

MANAGEMENT OF SEAGRASS HABITATS IN NSW ESTUARIES

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ABSTRACT

This paper reviews the importance of seagrasses to coastal ecosystems, with particular emphasis on their contribution to sustainable fisheries. A number Australian state government fisheries agencies have recently updated their legislation (eg. NSW Fisheries 1995, Couchman *et al.* 1996) and now have greater powers for the protection of marine vegetation. We present four case studies of activities in NSW waters which impact on seagrasses, including harvesting, damage by vessels, reclamation and dredging and the construction of structures such as jetties. We quantify the species and area of seagrass which have been directly destroyed in NSW waters in 1995, and we also discuss the need for future policy and research on seagrass.

INTRODUCTION

Seagrasses play a pivotal role in the coastal ecosystems of Australia and the world. Seagrasses are important in the sustainability of commercial and recreational fisheries, primarily because of their roles in maintaining sediment stability and water quality, and in providing shelter and food that is critical for the survival of a wide variety of aquatic biota (Bell & Pollard 1989, NSW Fisheries 1993). Because of their particular importance to the juvenile life history stages of economically important marine fishes and crustaceans, seagrass beds are sometimes known as the "nurseries of the sea" (West 1989, NSW Fisheries 1992, 1993; Lynch *et al.* 1993).

Seagrass communities are usually associated with intertidal wetland and shallow subtidal soft sediment areas within estuaries and coastal embayments. There are approximately 10 species of seagrasses present in NSW, and these can be grouped into four easily recognisable species/genera: strapweed (*Posidonia australis*), eel grass (*Zostera* spp), paddleweed (*Halophila* spp) and sea tassel (*Ruppia* spp). The later genus, however, is sometimes not regarded as a "true" seagrass as it does not

reproduce underwater.

West *et al.* (1985) mapped the distribution of seagrasses in NSW estuaries between 1981 and 1984. They reported approximately 155 square kilometres of seagrass in 111 estuaries. There have since been some significant changes (both decreases and increases) in various areas during the 12 years since this inventory was completed (NSW Fisheries 1993, Poiner & Peterken 1995). Seagrass beds can be easily destroyed (Short & Wyllie-Echeverria 1996). *Posidonia* is not known to recolonise areas from which it has been removed (NSW Fisheries 1993). Many major estuaries in NSW have lost as much as 85% of their seagrass beds in the last 30 to 40 years (West 1989, West *et al.* 1990, Poiner & Peterken 1995). This loss may contribute to declines in the abundances and diversity of fishes and invertebrates in some of these estuaries and the nearby coastal zone. The areas of some species of seagrasses, however, may have increased in some areas (such as Tuggerah Lakes) because of nutrient enrichment (West 1989).

One of the primary objectives of NSW Fisheries is to protect important fish habitats. The NSW Fisheries Management Act 1994 was proclaimed in January 1995 and provides significantly greater powers for protection of marine vegetation (such as seagrasses and mangroves) than the previous NSW Fisheries and Oyster Farms Act 1935 (NSW Fisheries 1995). This paper reviews the legislation and permit system, outlining some case studies, and discusses some of the present and future benefits and problems of seagrass management in NSW waters.

WHY ARE SEAGRASSES IMPORTANT?

Seagrass beds are valuable fish habitats. Seagrasses generally grow quickly and produce a large amount of organic material which enters the estuarine food chain. Seagrasses are eaten directly by

echinoderms, crustaceans, molluscs and some fish species (Pollard & den Hartog 1984, West 1989). Seagrasses are also important in stabilising bottom sediments. Many species of juvenile fish and crustaceans use seagrasses as nursery areas before moving to other habitats. The postlarvae and juveniles of some fish such as yellowfin bream, luderick and leatherjackets recruit to and live in seagrass habitats (Bell & Pollard 1989). Many seagrass dependent species form the basis of important commercial and recreational fisheries in NSW and interstate waters (Bell & Pollard 1989, West 1989).

NSW FISHERIES LEGISLATION

The Fisheries Management Act 1994 states that “*A person must not cut, remove, damage or destroy marine vegetation on public water land or an aquaculture lease, or on the foreshore of any land or lease, except under the authority of a permit issued by the Minister under this Part (205) or of an aquaculture permit.*” The maximum penalty in the case of a corporation is \$50,000, or \$10,000 in any other case.

