queensland recorded the fastest and largest population growth of any state or territory in 2005. In Queensland it is estimated that soil treatments associated with new developments cost in excess of \$100 million per annum.

9th International River Symposium

*4-7th September 2006
Brisbane QLD*

This year's theme is managing rivers with climate change and expanding populations.

www.riversymposium.com

QASSIT on-line

Visit the Queensland Acid Sulfate Soil Information Team (QASSIT) on-line. Download fact sheets, lab method guidelines, state planning policies and management strategies.

www.nrm.qld.gov.au/land/ass

Catchments to Coast Conference

*9-14 July 2006
Cairns, QLD*

The major focus of this international conference will be the significant role and value of wetlands within terrestrial and marine environments. www.catchments.org.au

On-line satellite imagery

The Australian Greenhouse Office has an on-line visual record of landscape and vegetation change in Australia since 1972. Through the data viewer, users may zoom into any area and compare satellite images and climatic data between different years.

Log on to www.greenhouse.gov.au/ncas/dataviewer/index.html

ASS mapping finished: double the area initially thought

The Department of Environment has identified double the area of 'high risk' acid sulfate soils (<3m) in the south-west of Western Australia than previously thought. A comprehensive program of coring and soil analysis has refined desktop mapping which appears to have underestimated acid sulfate soil distribution. Over 500 sites between Mandurah and Dunsborough have been cored and tested, together with 70 sites between Augusta and Scott Coastal Plain, and more than 50 sites in Albany and Torbay.

On the Scott Coastal Plain, extensive areas of acid sulfate soils have been identified up to 40 meters above sea level. Most of the potential acid sulfate soil material occurs within 1.5 meters of the ground surface and only marginally below current water tables.

Annual declines in rainfall, changes in land use and increasing ground-water abstraction all have the potential to lower water tables across the region. This could lead to widespread oxidisation of acid sulfate soils and acidification of groundwater supplies.

The Department of Environment's findings are being used by water resource managers to manage groundwater usage and draw-down across the Scott Coastal Plain.

For more information contact Dr Brad Degens on (08) 6364 6754 or brad.degens@environment.wa.gov.au

The Perth Groundwater Atlas

An on-line resource to help water-bore drillers establish groundwater bores in Perth Metropolitan area. The Atlas contains salinity and acid sulfate soil risk maps.

Click on Land, then acid sulfate soils.

www.environment.wa.gov.au

More arsenic found in Perth's groundwater

The peaty soils which underlay the suburbs of Stirling and Gwelup are thought to be the source of arsenic being detected in local groundwater supplies. The peaty soil contains iron sulphides which if exposed to air can oxidise, acidifying groundwater and releasing arsenic and other toxic metals.

Extensive de-watering conducted as part of the recent housing boom and an annual decline in rainfall has progressively lowered water table levels across the region.



Newspaper article explaining the elevated arsenic levels in Gwelup.

Monitoring results conducted by consultants as part of acid sulfate soil investigations in Gwelup found elevated levels of arsenic in groundwater up to 1,800 times above drinking water guidelines of 7ug/L and over 120 times above the irrigation water quality guidelines of 100ug/L.

There is concern that the acidic groundwater, which contains elevated soluble iron and aluminium, may cause environmental harm to Lake Gwelup as well as be visually displeasing. Concerns are also held over Gwelup's public water supply bore, located 200m to the east of the affected area, which may also become affected.

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Lower water tables have oxidised acid sulfate soils releasing arsenic into groundwater supplies.

The arsenic release mechanism in Gwelup is not clearly understood. While the elevated arsenic levels were initially associated with acidity, the recent detection is not consistently associated with acidic groundwater conditions.

The Gwelup incident has also highlighted the importance of water quality assessment techniques. This may be particularly important when surface drainage intercepts contaminated groundwater and discharges into sensitive wetlands such as Lake Gwelup.

The Department of Environment is working with the Water Corporation and the Department of Water to trial the use of calcite pellets as a neutralising agent in a nearby drain (Balcatta Branch Drain) connecting to Lake Gwelup.

For more information contact Stephen Wong from the Department of Environment on (08) 9222 7101 or stephen.wong@environment.wa.gov.au

Victoria

NatCASS visits Gippsland Lakes

The National Committee for Acid Sulfate Soil (NatCASS) met at Lakes Entrance during February. As part of the three day visit members inspected sites throughout the Gippsland Lakes known to contain high risk acid sulfate soils.

Duncan Malcolm, Chairman of the Gippslands Regional Coastal Board, accompanied the Committee on their field trip and informed members of the major issues facing the region. During the trip members saw first hand the intensive dredging required to keep Lakes Entrance open to the ocean and the increasing numbers of canal estates on the Lakes' shoreline.



A new canal estate at Paynesville.

