

Healthy estuary and rivers of the City

Water quality and ecosystem health monitoring programme of Ihutai

**The sediments and biota of the Avon-
Heathcote Estuary/Ihutai and tidal
reaches of the Avon and Heathcote rivers**

Summary report on data collected in 2008

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the City

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Summary report on data collected in 2008

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1 Introduction

The Healthy Estuary and Rivers of the City: Water quality and ecosystem health monitoring programme of Ihutai was written in 2006¹. It includes monitoring programmes for four environmental values. This report summarises data collected in 2008 from the Estuary and the tidal reaches of the Avon and Heathcote rivers as part of Value B – Healthy Ecosystems – soft sediments of the estuary and tidal reaches. Other parts of this value include water quality of the Avon and Heathcote rivers, water quality of the estuary and river habitat and its biota. These aspects are covered by separate summary reports.

Healthy mudflats of an estuary and tidal reaches of a river support a diverse range of animals such as anemones, snails, shellfish, worms, crabs and hoppers. The presence and survival of these animals (biota) not only depends on the quality and salinity of the water² but also on the quality of the sediments, i.e. the mudflats, that they live on or in. The diversity and abundance of animals living on and in the mudflats provides food for fish and birds while an abundance of healthy shellfish, such as cockles, are a valued food item for many people. In addition these mudflat-living animals, by their normal actions such as feeding and burrowing, keep the sediments well oxygenated and healthy.

The quality of the sediment in the estuary and the tidal reaches of the rivers have the potential to be impacted by:

- soil that runs off the land and into the rivers and estuary
- excessive amounts of organic matter, e.g. from dead and decaying plants including seaweeds and from bird and mammal excrement
- the quality of the overlying water
- contaminants such as metals, pesticides and herbicides that enter the rivers and the estuary in stormwater and other legal and illegal discharges

The features of the sediment that influence the types and abundance of the animals that live on or in it are:

- the size of the sediment grains that make up the sediment
- the amount of organic matter in the sediment
- the concentrations of potentially toxic contaminants

In order to assess the state of the sediments and biota of the Avon-Heathcote Estuary/Ihutai and tidal reaches of the Avon and Heathcote rivers a monitoring³ programme started in 2007. Not only does this monitoring provide information on the present state of the sediments and biota, but by sampling every year it will be possible to see if and how the sediments and biota change over time.

This annual report is the summary of the sediment and biota data collected in 2008 and is the second such report. A report including more detailed analysis, such as analysis of trends over time, will be produced following five years of data collection.

¹ The report was published in February 2009 – Batcheler, L., Bolton-Ritchie, L., Bond, J., Dagg, D., Dickson, P., Drysdale, A., Handforth, D and Hayward, S. 2009. Healthy Estuary and Rivers of the City: Water quality and ecosystem health monitoring programme of Ihutai. Environment Canterbury Report No RO9/8. 60pp.

² The water within the Avon-Heathcote Estuary/Ihutai is primarily a mix of the freshwater flowing out of the Avon and Heathcote rivers, the sea water from Pegasus Bay that flows into the estuary as the tide rises and the tertiary treated wastewater that is discharged from the oxidation ponds. The wastewater consists of nutrient and plant plankton enriched freshwater that is discharged into the estuary twice a day around high tide. Refer to the summary report on the water quality of the Avon-Heathcote Estuary/Ihutai for more information on the impact of the wastewater discharge on the water quality of the estuary.

³ Monitoring is the routine collection of data over time in order to assess the state of the environment and identify changes over time.

2 Sampling

2.1 Sampling sites

The sites sampled are shown in Figure 1. Note: in the 2007 summary report results from Sandy Point (between Discharge Point and Humphreys Drive) were included.

Sandy Point is not a routine site for the Healthy Estuary and Rivers of the City programme but is currently sampled every two years as a condition requirement of the resource consent for the discharge of wastewater into the estuary.

