INSTITUTE FOR MARINE AND ANTARCTIC STUDIES
UNIVERSITY OF TASMANIA

2013 SMALL BIVALVE FISHERY ASSESSMENT

Venerupis largillierti - Southern Zone, Georges Bay

Ostrea angasi - Georges Bay

David Tarbath and Caleb Gardner

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Tasmania
DEPARTMENT *of* PRIMARY INDUSTRIES, WATER *and* ENVIRONMENT

Venerupis Clam Survey, Georges Bay South Zone, April 2013

Summary
A survey of the Georges Bay southern zone found no *Venerupis* clam stocks at harvestable size. The clam population in this part of the bay was reported to be destroyed in 2011 following low salinity levels after prolonged rainfall in the bay's catchment. Large numbers of juvenile clams were found, indicating that the population is rebuilding. It is anticipated that it may take two or more years before stocks are rebuilt sufficiently to support fishing.

Introduction
A small fishery for the venerid clam *Venerupis* (=*Ruditapes) largillierti* takes place in Georges Bay, north-east Tasmania. This species is considered accidentally introduced from New Zealand in the late 1920's (Maguire, 2005; NIMPIS, 2013). It is found sub-tidally in shallow estuarine waters on sandy or muddy substrates exposed to water currents (Cook, 2010). Its distribution in Australia is limited to the east and south-east of Tasmania (Grove, 2011). Previous assessments showed that it forms large populations with densities reaching approximately 40 t/ha in parts of Georges Bay, and that this density has increased in recent years. Much higher densities may be attainable - a related species (*V. philippinarum*) was reported producing annual harvests in excess of 60 t/ha/yr (Becker *et al.*, 2008).

The most recent survey of the Georges Bay southern zone occurred in April 2013. Five areas in wading depth totalling approximately 5.5 ha were surveyed in which quadrats of size 23 cm x 30 cm were dug out and the *Venerupis* present were counted and measured for length. Four areas in deeper water (2-3 m) totalling approximately 1.1 ha were similarly surveyed by divers, using quarter square metre quadrats.

948 *Venerupis* of size range 4-53 mm were collected (Fig. 1). The modal length was 15 mm. Only 8 clams of legal size (≥ 40 mm) were found. On this basis there is no fishable stock in the southern zone with no prospects of a fishery for the remainder of 2013 and probably 2014.

Discussion
The previous (2010) survey estimated a biomass of 117 t, with a stock (i.e. clams ≥ 40 mm) of 75 t covering an area of approximately 5.5 ha. Most of this biomass was reported to be destroyed in 2011 due to prolonged low salinity levels following an extended period of high rainfall in the region (A. Flintoff, fisher, pers. comm.).

Compared with the remainder of the bay, the *Venerupis* beds in the southern zone are shallow and exposed to low salinity water following high rainfall. The northern zone beds are deeper (5-7m) and unaffected by changes in salinity.

Extensive settlement of *Venerupis* juveniles throughout Georges Bay was reported in 2012 (D. Ridgers, fisher, pers. comm.). It is likely that most of the juveniles collected in the recent survey originated from this settlement, and that the source of recruitment is the population in the deeper northern zone. Growth rates of *Venerupis* reported from Georges Bay and New Zealand varied between 1.2-2.0 mm/month (Gribben *et al.*, 2002; Kent *et al.*, 1999). Given linear growth rates, stock rebuilding should start to occur when parts of this cohort reach legal size in 2014. Rates of natural mortality for this species in the southern zone are unknown and projections of yield from juvenile density could be inaccurate and thus misleading.