Victorian ASS resources

Download hazard maps for the entire Victorian coastline.
Log on to www.dpi.vic.gov.au click on Victorian On-line Resources, then soil

International Landcare Conference

8-11th October Melbourne, VIC

The focus of the conference will be: people and the environment, creating future landscapes, lifestyles and livelihoods. www.internationallandcareconference2006.com.au

Top end 'blackwater'

Townsend S.A. & Edwards C.A. (2003) *A fish kill event, hypoxia and other limnological impacts associated with early wet season flow into a lake on the Mary River floodplain, tropical northern Australia. Lakes & Reservoirs: Research and Management* 8: 169–176

ABSTRACT - The Mary River, in the Australian wet/dry tropics, flows seasonally to inundate a coastal floodplain. In the dry season, the river reduces to a series of disconnected lakes located along the main river channel. This paper examines the impact of riverine inflow, at the beginning of the wet season, on the limnology of Shady Camp Lake, and addresses broader water quality management issues.

The first wet season flow of Mary River carried a high biological oxygen demand that reduced the lake's oxygen concentration. The resulting hypoxic conditions prompted fish avoidance behaviour and caused the death of at least 200 fish. There is no evidence of any direct anthropogenic pollution causing the event. After reaching near anoxic conditions, dissolved oxygen concentrations recovered several weeks later, although they remained low.

The water quality of the Mary River was characterized by an initial pulse of water with high concentrations of organic carbon, suspended particulate material, colour, total nitrogen and total phosphorus. Phytoplankton biomass, measured as chlorophyll *a*, did not increase because of nitrogen limitation attributed to low nitrate and ammonia concentrations in the inflow waters. The low concentrations of available nitrogen were probably a result of denitrification, which would have been enhanced by the warm temperatures and low oxygen concentrations.

The oxygen sag in Shady Camp Lake caused by the inflow of the Mary River exemplifies the vulnerability of floodplain channel lakes to riverine waters and underscores the need to manage catchment practices to minimize the concentration of labile organic material in the river and its associated oxygen demand.

For a copy of the paper log on to <http://www.blackwell-synergy.com/toc/lre/8/3-4> or contact the Information Officer on (02) 6626 1355 or christina.clay@dpi.nsw.gov.au

An initial understanding of ASS across the Territory

The Land Resources Branch of the Department of Natural Resources, Environment and the Arts, NT has produced an acid sulfate risk map for its coastline based on geomorphic criteria from 1:250,000 land system mapping. The project has been assisted by the ASRIS Project (Australian Soil Resource Information System). Although general, it is the first attempt to map the extent of these soils into a high, moderate and low risk category. A second similar product based on more detailed 1:25,000 soil mapping has been produced for the Darwin coastal region.

Although specific data has not been obtained for most of the Territory coastline, recently published land resource information in the Darwin and surrounding regions has included analyses of potential acid sulfate soils. These results show particularly high percentages of oxidisable sulphur and acidity.

The next step for the Territory is a broad based sampling program to verify and quantify existing risk categories. A similar more detailed mapping project in the Darwin region would also assist the development of sustainable aquaculture, urban development and the construction of coastal infrastructure such as natural gas ports and pipelines.



Land susceptible to acid sulfate soil risk in the Top End based on land systems.

Remote sensing: acid sulfate soils

Bierwirth P.N. & Brodie R.S. (2005) Identifying acid sulfate soil hotspots from airborne gamma-radiometric data and GIS analysis Bureau of Rural Sciences, Canberra ACT

A new mapping technique developed by the Bureau of Rural Sciences utilizes airborne gamma-radiometric surveys to identify and map acid sulfate soil hotspots.

A relationship between actual acid sulfate soils and natural low-level radioactivity was identified on the coastal zone of northern New South Wales. Secondary data; digital elevation, satellite solar reflectance and geological mapping were used to refine the model. Following on from the investigation a remote sensing model has been developed to help identify acid sulfate soil hotspots that may not have been previously identified. The model is also widely applicable given that there are sizeable regions covered by airborne gamma-radiometrics along the Australian coast.

For a copy of the report contact Chrysy Clay on christina.clay@dpi.nsw.gov.au or (02) 6626 1355.



ACID SULFATE SOILS

information and awareness

Fish and prawns avoid acid water

Kroon F.J. (2005) Behavioural avoidance of acidified water by juveniles of four commercial fish and prawn species with migratory life stages Marine Ecology-Progress Series 285:193-204

ABSTRACT - Impacts on aquatic ecosystems resulting from acute exposure to acid sulfate soil discharge are well documented. However, less is known about the long-term impacts of chronic acid sulfate discharge. Such discharge may create barriers to movement, potentially affecting migration of fish and invertebrate species, including commercial species. Avoidance of such discharges by adults may affect spawning migrations, while similar behaviour by juveniles may affect migration to nursery habitats.

As a result, the capacity of fish to access important habitats beyond the discharge point may be reduced with potential consequences for stock size. This study examined the possible existence of acid sulfate avoidance behaviour in juveniles of 3 commercial fish species and 1 commercial prawn species. Schools of 10 individuals were given a simultaneous choice between 2 different water qualities in paired channels of a laboratory stream, i.e. preference-avoidance situation. All species avoided acidified water, indicating that chronic acid sulfate discharge has the potential to affect migration of these species in the field. The pH levels avoided in these experiments were well within the magnitude exhibited by natural systems. Thus, chronic acid sulfate discharge in the field could have a detrimental impact on commercial and recreational fisheries.

Contact the Information Officer, Chrysy Clay on christina.clay@dpi.nsw.gov.au or (02) 6626 1355 for a copy of the paper or log on to

<http://www.int-res.com/abstracts/meps/v285/>

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