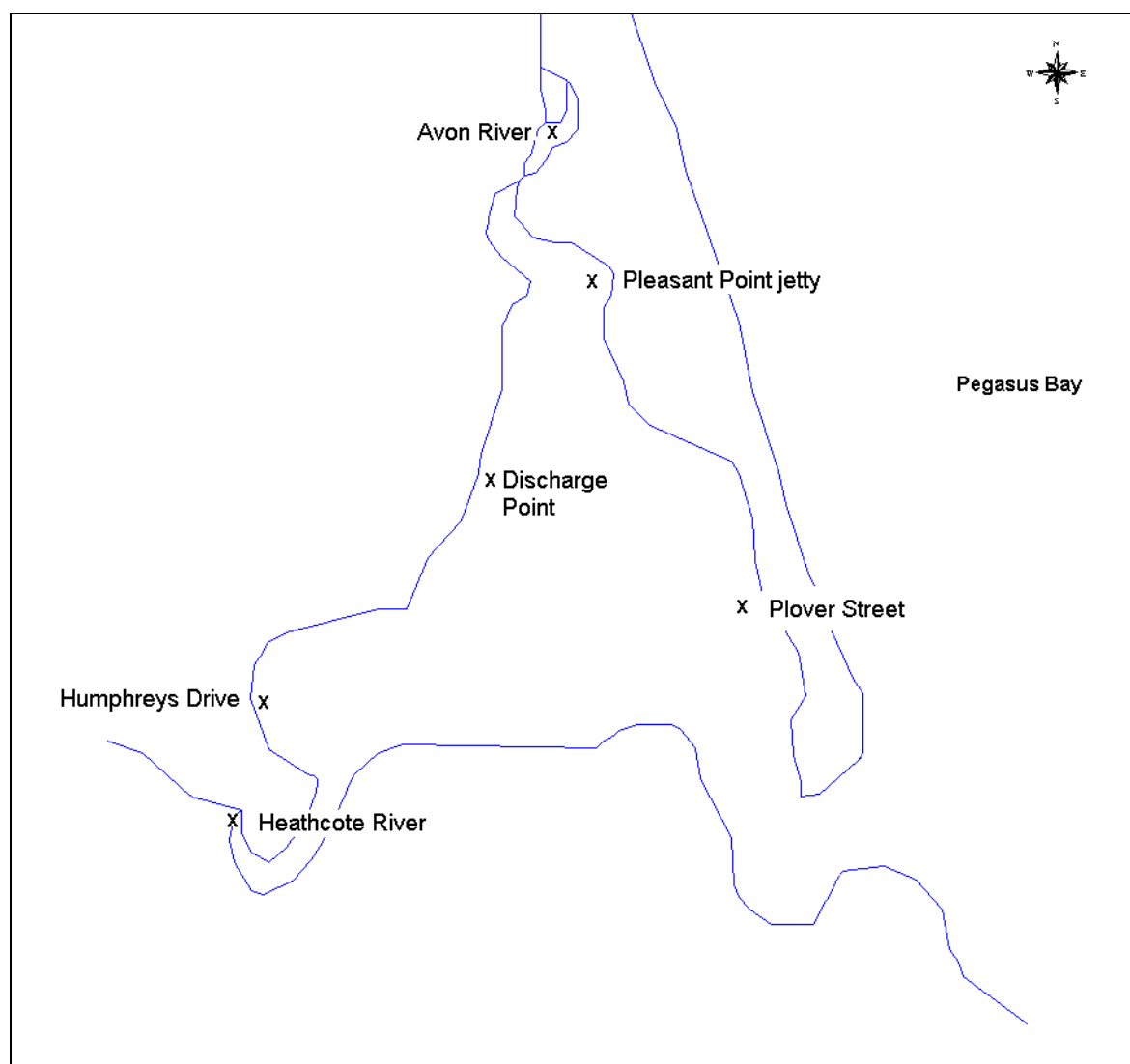


Figure 1 The sampling sites within the Avon-Heathcote estuary/Ihutai and in the tidal reaches of the Avon and Heathcote rivers

2.2 Collection of samples

The methods used followed the national protocol for monitoring estuarine environments (Robertson *et al.*, 2002). The GPS co-ordinates of each site were recorded.

Samples from the river sites were collected on 26 March and those from the estuary sites were collected on 10 - 12 and 27 March, 2008.

These sites were sampled by EOS Ecology on contract to the Christchurch City Council.

The following samples were collected at the sampling sites.

Sediments

Ten samples from the estuary sites and five composite samples from the river sites were collected and analysed. The top 20 mm of sediment was collected for analysis. Sediment samples were only analysed for sediment grain size. Sediment organic matter content and metal concentrations were not measured in 2008 as the programme specifies that they are measured every three years. They were measured in 2007 and will be measured again in 2010.

Biota

Plants and animals on the surface of the sediment

Fifteen, 50 cm x 50 cm (0.25 m²) quadrats were sampled. The number of each different type of animal on the surface of the mud and the number of crab burrows in each quadrat was counted and recorded. The percentage cover of the surface by seaweeds was determined using a grid overlying the quadrat.

Animals living in the sediment

Fifteen 130 mm diameter x 150 mm deep cores were sampled. Each sample was sieved through a 0.5 mm screen and the material retained on the screen stored in alcohol for analysis. The number of each different type of animal in each core was counted and recorded.

Size distribution of some common animals

The height of all mudflat snails present in the quadrats was measured.

The length of all cockles in each quadrat (dug to a depth of 120 mm) was measured.

3 Results

The results are presented on the following pages. The data are typically presented as bar graphs. The bars have been positioned on a map and below each bar are the minimum and maximum values recorded at a site. This form of presentation makes it is easy to see the similarities and differences between sites.

3.1 Bar graphs

The bars for the sediment grain size and the biological data represent the average⁴ value. The height of a bar represents the value.

