Report to Friends of Venus Bay Peninsula

# The sustainability of pipi (*Donax deltoides*) harvesting at Cape Liptrap Coastal Park, Venus Bay, Victoria.

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Cover photo: Pipi collectors at Cape Liptrap Coastal park, Venus Bay Beach #4 on Christmas Day 2012.

# Sustainability of pipi (*Donax deltoides*) harvesting at Cape Liptrap Coastal Park, Venus Bay, Victoria.

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## Terms of Reference

This report to the Friends of Venus Bay Peninsula is intended to address the two terms of reference discussed at a meeting in Queenscliff on 14 June 2013.

1. Review the studies undertaken on pipis at Venus Bay
2. If required, suggest changes to management that would make the pipi fishery more sustainable.

# Background

In a recent review of clam fisheries (McLachlan *et al.* 1996) noted that:

- recreational fisheries are notoriously difficult to manage since the number of harvesters cannot usually be controlled and exploitation must be limited by recourse to size, bag and season and/or area restrictions.
- the recreational experience provided by clam fisheries on ocean beaches must be considered to be as valuable as the food value of the resource itself.

Defeo *et al.* (2009) added that

- beach fisheries tend to involve a complex blend of users, requiring explicit incorporation of cultural, social and political dimensions in resource management.

The primary management objective for the Cape Liptrap Coastal Park (CLCP), Venus Bay pipi fishery identified in this report is to ensure the pipi resource is sustainable. This resource will then provide an ongoing source of food and enjoyment for harvesters, and contribute to ongoing economic benefits to the local area through sustainable tourism.

It is also important to ensure that the wider ecological impacts of exploiting pipis are acceptable. Pipi fisheries, like all fisheries, will have some ecological impact. These are not well documented in most fisheries, but the intertidal sandy habitat in which pipis are found is one of the more ecologically robust environments. In contrast to collection of bivalves in seagrass environments, the collection of pipis on sandy beaches is unlikely to cause damage to its sandy habitat. But some indirect effects may occur to their predators. Pipis are regarded as the principal food of Pied Oystercatchers in NSW (Owner and Rohweder 2003), and Dakin (1987) also records the large bait worm *Australonuphis teres* as a predator, but this species does not occur on Victorian beaches west of Lakes Entrance (Anon 2008/09).

This report does not deal with indirect effects, except so far as maintaining a viable population of this bivalve should assist the conservation of their predators. Nor does this report attempt to deal with the effect of high visitation on nesting seabirds or conflicts between different beach users. These are matters that need consideration in planning access to different areas of the Venus Bay beach, but will not be considered here.

Sophisticated fisheries models are unlikely to be developed for minor fisheries such as recreational fisheries for pipis, as the cost of developing such models, and populating them with data, would be prohibitively expensive. This does not mean that these fisheries should be abandoned to over-exploitation, but it does mean that regulations need to be practical and data collection/monitoring affordable. Key to managing low value recreational fisheries is adequate monitoring of the size of the fished population and the proportion of this population being taken by harvesters.

## Biology of pipis (*Donax deltoides*)

Pipis (*Donax deltoides*, also called Goolwa cockles in South Australia) have significant commercial fisheries in South Australia (annual catch >1000 tonnes, Ferguson and Mayfield 2006) and New South Wales (annual catch 460 tonnes in 1996-97, Murray-Jones 2000), but only small recreational fisheries occur in Victoria, and these appear to be restricted to Discovery Bay Coastal Park and CLCP, Venus Bay.

The apparently lower abundance of this species in Victoria probably results from low nutrient concentrations along most of the open Victorian coast, which results in low phytoplankton production, and reduced larval/adult pipi survival and growth. Higher nutrient concentrations near the mouth of the Murray River (e.g. near Goolwa) and adjacent to estuary mouths in NSW probably explain the higher productivity of pipis in adjacent states.

The reason pipis are concentrated on two beaches in Victoria is uncertain, but the high pipi population at Discovery Bay may be due to periodic upwelling of nutrient enriched water off the western Victorian coast, and the high population of pipis at CLCP, Venus Bay may be the result of elevated nutrient concentrations associated with Andersons Inlet.

Ferguson and Mayfield (2006) reviewed much of the biology of this species, and the following summary is taken from their report. In NSW pipis grow to 37 mm in 10 months and the

estimated maximum longevity was 3.8 years in NSW and 3.5 years in SA. They reach sexual maturity at 36-37 mm in NSW and SA, at approximately 1 year of age. Different authors have estimated the duration of the larval period of pipis as 3-4 weeks and 5-6 weeks.

All pipi (*Donax deltoides*) populations in eastern Australia are genetically similar (Murray-Jones and Ayre 2000) and their long larval life (3-6 weeks, see references in Murray-Jones and Ayre 2000) suggests that most larvae released from a beach do not recruit back to the beach on which they were spawned. However, as there are only two large pipi populations in Victoria, if recruitment to each population is not the result of spawning in each population, the source of the recruits not clear. In the analysis of sustainability that follows, it is assumed that recruitment to the Venus Bay population results primarily from spawning in that population.