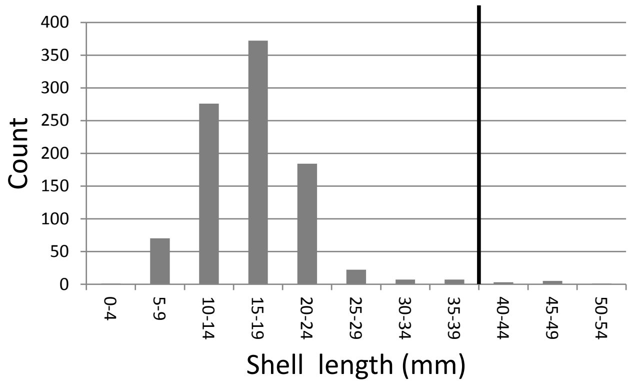

Figure 1. Length frequency of *Venerupis largillierti* from samples collected in April 2013, Georges Bay southern zone. The vertical black line shows the position of the 40-mm minimum legal size relative to the measured clams.

Native Oyster Survey, Georges Bay, April 2013

Summary
A survey was conducted in the Georges Bay in April 2013 and from data collected it was estimated that the biomass of native oysters was 618.4 tonnes, with 95% confidence limits at 504.3 t and 732.5 t. The fishery is managed under a TAC that specifies the number of oysters available to fishers in dozens. Based on 10% of the exploitable stock, the TAC is 39,796 dozen. Based on 10% of total biomass, the TAC becomes 55,573 dozen. The former approach is recommended, because almost 30% of the biomass was below marketable size.

Introduction
The native oyster *Ostrea angasi* (also known as mud oyster) is widespread and common throughout Tasmania, and also across much of southern Australia (Grove, 2011). It lives inter-tidally on sand or muddy bottom, in some places with large numbers forming dense beds. In Georges Bay, north-east Tasmania, a small fishery has operated for many years, possibly since 1985. More recently market demand has been weak, and consequently harvest levels have been negligible: between 1,000 and 3,000 dozen, or less than 1% of the estimated biomass. Oysters are deemed marketable at 70 mm shell length. The fishery occupies a defined area in the bay with a number of separate beds being available for harvesting, the total area of which is 75,618 m^2 (Figure1).

Four assessments of oyster abundance in Georges Bay have been made since 2003. The boundaries of the oyster beds were defined after the 2003 assessment with the use of a GPS receiver and the areas of the beds were subsequently estimated (Figure 1). Since 2008, assessments have used a stratified (by bed) random design, with samples collected from the beds using a quarter square-metre quadrat. Assuming that the quadrats provide a representative sample, the average density per 0.25 m^2 is calculated, and then extrapolated to the total bed area.

2013 assessment.
The summed area of surveyed oyster beds surveyed was 52,104 m^2 comprising the beds 7, 4 and 1, the assumed equivalent areas of beds 6, 5 and the small patch between beds 4, 5 and 8 (approximately 5,000 m^2, see Discussion).

2,387 oysters were collected and measured (shell length, mm). A length-weight relationship developed from previous survey data was used to estimate weights ($w = a.l^b$, where a = 2.49E-04, b = 2.87543). Numbers of oysters and biomass were calculated for each bed and then totalled to provide estimates for the fishery.

Mean weight per m^2 of oysters was 11.9 kg/m^2, giving a fishery biomass of 618.4 t ± 114.1 t. The mean density across all six surveyed beds was 128.0 oysters per m^2, for a total of 666,871 oysters, of which approximately two thirds were of marketable size (≥70 mm). At 10% of available biomass, the TAC equates to 55,573 dozen. The number of marketable sized oysters i.e. the stock, was 4,775,515. At 10 % of available stock, the fishery TAC equates to 477,552 or 39,796 dozen oysters.

Many small oysters were encountered, and it appears that recruitment is ongoing (Figure 2). The modal size at all beds was larger than the legal minimum size. Bed 5 had quantities of particularly small oysters (<30 mm). The proportion of oysters >100 mm was low considering that their maximum reported length is 170-180 mm (Edgar, 1997; Grove, 2011).