3.2 Pie graphs

Pie graphs have been used to show the average number of individuals of each type of animal living in the mud at each site. The size of a piece of the pie represents the average as a proportion of the total number of individuals present.

3.3 Names of plants and animals

The scientific names of the plants and animals are used but if there are common names they are also used.

⁴ The average is obtained by adding up all the vales and then dividing the total by the number of values used

3.4 Interpretation of biota data

The biota data presented summarises the types and abundance of animals, the size range of mudflat snails and cockles and the abundance of seaweeds at the sites in 2008. No analyses have been undertaken to investigate why there are differences in the plants and animals between sites. That is, the information provided only gives the state of the biota in 2008.

3.5 Sediments

3.5.1 Grain size

This is a measure of the size of particles that make up the sediment. The sediment grain size distribution affects the types of animals that live at a site. Some types of animals live in or on sandy sediment without too much silt or clay while other types live in or on muddy (silt and clay) sediment.

From the results obtained the percentage of sand, silt and clay in each sample was calculated. The average percentages of sand, silt and clay at each site are shown in Figure 2.

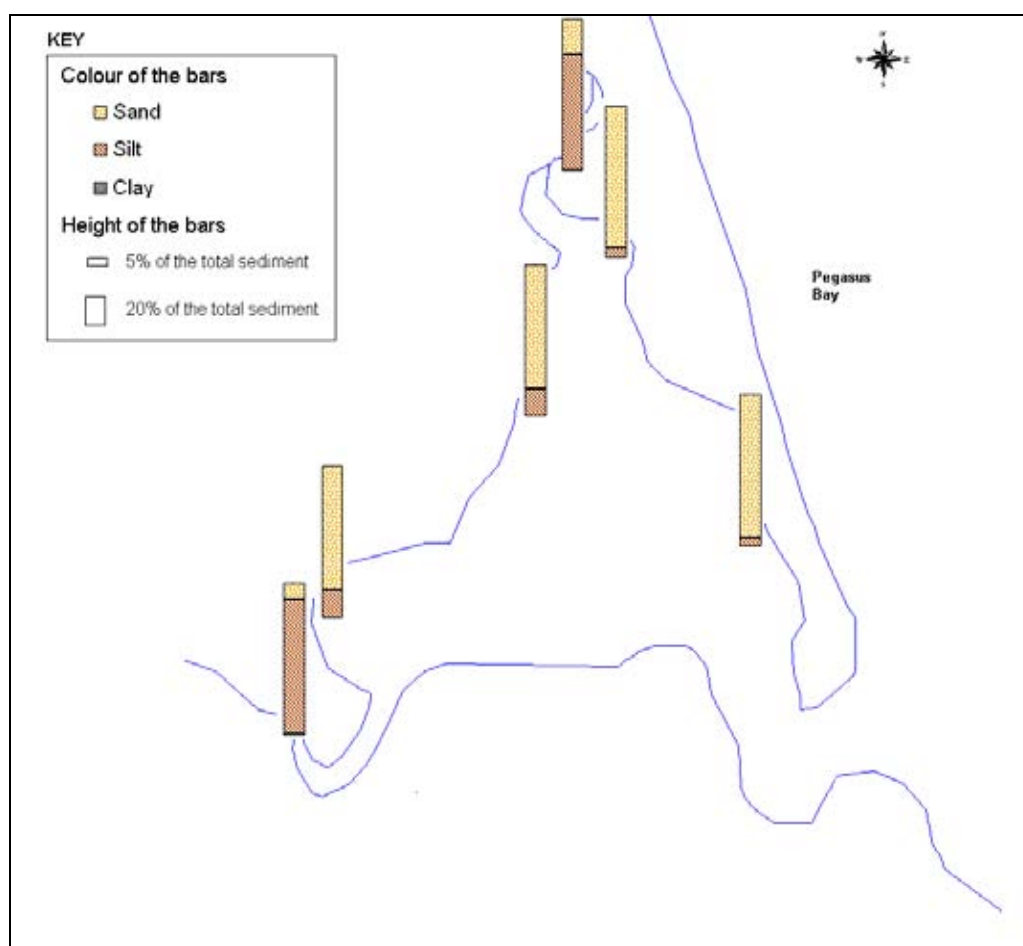


Figure 2 Percentage of sand, silt and clay in the sediment at each site

The sediment at all sites in the estuary was predominantly sand (more than 80%) with less than 20% silt and 1% clay. There was less silt at the sites on the eastern side than those on the western side of the estuary.

The sediment at the Avon and Heathcote river sites was predominantly silt (more than 75 %) with less than 25% sand and 1% clay.

3.6 Biota

3.6.1 Plants and animals on the surface of the sediment

Number of different animals

Twenty nine types of animals were found to be present. Of these 29 types of animals one was an anemone, 14 were snails and shellfish, 4 were worms and 10 were crustacea (crabs, lice, hoppers and a barnacle).