Surf clam populations are prone to large temporal variations, including large variation in recruitment, making stock assessment difficult (Murray-Jones and Steffe 2000).

# Review of studies undertaken at CLCP, Venus Bay.

There have been two studies undertaken that have attempted to assess the sustainability of the recreational fishery for pipis at Venus Bay. Both of these studies (Lewis 2010, Early *et al*. 2013) were undertaken as part of BSc (Hons) degrees at Victoria University.

Both studies provide valuable data and make a convincing case that harvesting has reduced the population of large (reproductive) pipis near access points on Venus Bay. Both studies found lower densities of pipis and fewer adult pipis at more accessible sites, where most harvesting has occurred historically. Lewis (2010) found that the mean abundance of pipis along three transects located at, and 500 m on either side of, three popular access points, had mean abundances of 1.44-1.89 pipis/$m^2$, compared to a density of 17.1 pipis/$m^2$ at a 'control ' transect, 5 km from an access point. Pipi biomass was approximately 10 × greater in less accessible locations.

Lewis (2010) only provided evidence that areas within 500 m of access points have been affected by harvesting. Early *et al.* 2013 provided a more comprehensive assessment across Venus Bay. They sampled pipis along 20 transects at 1 km intervals along the length of Venus Bay. The mean biomass of pipis at less accessible transects (1-8 & 20) was 0.20 kg/$m^2$, compared to 0.06 kg/$m^2$ at more accessible transects (9-19) (Table 1). This 3 × difference in biomass was highly significant (ANOVA of log (biomass), $p<0.008$*).

Fisheries stock assessments usually rely upon an estimate of population size (typically estimated as catch per unit effort, CPUE) and how this has varied over time and/or with different levels of fishing effort. Lewis (2010) measured CPUE for pipis on Venus Bay, but CPUE can only be used to assess fishery sustainability when there is a time series of such data, and ideally historical measurements of effort in the fishery. As neither Lewis (2010) nor Early *et al*. (2013) provide any analysis of temporal changes in population size, nor any estimate of the total recreational catch, it is unclear how they were able to conclude this fishery is sustainable.

**This test was performed using data from Figure 6, Early et al. (2013). Remarkably, although there were many statistical comparisons in Early et al. (2013), there was no statistical comparison of densities of pipis in accessible and less accessible regions.*

# Estimates of pipi population biomass and the amount harvested

**Table 1. Estimates of total biomass of pipis in accessible (transects 9-19) and less accessible (transects 1-8 and 20) regions at Venus Bay, assuming beach width is 40 m (Early *et al*. 2013) or 60 m (Lewis 2010).**

| Accessability of transects* | Transects | Biomass (kg/m$^2$) | Length (km) | Width (40 m) | Width 60 m | Biomass (tonnes) | |
|---|---|---|---|---|---|---|---|
| | | | | | | (width=40 m) | (width=60 m) |
| Inaccessible | 1-8, 20 | 0.196 | 9 | 40 | 60 | 71 | 106 |
| Accessible | 9-19 | 0.057 | 11 | 40 | 60 | 25 | 38 |

*All transects >3km from an access point were considered inaccessible. Early *et al.* (2013) used both this criterion, and considered only transects 12-19 as accessible (2nd page of discussion).
Note that some harvesters also use 5 Mile Track, near transect 9 for access, although this track is poorly maintained.

Data on pipi catches from Lewis (2010) and estimates of pipi biomass in more and less accessible/harvested areas of Venus Bay from Early *et al*. (2013) were used to estimate the absolute size of the pipi population and the likely catch of pipis by harvesters. Neither of these parameters were estimated in previous studies.

Back-of-the-envelope style calculations in Table 1 show that the biomass of pipis in the accessible area of Venus Bay (transects 9-19) was 25-38 tonnes, while in the less accessible area of Venus Bay the biomass of pipis was 71-106 tonnes. If 2L=2kg of pipis* then on the accessible beach there was the equivalent of 12,500-19,000 × 2L catch limits, and on the less accessible beach there were 35,500-53,000 × 2L catch limits. Over the past three years Fisheries Enforcement Officers have checked the compliance of ~3000 harvesters on Venus Bay beach annually. 3000 collectors taking their limit from the accessible part of Venus Bay beach could legally remove the entire population in 4-6 days. As Fisheries Officers clearly do not check all harvesters, it is clear that harvesting is likely to have had a large effect on the more accessible pipi populations. Clearly, diminishing returns would ensure harvesters were discouraged before the entire population was collected. But these calculations indicate the vulnerability of the pipi population to large numbers of harvesters.

Early *et al.* (2013) concluded that the fishery is sustainable, largely based on the size of the refuge population which mostly occupies the less accessible eastern half of Venus Bay. At the moment this refuge population appears large enough to prevent recruitment over-fishing. They also indicate that the currently less accessible areas should remain so, to protect the refuge population.