In addition, NSW Fisheries’ Estuarine Habitat Management Guidelines (NSW Fisheries 1993) recommend buffer areas around seagrass beds of at least 50 m.

In addition to this specific legislation, which deals with damage to marine vegetation, seagrass may also be protected under NSW Fisheries legislation which controls the granting of permits for dredging and reclamation and the commercial collection of marine vegetation. Aquatic Reserves, Fish Habitat Protection Plans, closed areas, scientific collecting permits and commercial fishing and aquaculture licenses may also be of relevance to seagrass conservation.

Other legislation

An Environmental Impact Statement may be required for a development which impacts upon seagrass habitat (Department of Urban Affairs and Planning 1995). The Department of Land and Water Conservation, National Parks and Wildlife Service, Waterways Authority and the Sydney Ports Corporation may also have control of the substratum of some sub-tidal

and inter-tidal lands which support seagrass beds.

ACTIVITIES AND PROCESSES LIKELY TO AFFECT SEAGRASS

There is a wide variety of activities/processes that can affect seagrasses (Poiner & Peterken 1995). Many such processes are natural environmental events such as variations in tides, currents, temperature, salinity and turbidity, or biological events such as an increased abundance of grazers.

A diverse array and large number of activities are undertaken by humans within and near to seagrass habitats. These activities may directly or indirectly affect seagrasses. Generally, these activities cause a negative impact, and this has resulted in a general decline of seagrass species throughout the world (Short & Wyllie-Echeverria 1996). NSW Fisheries’ responsibility is to mitigate the impacts of any activities that may adversely affect seagrass, and evaluation of these impacts is generally based upon the location, extent, and type of the activities and the vulnerability and importance of the seagrass habitats involved. Table 1 provides a list of activities and actions that may affect seagrasses and are thus of concern to NSW Fisheries.

Case study 1. Harvesting of seagrass in Tuggerah Lake

The problem. The foreshores of Tuggerah Lakes on the central coast of NSW have been subject to rapid urban development as well as some industry and agriculture. This has led to the enrichment of the lake with inputs of both sediments and nutrients. Together with the shallow nature of these lakes, this has resulted in accelerated growth of algae and seagrasses. The dead algae (or wrack) and seagrasses cause unpleasant odours for residents when the vegetation washes up on the shore and decays. Wyong Shire Council proposed to remove excess dead (and also some live) aquatic vegetation from the inshore waters of Tuggerah Lakes by using land-based equipment, and also from the water by using a floating weed harvesting machine.

Table 1. Activities that may have direct adverse impacts on seagrasses in NSW waters.

Activities	NSW Fisheries current management responses
Collection or trimming of live seagrass	Not permitted
Collection of dead seagrass wracks from beaches	Discussion paper has been developed and about 5 commercial permits have been issued; non-commercial collecting is not regulated
Dredging	Permit required
Reclamation	Permit required
Artificial opening of coastal lagoons	Draft policy and guidelines developed
Groynes and breakwaters	Draft policy and guidelines developed
Jetties and wharves	Concurrence authority with local Councils
Ramps and pontoons	Concurrence authority with local Councils
Swing moorings	Discussions with Waterways Authority
Anchoring	Discussions with Waterways Authority
Boating	Discussions with Waterways Authority
Trawling and netting	Current Research Project
Oyster leases	Review of Environmental Factors (REF); Concurrence authority with local Councils
Bait digging	Closures, restrictions on methods
Diffuse and point source pollution	Environment Protection Authority responsibility

NSW Fisheries management response

Council's proposal was seen as a short term solution which did not address the main cause of the problem (i.e. nutrient enrichment due to excess urbanisation). The proposal was likely to cause large scale damage to seagrass beds and thus create a deleterious impact on local and regional fish and fisheries resources. NSW Fisheries has recently refused the application by Wyong Shire Council to use a large algae/seagrass harvester to cut live seagrass within Tuggerah Lakes. NSW Fisheries has however issued an experimental permit for the collection of wrack from the lake. A condition of the permit is an extensive monitoring program to study the impacts of the harvest of wrack on live seagrass and invertebrates.