The number of each type of animal living on the surface of the sediment at each site, is shown on Figure 3.

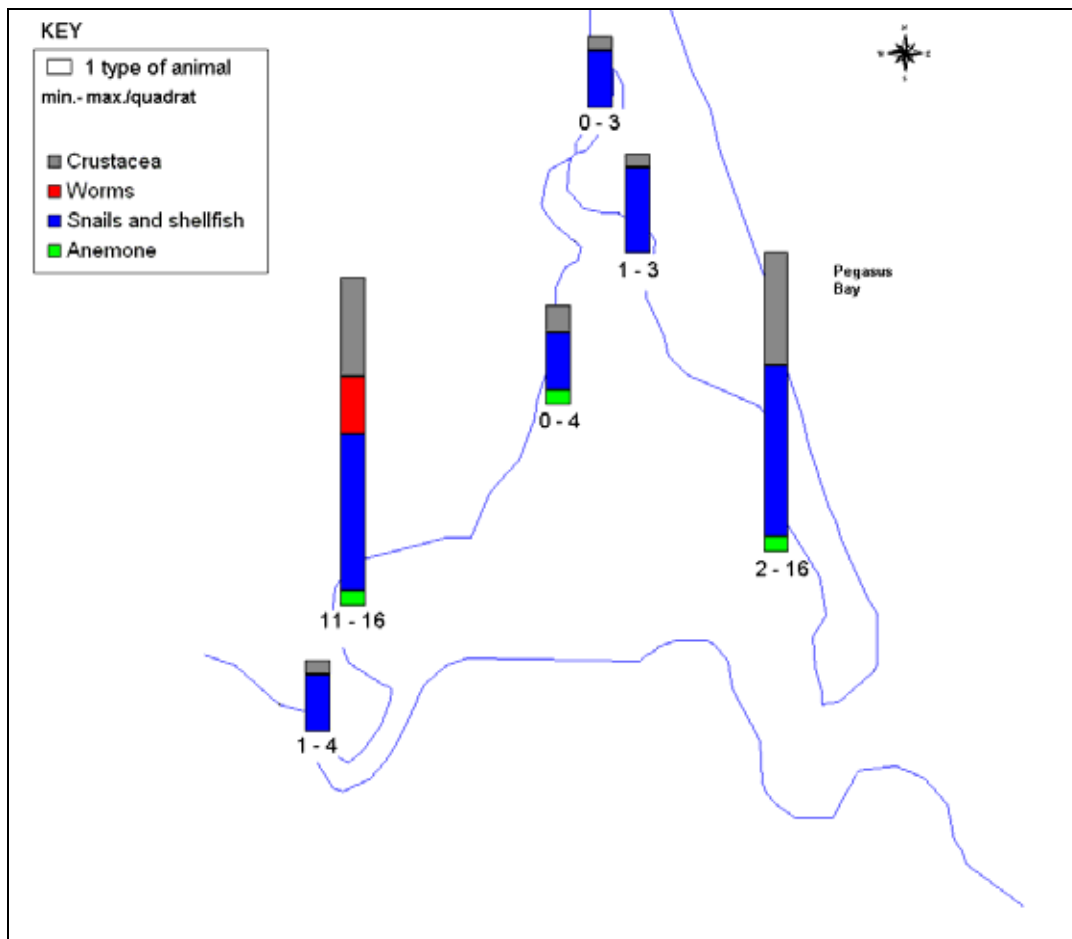


Figure 3 Number of different types of animals living on the sediment surface at each site

There were more types of animals at Humphreys Drive than at any of the other sites, with two more types of animals at Humphreys drive than at Plover Street. Five different animals occurred at both the Avon and Heathcote rivers.

Snails and shellfish and crustacea (not including crab burrows) were present at all sites, anemones were present at three sites and worms were present at one site. The worms, lice and hoppers were living amongst the seaweed that was on the sediment surface.

Mudflat snail (Amphibola crenata)

Mudflat snails feed on the micro-organisms and organic matter in the sediment. As they feed they leave a string-like trail of waste on the surface of the mud. They lay their eggs into a tyre-like rim of mud. These egg cases can be seen on the mud surface from late November to March. Mudflat snails can tolerate a wide range of salinities and temperatures and exposure to air for considerable periods of time.



Number of snails

The average number of snails per m² at each site is shown on Figure 4.