**Figures on p76-77 of Lewis (2010) can be used to estimate that 2L of pipis=2kg, 1.72kg or >2.28kg.*

# Management recommendations

## Background

### Current restrictions

Currently there are three legislative mechanisms for managing the recreational pipi fishery at CLCP, Venus Bay.

- All harvesters must have a recreational fishing licence,
- There is a maximum allowable catch per day of 2L of pipis/person or 0.5 L of shucked pipis, and
- Only hand collection is permitted.

### Effectiveness of current fishing restrictions

Lewis (2010) found that the mean individual catch rate was 1.14 kg/day, less than half the legal 2 L limit. This indicates that in most instances, at least in more accessible areas, that catch limits are determined by the scarcity of pipis rather than by the bag limit.

Restrictions on use of tools are difficult to enforce as these must be seen in use by a Fisheries Officer for an offence to be prosecuted. Plastic spades/rakes are such commonly used toys on sandy beaches that their possession does not constitute an offence.

### Additional recommendations in recent reports

**Size limits:** Lewis (2010) recommended that the harvest of pipis should be restricted to those >45 mm.

**Monitoring:** Lewis recommended that pipi populations should be monitored annually, while Early *et al*. (2013) suggested that populations should be monitored every 5 years. (Monitoring every 5 years is clearly inadequate as the estimated longevity of pipis is <4 years)

**Maintenance of a refuge population.** Early *et al*. (2013) recommended that no new access points to Venus Bay should be introduced, as this would make the refuge population of reproductive adults, currently >3 km from access points, vulnerable to harvesting and threaten the sustainability of the population.

## Harvesting/monitoring recommendations

CLCP Venus Bay can be divided into two regions.

- A less accessible region with much less harvesting and a high pipi population
- An accessible region with high harvesting pressure and a low pipi population,

Management of both regions could be improved.

**Improved management of inaccessible areas**: Within the less accessible SE region of Venus Bay (Transects 1-9 in Early *et al.* 2013), I concur with Early *et al*. 2013, that it is important that exploitation in this region is not increased. But, unlike Early *et al.* (2013), I am not confident that merely preventing improved access to this region will provide adequate protection. I expect harvesters will travel further, as the more accessible populations are depleted. Therefore, I would recommend active protection of the refuge population. The easiest way to protect this refuge population would be to close it to all pipi harvesting immediately (as has been done for pipis throughout Port Phillip Bay).

**Improved management of accessible areas:** Within the accessible NW area of Venus Bay (Transects 10-20 in Early *et al*. 2013), where the pipi population has been depleted, pipi management should aim to ensure that harvesting remains rewarding and pleasurable.

Reducing the allowable catch to less than 2L /day seems at odds with the social objectives of this fishery, as it would mean that one days harvest would provide less than a meal. However, the pipi population appears to have been depleted well below that which would yield the maximum harvest. To increase the return to harvesters more large pipis need to be available.

This could be achieved using size limits or rotational closures. Size limits would assist as they would prevent people harvesting small pipis, and ensure all pipis have a chance to spawn. Alternatively, a numerical bag limit (in NSW there is a limit of 50 pipis/day, Murray-Jones and Steffe 2000 ) could be used to encourage harvesters to collect larger shellfish. But size limits and numerical limits appear difficult, time-consuming and costly to enforce.

Consequently, to ensure a more sustainable harvest in the more accessible region, I would recommend rotating annual closures of areas

within the accessible region. This appears the most practical means of ensuring areas are not constantly over-fished. Such closures appear more practical to enforce as no-one should be harvesting in any closed area.

In contrast to size limits, compliance with rotational closures is evident without close inspection of the catch, and can be determined by fisheries inspectors and the public from a distance. Consequently, provided there is adequate engagement with stakeholder groups, strong public pressure to do the right thing is likely to make these closures self-enforcing over time. This is not possible with size limits, as it is too easy to cheat without this being obvious to other beach users.

In the first instance, I would suggest closing approximately 30-40% of coast in the 10 km section of the more accessible beach. The initial locations and size of closures within this area should be a matter for community discussion. The effectiveness of the closures will depend more upon the proportion of the beach closed than on their exact location (i.e. the effectiveness of 4×1 km closures, 2×2 km closures, or 1×4 km closure will be similar).

Both harvested, less harvested (and the closed refuge areas) should be monitored annually (in October-November, before the main harvest season) as part of an adaptive management arrangement. On the basis of monitoring, and any enforcement issues, the duration and spatial extent of closures could be modified over time. But I would expect that areas would be 'rested' for a year, before being re-opened, and adjacent areas 'rested'.

# Summary of recommendations

1. Existing catch limits and gear restrictions should be maintained.
2. The refuge pipi population should be actively protected by permanently closing the SW half of CLCP, Venus Bay to all pipi harvesting immediately.
3. Rotational closures should be implemented in the more accessible NE half of CLCP, Venus Bay
4. Monitoring of pipi abundance should occur annually in both the accessible (open and closed sectors) and in the permanently closed SW of CLCP, Venus Bay.

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