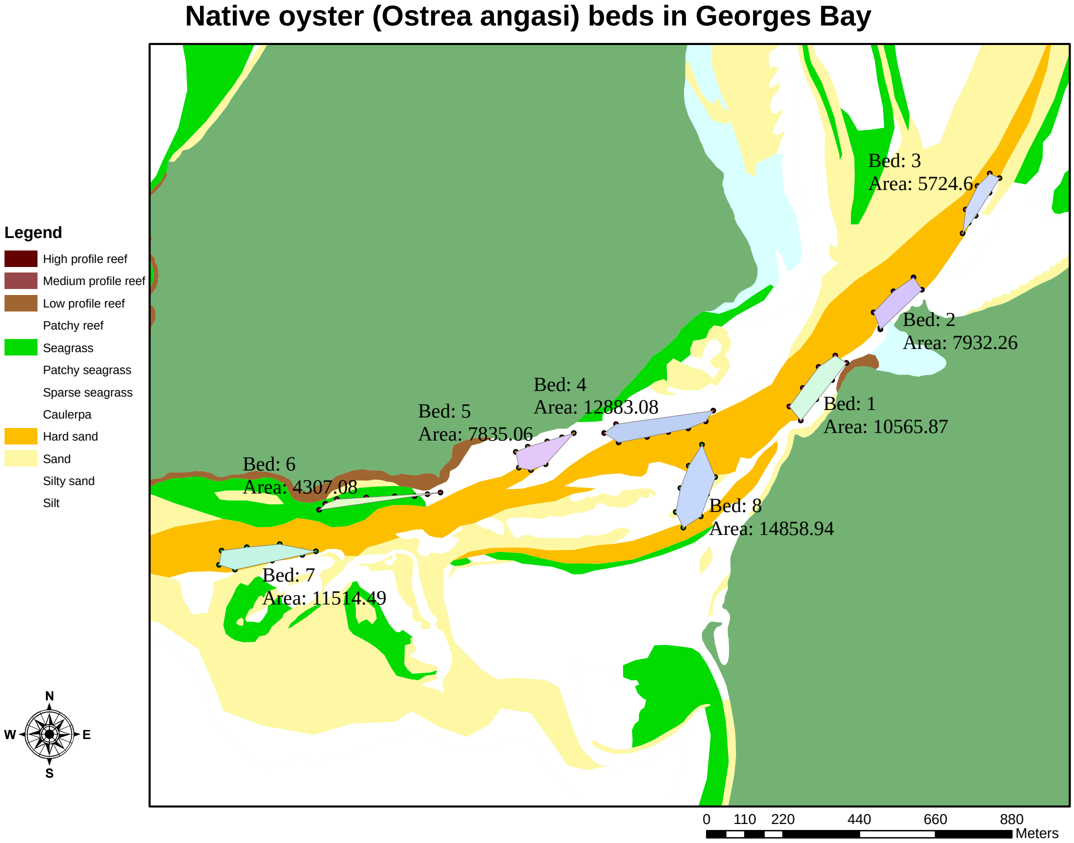

Figure 1. Habitat map of part of Georges Bay with eight separate native oyster beds delineated.

Discussion

The 2003 assessment recognised only three beds: the main bed (20,160 m^2), the eastern bed (8,976 m^2) and the Akaroa bed (13,000 m^2), with a total area of 42,000 m^2. Later surveys included more beds and greater areas.

During the 2010 and 2013 surveys, the sampling locations were logged using GPS, accurate to within approximately 10 m. Figure 3 shows the position of the GPS tracks relative to the identified beds. It shows that in both years less than 50% of the samples were collected inside the defined beds. This has implications for the accuracy of the assessments.

In 2010, it was assumed that samples collected near beds 4, 5 and 6 could be attributed to those beds and that the area sampled was approximately equal to the area of those beds. This assumption was repeated in 2013, although the area covered by oysters was substantially greater than the defined areas of those beds. No sampling was done in bed 6 (all sampling was done immediately south of the bed) and bed 5 samples were mostly collected outside their boundaries. It appeared that the floor of the bay from south of bed 6 to the east of bed 4 forms a continuous bed i.e. the areas attributed to beds 4, 5 and 6 under-represent the area covered by oysters.