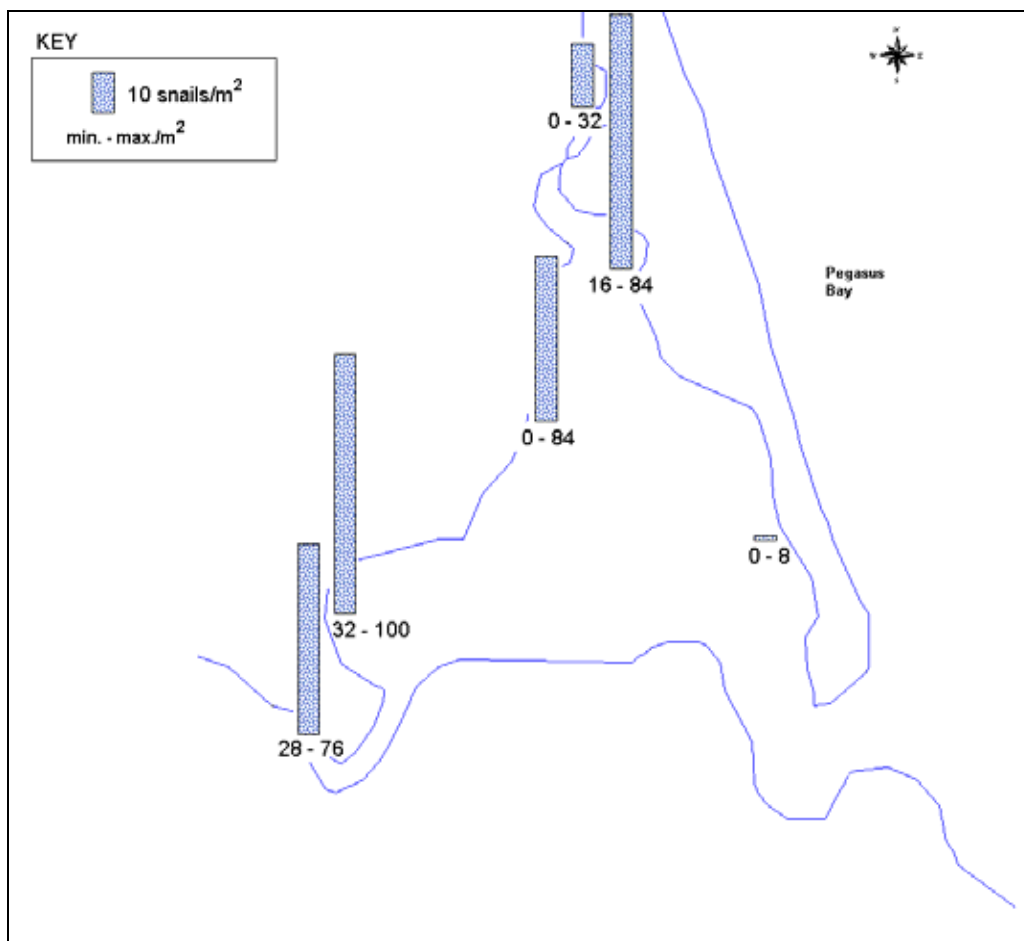


Figure 4 Average number of mudflat snails per square metre on the surface of the sediment at each site

Mud flat snails occurred at all sites but there were very few at Plover Street. The average number of snails at Humphreys Drive and the Pleasant Point jetty was similar. There were less snails at

Discharge Point than at Humphreys Drive and the Pleasant Point jetty. There were more snails at the Heathcote River than the Avon River site.

Size of mud flat snails

The height distribution of all mud flat snails present in the fifteen quadrats sampled at each site are shown in Figure 5.

