

TUGGERAH LAKES INTERIM WRACK HARVESTING STRATEGY



draft report to
Wyong Shire Council

prepared by
NSW Office of Environment and Heritage

December 2012



Office of
Environment
& Heritage

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INTRODUCTION

Healthy seagrasses are vital to the on-going biodiversity, health and amenity of Tuggerah Lakes. They have been demonstrated to be vital nursery and feeding areas for prawns and a wide range of commercially and recreationally valuable and protected fish and perform essential ecosystem services including stabilising sediments, improving water clarity and removing nutrients. Seagrasses naturally shed leaves throughout their lives, particularly when the leaves grow long or are subject to wind and waves. Plant material (including seagrass) that is moved about by wind and washed onto beaches or collects in shallow areas is often referred to as wrack. In Tuggerah Lakes, the majority of wrack is seagrass and associated algae.

Wyong Shire Council has approached NSW OEH to provide interim advice on wrack harvesting in Tuggerah Lakes, prompted by pressure to redouble harvesting efforts in order to improve public amenity of lake foreshores. This document provides context, rationale, methodology and strategic planning advice to council staff dealing with this issue. It is intended that the document will be superseded by the final report on wrack / ooze management provided by NSW OEH to council in early 2013. The aim of the strategy is to manage wrack accumulations in order to 1) improve public amenity of the shoreline, and 2) maintain / enhance the health of the lake ecosystem. OEH research shows clearly that any wrack/ooze management strategy requires two main directions. The first is to minimise the inputs of nutrients and organic matter via stormwater. The second is to maximise the dispersal of inputs (and existing ooze) from the near-shore. It is also seen as important to couple the strategy to an education program that aims to improve public awareness and dispel myths surrounding this issue.

BACKGROUND

WRACK PRODUCTION

Tuggerah Lakes supports large areas of seagrass (*Zostera nigricaulis*) which produces large volumes of wrack (detached leaves). In calm conditions wrack accumulates in the seagrass bed of origin, however once wave energy / water currents exceed a certain threshold, it is liberated from the bed and forms floating rafts which are transported around the lakes according to the prevailing wind-driven currents. Wrack rafts are primarily trapped against shorelines, shallow shoals and emergent seagrass / macroalgae. Floating wrack stays buoyant for approximately 2 – 3 weeks after which it sinks where it has been trapped.

CONTRIBUTION OF WRACK TO OOZE FORMATION

Seagrass wrack decomposes very slowly, and in the absence of any other organic material will persist for many months. In many situations however, wrack accumulations along the shoreline dampen

circulation currents and tend to trap other material (microalgae, inorganic sediment and macroalgae) which can greatly increase the overall rates of decomposition in the wrack pile. This can lead to a predominance of anaerobic decomposition (i.e. in the absence of oxygen) and the production of hydrogen sulfide.

SPATIAL VARIATION IN WRACK ACCUMULATION AND OOZE FORMATION

Preliminary results from surveys of ooze accumulations being carried out by NSW OEH suggest that the presence of wrack accumulations varies widely at spatial scales of 100m to 1km depending on the interactions between a) the location of wrack sources; b) prevailing currents and wave energy; c) shoreline aspect / grade; and d) the existence of emergent vegetation. It should be noted that not all wrack accumulations will result in the formation of sulfidic black ooze. Comparison of urban and natural shorelines suggest that sulfidic ooze development is largely confined to urban shorelines where nutrient-rich stormwater and groundwater discharges are trapped in the nearshore by the presence of offshore rafts of wrack or dense macroalgae beds in the seagrass.