The eastern side of the channel (beds 1, 2, 3 and 8) appeared less productive. In 2008, beds 3 and 8 were not sampled. In 2010, bed 3 was not sampled and only part of bed 8 was sampled because oyster abundance was low and patchy. Bed 2 had low abundance. In 2013, the only recognised bed sampled was bed 1 i.e. beds 2, 3 and 8 were omitted because the fishers considered that abundance was too low for fishing.

In both 2010 and 2013, a small patch between beds 8, 4 and 5 was sampled. The boundary of this patch was undefined, but for the purposes of this 2013 assessment it was estimated at 5,000 m^2. Bed 7 has been sampled consistently in all years and has the highest densities.

Oyster biomass has increased since 2010, but not to 2008 levels (Table 1). Given that the annual catch has been < 1% of the TAC for many years, differences in biomass are probably attributable more to sampling error rather than actual variation in abundance. This sampling error can in turn be attributed to between-survey spatial variation in the sampling and the patchy distribution of oysters in the bay. Due to the low level of effort, the fishers who conducted the sampling were less familiar with the spatial distribution of oysters in the bay than they might have been if the stock had been fully fished. This degrades the ability to detect changes in abundance and needs to be addressed.

Table 1. Comparison between weights and numbers from 2008 and 2010 surveys:

	2008	2010	2013
mean density (kg/quadrat)	3.046	2.037	2.763
area of fishery (m^2)	55,036	69,895	52,104
mean density (kg/m^2)	12.185	8.148	11.051
total biomass (t)	670.6	569.5	618.4
density (count legal/m^2)	90	67	92
TAC (10% of count, in dozens)	41,369	39,025	39,796
average weight (g/oyster)	132	121	129

A possible solution is that fishers be required to use GPS and depth/time loggers, so that the position of the productive beds that comprise the fishery becomes known and the bed areas more accurately estimated. However, if the fishery continues to receive minimal effort, GPS loggers will provide no benefit. The alternative is to conduct a dedicated survey of beds using both IMAS and industry divers, although this would be costly in terms of the returns from the fishery.

Table 1 compares results from previous surveys with the current survey. Density was least, with smaller (lighter) oysters in 2010, but the surveyed area was greater. It shows that sampling large areas with low or patchy abundance does not necessarily increase biomass, and reflects the need for consistent sampling across the most productive parts of the fishery.

The 70-mm minimum length needs consideration. The size was chosen to suit marketing needs and is not legislated. No study has been done on minimum size with respect to ensuring sufficient egg production and recruitment for sustainable fishing. This is no problem while the stock remains unfished, but the size limit is low relative to the modal size of oysters in all beds (Figure 2), and ideally the minimum size would be larger than the mode if was intended to promote sustainable fishing.

The length-weight relationship shows that these oysters gain weight rapidly from 70 mm. Using the 2010 length-weight relationship a 70-mm oyster weighs approximately 50 g, while at 80 mm the meat volume is much larger and the oyster is almost 50% heavier (74 g). Most of the oysters of about 70 mm were clustered and required breaking apart, reducing their size and weight. At larger sizes, the clusters break up, the oysters separate and can be captured individually (Edgar, 1997). It is not yet clear whether the clustered oysters are marketable.