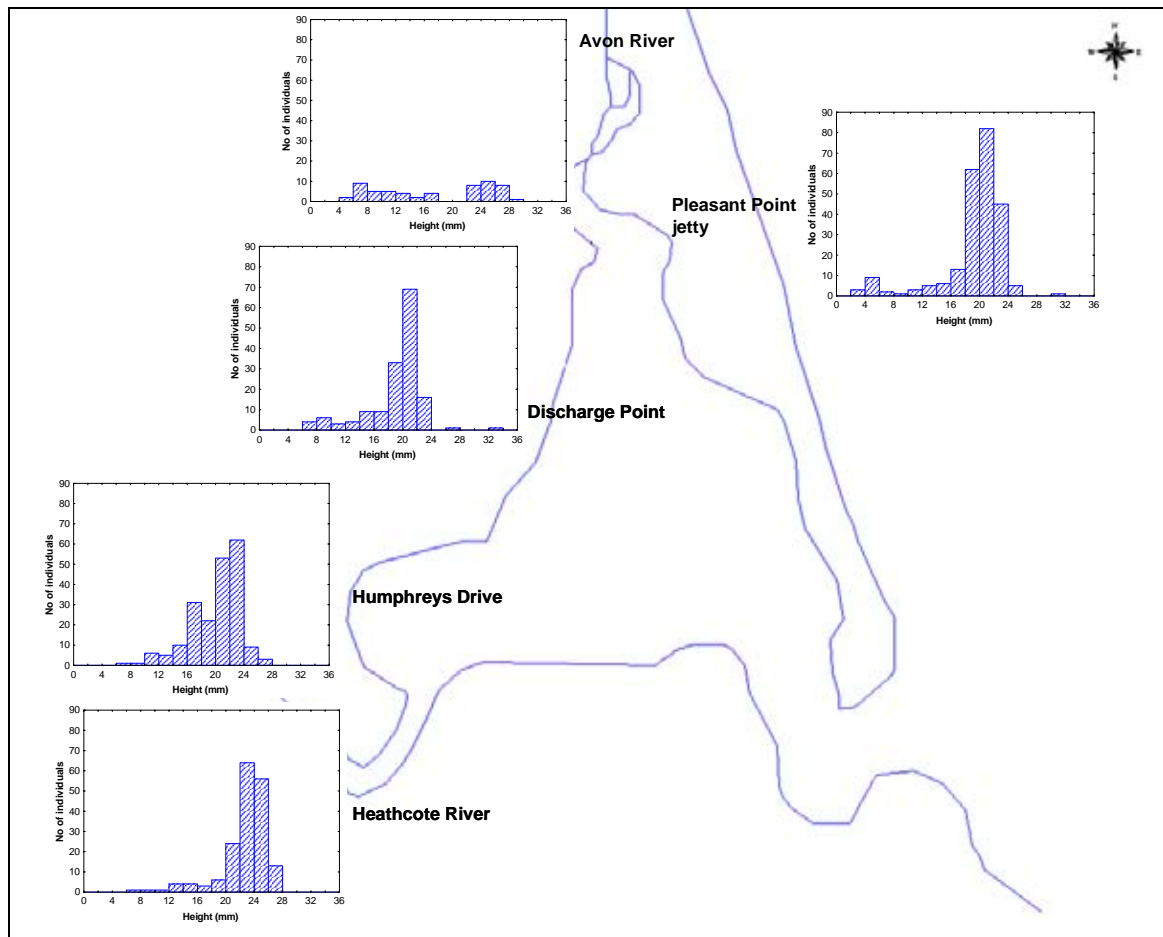


Figure 5 Height (mm) distribution of the mud flat snails at each site

The snails sampled ranged in height from 3 - 32.5 mm. Of the individuals measured, 40% at the Avon River site, 9% at both Pleasant Point jetty and Discharge Point, 5% at Humphreys Drive and 3% at the Heathcote River site, were smaller than 14 mm.

That is, at most sites there were few juvenile snails with almost all snails being adults. At Pleasant Point jetty and Discharge Point 61% and 66% respectively of individuals, had a height of 18-22 mm. At Humphreys Drive 57% of individuals had a height of 20-24 mm and at the Heathcote River site 68% of individuals had a height of 22-26 mm.

Crab burrows

Crab burrows are a common sight in the estuary. Burrows are easily counted but whether a crab lives in the burrow is not known nor is the type of crab in the burrow known. The two common crabs that burrow in the estuary are the stalk-eyed mud crab (*Macrophthalmus hirtipes*) and the short-eyed mud crab (*Helice crassa*).



Number of crab burrows

The average number of crab burrows per m² at each site is shown in Figure 6.