IMPACT OF WRACK ACCUMULATIONS ON NEARSHORE FLUSHING

The presence of emergent wrack and macroalgae along the nearshore reduces the amount of near-shore water movement and mixing that could have resulted from wind/wave energy. This then allows the concentration of groundwater seepage and small urban stormwater discharges in the vicinity of the discharge location. The localised nutrient enrichment forms a positive feedback enhancing excessive macroalgae growth, which in turn greatly contributes to the development of sulfidic ooze. Wrack accumulations and excessive macroalgal growth effectively separate the nearshore zone from the lake basins. As such, the problems of wrack accumulation and ooze development cannot be addressed by enhanced oceanic exchange and entrance management.

WRACK HARVESTING STRATEGY

RATIONALE

The main aims for harvesting wrack are to 1) improve public amenity of the shoreline, and 2) maintain / enhance the health of the lake ecosystem. Shoreline amenity is primarily impacted by the buildup of organic matter, fine sediments, and sulfidic smells. Strategic harvesting of wrack will help:

- a) reduce the trapping of fine sediments resuspended from the lake basin;
- b) improve flushing of the nearshore zone to reduce buildup of nutrient-rich stormwater and groundwater;
- c) increase wave energy along the shoreline to promote dispersion of wrack and macroalgae
- d) minimise the disturbance of desirable plant and sediment communities
- e) minimise unintended downstream impacts

- f) provide for appropriate 'wrack reserves' where natural accumulations of wrack can occur in areas not prone to nutrient enrichment
- g) provide monitoring opportunities to assess management strategies

Any harvesting would also need to comply with the requirements of the Fisheries Management Act, with respect to the potential for damaging marine plants and disturbing protected species. Harvesting would also have to be undertaken in line with the requirements of Council's licence for wrack management issued by NSW Department of Primary Industries (Fishing and Aquaculture).

HARVESTING METHODOLOGY

Wrack harvesting should strive to strategically clear wrack accumulations in order to achieve maximum benefit with minimal negative impacts. Most wrack accumulations occur in shallow water (<30cm deep) adjacent to the shore, and are mostly underlain by either live seagrass or organic ooze. It is therefore vital that harvesting methods are able to be deployed in very shallow water and ensure minimal disturbance to underlying living seagrass and sediments. It should be noted that wrack harvesting should not be confused with efforts to reduce existing accumulations of organic ooze.

TRUXOR HARVESTING

Mechanical harvesting using a Truxor or tractor based method will cause massive disturbance to sediments and seagrass communities. The disturbance of organic ooze will a) liberate nutrient-rich porewaters thereby promoting further undesirable macroalgal growth; b) expose reduced chemical compounds with extremely high oxygen demand thereby causing loss of oxygen in the nearshore; and c) cause high turbidity thereby reducing light penetration to seagrass. These effects are likely to constitute an unacceptable ecological impact on the system, therefore the use of a Truxor is not recommended in the nearshore of Tuggerah Lakes.

NET HARVESTING

A more sensitive and potentially efficient way of wrack harvesting is to skim wrack from problem areas using a shallow-water, modified seine net deployed on the inshore edge of wrack accumulations. Wrack can be dragged into deeper water using one or two boats where it can then be harvested by council's existing harvester. This method would allow clearing of large areas relatively quickly with minimal disturbance to underlying plant communities or sediments.

SHORELINE HARVESTING

In some locations it may be appropriate to implement shoreline harvesting of wrack where it is massed against urban shorelines prone to groundwater seepage (e.g. Canton beach). This will reduce the development of sulfidic conditions common to these areas. Appropriate methods may include hand harvesting or tractor-based racking. At no times should disturbance of sub-tidal sediments occur beyond the first 5m of the shoreline.

TIMING AND LOCATION OF HARVEST

Wrack harvesting should synchronise with seasonal patterns in wind and wrack production to ensure problem areas are kept clear and that prevailing wind waves and currents are used to greatest effect in keeping areas clear. The strategy should be divided into 1) routine seasonal harvesting; and 2) targeted clearing activities dependent on monitoring of wrack accumulations around the lake. These components are described in detail below.