Case study 2. Damage of seagrass by large vessels at Collins Flat, Sydney Harbour

The problem. Commercial mesh net fishers have made a number of complaints to NSW Fisheries about large private vessels and a Waterways Authority barge entering the shallow waters of Collins Bay in Sydney Harbour. The large private vessels were landing people onto the beach. The Government barge was a front-loading vessel which drove onto the beach and unloaded a small bulldozer to clean rubbish from the beach. Both private and Government vessels were operating in very

shallow water and occasionally would be caught at low tide. The drivers of the vessels would attempt to extricate their vessels and this would result in the propeller digging a large hole, creating a turbid plume and destroying eelgrass (*Zostera* spp.) habitat. There were no scientific data on the size of the direct or indirect losses of seagrass.

NSW Fisheries management response

A site inspection was conducted involving a group comprising representatives from NSW Fisheries, Waterways Authority, Ocean Watch and commercial fishers, who agreed that they would undertake the following three actions: (1) information about the importance of seagrasses would be distributed to boat owners, (2) signage would be posted, and (3) internal discussions would be initiated within the Waterways Authority about ways to mitigate the impact of the cleaning barge (e.g. to operate only at high tide and when conditions were calm). In addition, discussions would be held between the Waterways Authority and the National Parks and Wildlife Service (NPWS) (the adjacent landowners) about the future responsibilities of the Waterways Authority's cleaning contract, and the responsibility for environmental damage caused to seagrass when attempting to clean beaches.

Two large multi-coloured signs were funded jointly by NSW Fisheries and the Waterways Authority at a cost of about \$1700. The wording of the signs was discussed and the following was finalised: "Shallow water and fragile seagrass, No anchoring, 4 knot limit".

NSW Fisheries is also currently liaising with the Waterways Authority to map the extent of seagrasses in NSW waters in relation to existing boat moorings. It is envisaged that this inventory will be the first step towards the removal and relocation of swinging moorings from seagrass beds, and the installation of "habitat friendly" moorings where this is not possible.

Case study 3. Creation of little tern and wading bird habitat at Towra Spit Island, Botany Bay.

The problem.

The construction of the Third Airport Runway at Botany Bay by the Federal Airports Corporation (FAC) resulted in loss of habitat for an endangered bird species, the little tern (*Sterna albifrons*), and also of migratory wading bird habitat. A condition of development consent was that the FAC investigate construction of compensatory bird habitat in Botany Bay. Initial investigations for the relocation of little tern nesting sites recommended Towra Spit as the most suitable site, and an EIS was prepared. The EIS recommends construction of 4 groynes and the removal and relocation of 33,000 cubic metres of sand to stabilise the island and create an intertidal area. The sand removal and relocation areas originally encompassed approximately 5 hectares of *Posidonia* and *Zostera* spp. seagrass beds within the Towra Point Aquatic Reserve.

NSW Fisheries management response

NSW Fisheries, NPWS, Sydney Ports Corporation (SPC) and Dames & Moore (consultants) have had a number of meetings about the proposal. The release of the EIS was delayed for a number of years because NPWS and NSW Fisheries had not been able to agree about the advantages and disadvantages of the development in relation to their separate responsibilities. NSW Fisheries has to date not allowed the proposal to proceed by refusing to issue a

permit for the destruction of *Posidonia*. NPWS and SPC have recently undertaken to reduce the length and change the configuration of some of the groynes to prevent damage to *Posidonia*, and to incorporate buffer zones of 10 to 50m. If the proposal is to proceed, NSW Fisheries will also require a comprehensive program for replanting of *Zostera* spp., and a monitoring program of seagrass distribution and health.

In January 1997, NSW Fisheries considered the public submissions regarding the EIS, and the Department wrote to NPWS that "the Department cannot support this development proceeding within an aquatic reserve".

Case study 4. Cumulative impact of permissive occupancies (POs)

The problem

Extensive areas of estuarine foreshore have been reclaimed throughout the length of the NSW coast, leading to destruction of natural aquatic habitats. Such coastal developments may cause damage during construction and/or operation and are often built at the expense of mangrove and seagrass vegetation. Large numbers of developments such as private jetties, marinas, breakwalls, groynes, roads, bridges, aquaculture leases, etc., have in the past been approved on an *ad hoc* basis with very little consideration being given to their cumulative impacts on aquatic habitat.