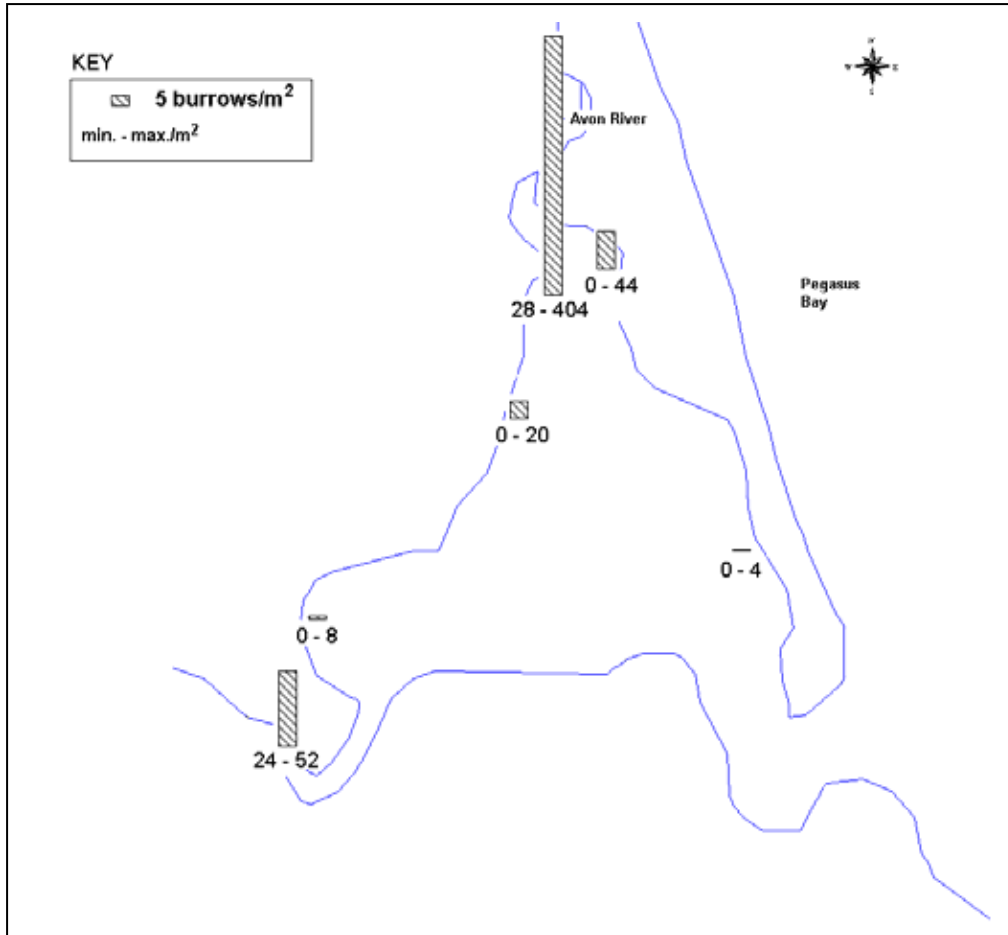


Figure 6 Average number of crab burrows per square metre at each site

Crab burrows were present at all sites but there were very few at Plover Street and Humphreys Drive. There were more crab burrows in the lower Avon and Heathcote rivers than in the estuary and there were more burrows in the Avon River than the Heathcote River.

Seaweed cover

The most abundant seaweed within the estuary is the green sea lettuce (*Ulva* sp.) with the red seaweed *Gracilaria chilensis* also common. Where these seaweeds occur they cover the mudflat, so in a quadrat it is the percentage of the mudflat covered by seaweed that is used as a measure of seaweed abundance.



The average percent seaweed cover at each of the sites is shown in Figure 7.

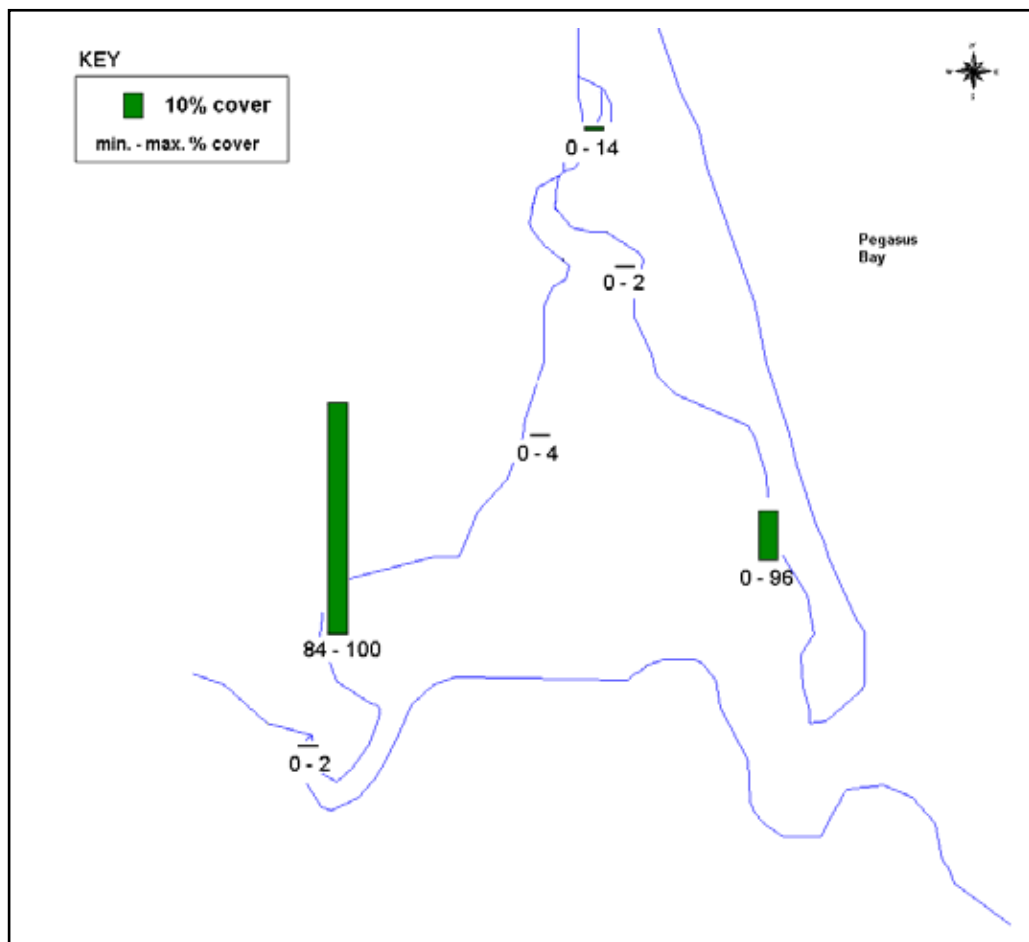


Figure 7 Average percent seaweed cover at each site

Seaweed was present at all sites. Of the 15 quadrats sampled two at the Avon and Heathcote river sites, three at Discharge Point and four at Pleasant Point jetty, contained seaweed. At Plover Street seaweed cover was patchy with no seaweed in five quadrats, and up to 96% cover in the other ten quadrats. At Humphreys Drive the mudflat was generally extensively covered with seaweed.