ROUTINE SEASONAL HARVESTING

The aim of this component is to maximise exposure of nearshore zones to prevailing wave and current energy, and to clear seasonal buildups of wrack at key locations. This will aid in flushing of the nearshore zone, and minimise the progressive build up of wrack throughout the season. An indicative harvest zoning map is shown in Figure 1. It is strongly recommended that the wrack model created by NSW OEH as part of the Tuggerah Lakes Project Stage 2, in conjunction with local knowledge, is used to develop a detailed seasonal harvest strategy.

Season	Wind	Harvest Location	Aims
Spring	NE	Long Jetty north	Better circulation
Summer	NE / SSE	Tumbi, Berkley Vale	Better circulation, clear large seasonal accumulations
Autumn	S / SSE	Canton, Chittaway south	Better circulation, clear large seasonal accumulations

During spring, wrack harvesting efforts should commence at the northern end of the Long Jetty shoreline and progress south towards Tumbi and westward to Berkley Vale. This will capitalise on the onset of strong northeast winds and promote unimpeded flow along the shoreline. In early summer, large accumulations of wrack should be cleared from the Tumbi shoreline in preparation for the onset of more frequent southerly winds, promoting better flow along the Tumbi to Berkley Vale shoreline. During Autumn, harvesting should concentrate on areas prone to winter accumulations of wrack due to the predominance of strong southerly winds.

TARGETED HARVESTING

Unseasonal winds may result in unexpected or excessive wrack accumulations at some locations. Where these accumulations are judged to be impeding circulation / wave energy, or adjacent to urban stormwater inputs where they may exacerbate excessive macroalgae growth they should be removed as a priority. A local community network should be set up to alert council to problem areas.

MINIMISE DOWNSTREAM IMPACTS

All harvesting activities should aim to minimise disturbance to seagrass communities and sediments. The use of sediment booms should be considered in areas known to have significant ooze accumulations (e.g. Tumbi and Berkley Vale) to minimise the influence of poor water quality arising from harvesting activities on neighbouring areas of the lake. Clean wrack can be spread onto fringing saltmarsh, whereas wrack taken from nutrient enriched areas should be composted offsite.

CREATION OF WRACK RESERVES

Wrack constitutes an important part of the Tuggerah Lakes ecosystem, providing services such as food and habitat for invertebrate, fish and bird species. It is desirable therefore that wrack should be allowed to accumulate in areas that are not prone to urban stormwater or groundwater inputs, and will not cause adverse public reaction.