NSW Fisheries management response

NSW Fisheries will object to any new structures (such as jetties/pontoons, oyster leases etc.) which are proposed for construction above *Posidonia* seagrass because of the irreversible damage to this seagrass caused by shading (Fitzpatrick & Kirkman 1995). NSW Fisheries may approve some structures over *Zostera* spp. seagrass, but these will be assessed on a case by case basis. NSW Fisheries recognises that structures can also cause damage to *Zostera* spp. seagrass (Everett *et al.* 1995), but this seagrass species can recolonise some affected areas. The decision for approval of POs will be based on the regional importance of the seagrass beds, and attempts to mitigate any impacts of the structure, e.g. by incorporating a buffer zone, using a small pontoon, or using mesh or perspex in place of decking

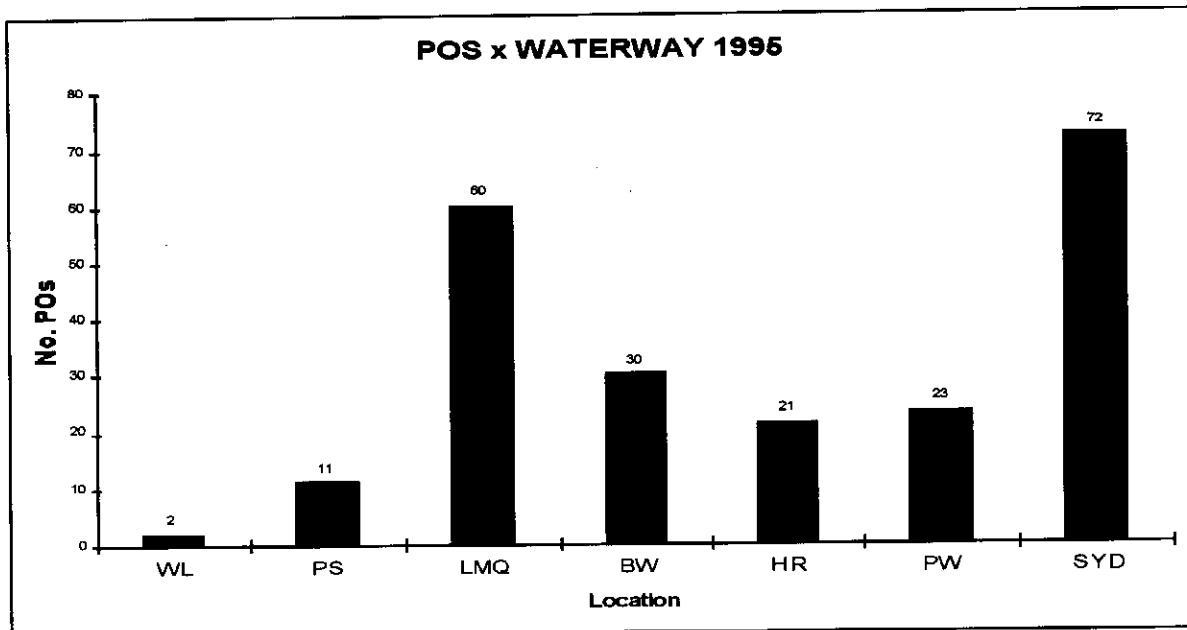


Figure 1: Number of Permissive Occupancies by waterway in NSW in 1995.
Key: WL=Wallis Lakes, PS=Port Stephens, LMQ=Lake Macquarie,
BW=Brisbane Water, HR=Hawkesbury River, PW=Pittwater, Syd=Sydney.

to allow light to penetrate to the underlying seagrass.

The Department of Land and Water Conservation referred 162 applications for POs (essentially Crown Land leases on Foreshores) to NSW Fisheries in 1995. Figure 1 shows the number of POs considered for each waterway. It is interesting to note that these waterways encompass the area of coastline from Wallis Lake to Sydney, but rarely include estuaries on the far north or south coasts of NSW. This is thought to be because there are a small number of applications from these areas and that many of these POs are assessed by NSW Fisheries before the development application stage. NSW Fisheries objected to 18 of these POs because of their potential impact on seagrass.

MARINE VEGETATION PERMITS ISSUED BY NSW FISHERIES IN 1995

NSW Fisheries issued 34 permits for the destruction/removal of marine vegetation in NSW waters in 1995. Most permits issued were for mangrove destruction, and twelve permits were issued for seagrass destruction (Table 2). The species of seagrass that was approved for destruction

was generally eelgrass (*Zostera* spp.) One permit approved the destruction of *Heterozostera*.