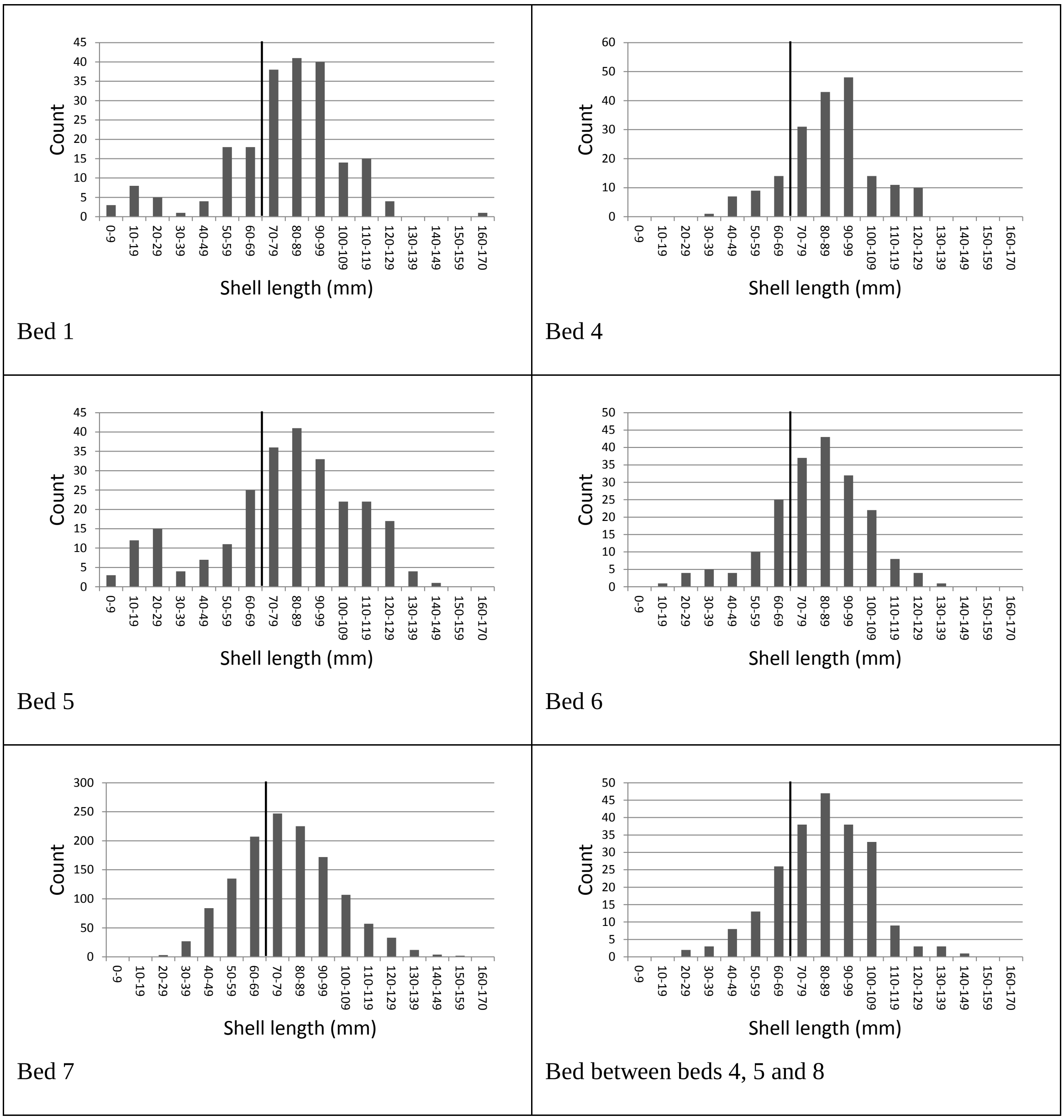

Figure 2. Size distribution of native oysters. The vertical line indicates the position of the 70-mm legal minimum length relative to each size distribution.

DPIPWE's shellfish policy document specifies a TAC set at 10% of biomass (2007). During the 2013 survey, the proportion by number of oysters <70 mm was large (almost 30%) relative to earlier surveys (12% in 2010, 18% in 2008). Part-founding a TAC on biomass that will not be fished exposes the stock to higher levels of fishing mortality than anticipated. In 2013, 10% of the biomass implies that 14% of the stock is exposed to fishing. A more precautionary approach would set the TAC as a percentage of stock size.

Figure 3. Native oyster surveys in Georges Bay, showing GPS tracks from the 2010 (yellow marker) and 2013 (green marker) surveys, the position of mapped oyster beds and the undefined bed between beds 4, 5 and 8.

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