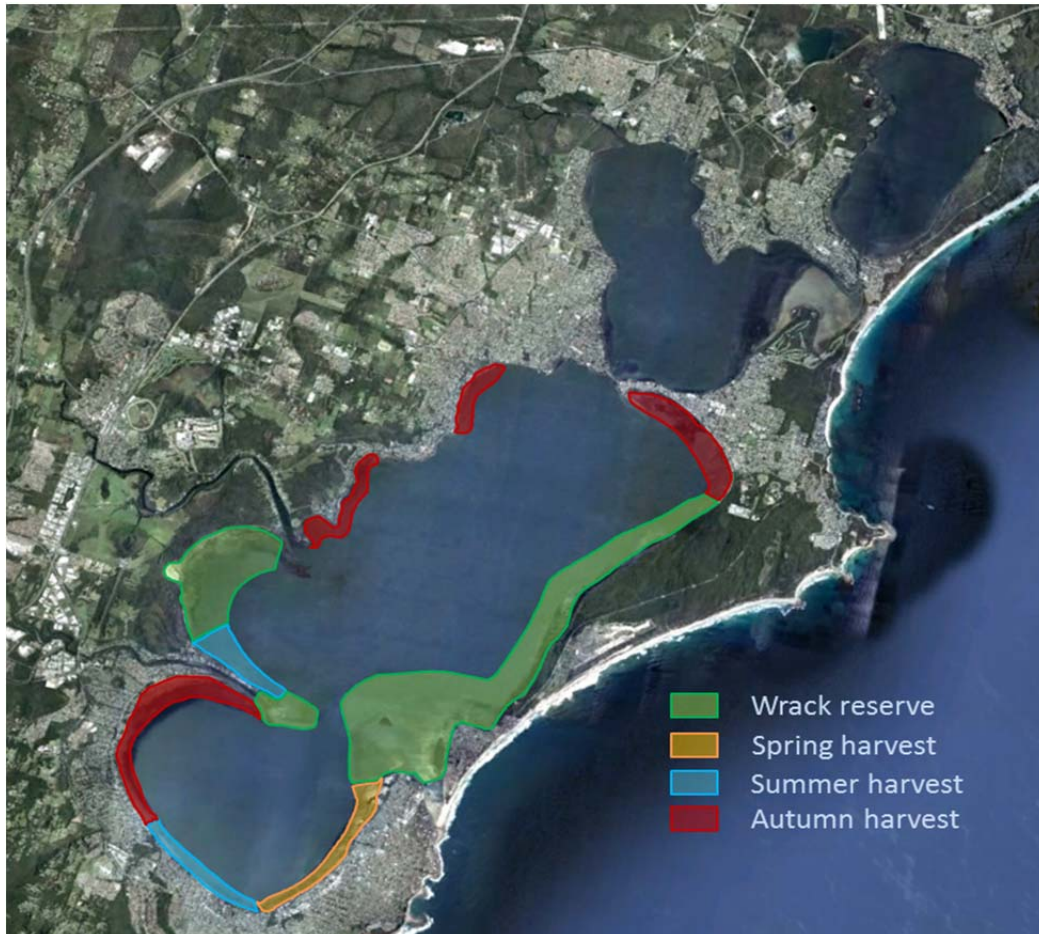


Figure 1 Harvest zoning map showing the seasonal timing of routine harvesting efforts in Tuggerah Lake. This map is intended to be indicative of the general approach, and will be updated using a combination of modelling and local knowledge.

EDUCATION STRATEGY

The wrack harvesting strategy should include an integrated education program for local residents and council staff to gain a better appreciation of the role "weed" plays in Tuggerah Lakes. A common perception is that "weed is BAD" and the solution is to "bring in the dredge".

Seagrass, wrack, and balanced macroalgae growth are integral parts of the lake ecosystem, essential to invertebrate (e.g. prawns), fish, and birds. Healthy reference sites (e.g. Tuggerah Bay, Wirrabalong) could be used to illustrate the nature of a healthy shoreline. The CSIRO anecdotal report confirms

that the lakes have always been "weedy" and that wrack has always washed up along the shoreline. The alteration to water level regimes through entrance management has exacerbated the severity of accumulations however this can be managed through strategic harvesting.

The education strategy needs to stress that it is nutrient enrichment of wrack accumulations (and subsequent macroalgal blooms) that cause wrack accumulations to turn into ooze. As such, it is the actions and choices of local residents that largely determine the amenity of their local shoreline. Wrack harvesting by council can help alleviate smelly ooze problems, but they will persist in a different form until the chronic drip of urban stormwater and groundwater to the nearshore is stemmed.

MONITORING STRATEGY

The wrack harvesting strategy should be regarded as an adaptive management program that strives to improve and adjust practices in line with quantitative evidence from an ongoing monitoring program. This will ensure maximum effectiveness in achieving the overall aims of the strategy. A comprehensive monitoring strategy is required to measure the effectiveness of wrack harvesting in:

- 1) Maintaining shorelines within active management zones clear of major wrack accumulations
- 2) Enhancing water circulation within cleared zones
- 3) Reducing the occurrence / depth of sulfidic ooze
- 4) Reducing the occurrence of macroalgae blooms
- 5) Improving public perceptions of shoreline amenity

NSW OEH will develop a full monitoring strategy as part of the full report delivered in early 2013.