Less than 1.3 ha of seagrass were destroyed under permit conditions, statewide in 1995. In some cases, however, there were limited data available to estimate areas. For example, in the case of damage caused by boat salvage and some dredging activities there is likely to be significant overestimation of seagrass destruction.

One permit stipulated rigorous monitoring conditions (costing about \$50,000), because of the impact of dredging and disposal of the dredge spoil near seagrass beds in Port Hacking. A large number of applicants were advised that they should not apply for permits to damage *Posidonia* seagrass as they would be refused. The small number of applicants who have applied for permits have been refused.

PROSECUTIONS

In 1995, seven individuals were reported by fisheries officers to be in breach of Section 205 of the Fisheries Management Act. This section applies to both mangroves and seagrasses, and all offenses involved the cut/remove/damage or destruction of

Table 2. Permits issued for the destruction of seagrass in NSW waters in 1995. Z = *Zostera*, P = *Posidonia*, H = *Heterozostera*, na = not available.

Applicant	Location	Species	Area (m ²)	Reason	Comments
Great Lakes Council	Forster	Z	<530	clean baths	dredging
Individual	Lake Macquarie	Z	6	slipway	
Individual	Lake Macquarie	Z	na	boat salvage	
Individual	Lake Macquarie	Z	na	boat salvage	dredge groove
Individual	Lake Macquarie	Z	na	boat salvage	
Wyong Council	Lake Munmorah	Z	<3500	beach restoration	
Individual	Gynea Bay	Z	na	slipway	
Department of Land and Water Conservation	Port Hacking	P, Z	<5,000	navigation	indirect impacts, monitoring
Shoalhaven Council	Shoalhaven Heads	Z	na	navigation	new entrance
Shoalhaven Council	Lake Burrill	Z	<3000	navigation	
Company	Batmans Bay	Z	372	navigation	
Company	Twofold Bay	H	6	marina	

mangroves. Four of the individuals were cautioned, and three were prosecuted. The maximum fine and costs was eight hundred dollars.

CONCLUSIONS

Natural resource management is a complex problem, and there is a need to evaluate the decisions of natural resource managers (Underwood 1995). This paper has reviewed recent legislation, policies and case studies in relation to the marine vegetation provisions of the Fisheries Management Act which is administered by NSW Fisheries. A positive outcome is that the direct damage to seagrass species by foreshore developments may now be halted. A major limitation of the legislation is that NSW Fisheries has very little power over existing developments which may continue to damage seagrass, and over indirect impacts such as discharges of pollutants and runoff. Another potential difficulty is determining how NSW Fisheries should enforce the legislation. For example, we now have the power to prosecute people who deliberately anchor their boats, or who place swing moorings, in seagrass beds, and also commercial fishers who net in seagrass beds.

Obviously, future policy decisions must be made in light of the social and economic costs and benefits as well as the environmental issues. NSW Fisheries does not wish to prosecute people who inadvertently damage very small amounts of seagrass, but we must be aware of the major and cumulative threats to seagrass in NSW waters and either attempt to prevent these threats and activities from being undertaken, or to mitigate their impacts. Less than 13,000 m² (1.3 ha) of seagrass was destroyed under permit conditions in 1995 in NSW waters. This is approximately 0.008% of the total seagrass currently present in NSW waters. However, almost certainly more seagrass has been lost than has been documented or even observed. The loss of 1.3 ha of seagrass seems very small in comparison to the estimated 30 000 ha of seagrass that has been to be lost to date in Australian waters (Larkum *et al.* 1989) or the 90,000 ha that has been documented as lost throughout the world over the last decade (Short & Wyllie-Echeverria 1996).

NSW Fisheries has recently drafted its Aquatic Habitat Management and Fish Conservation Policy and Guidelines, and on 1 February 1997, released for public

comment a draft Fish Habitat Protection Plan for seagrasses. These educational and policy documents should help local councils, developers and the community in determining which activities they can and cannot undertake in or adjacent to seagrass habitats. It is anticipated that the details of these documents will be incorporated by local councils into their Local Environmental Plans and Development Control Plans. NSW Fisheries will also encourage all coastal Catchment Management Committees and Estuary Management Committees to initiate long-term seagrass monitoring plans in their local areas.

In addition, NSW Fisheries intends to repeat the seagrass inventory of NSW estuaries that was conducted prior to 1985, as this will provide a quantitative assessment of temporal changes in the distribution of seagrass since that time and allow targeted protection and restoration projects to be initiated.

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