Animals that live in the sediment

Number of different animals

Thirty-three types of animals were found to be present. Of these 33 types of animals 12 were of snails and shellfish, 1 was an anemone, 13 were worms and 7 were crustacea (crabs, lice and hoppers).

The number of each type of animal living in the sediment at each site is shown in Figure 8.

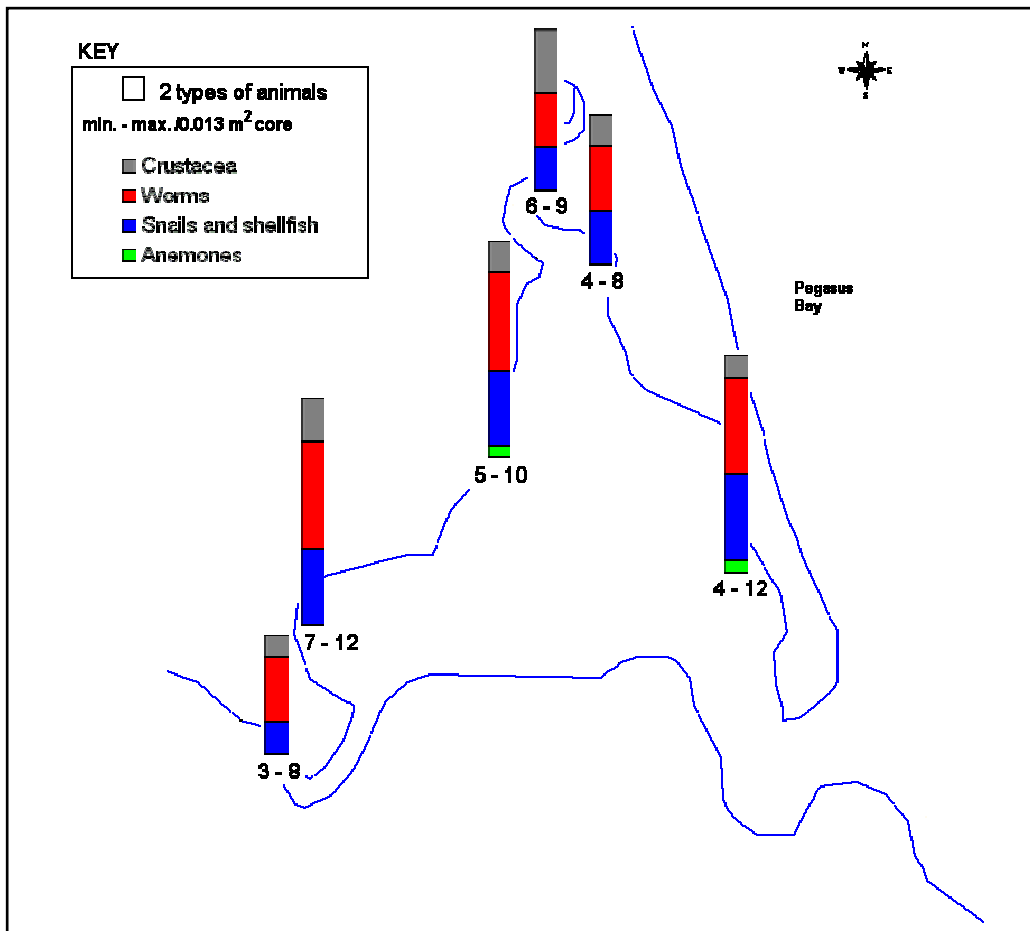


Figure 8 Number of different types of animals living in the sediment at each site

Worms, snails and shellfish and crustacea were present at every site while anemones were only present at Discharge Point and Plover Street.

At all sites in the estuary and at the Heathcote River site there were more types of worms than types of crustacea or snails and shellfish. At the Avon River site there was one more type of crustacea than type of worm. More types of worms occurred at Humphreys Drive, more types of snails and shellfish occurred at Plover Street and more types of crustacea occurred at the Avon River site, than at any of the other sites sampled.

There were more generally more types of animals at the sites in the estuary than in the rivers. However, there was one more type of animal at the Avon River site than at Pleasant Point jetty. Within the estuary there was one more type of animal at Humphreys Drive than at both Plover Street and Discharge Point.

Number of animal individuals

The average number of animals per square metre is shown in Figure 9.

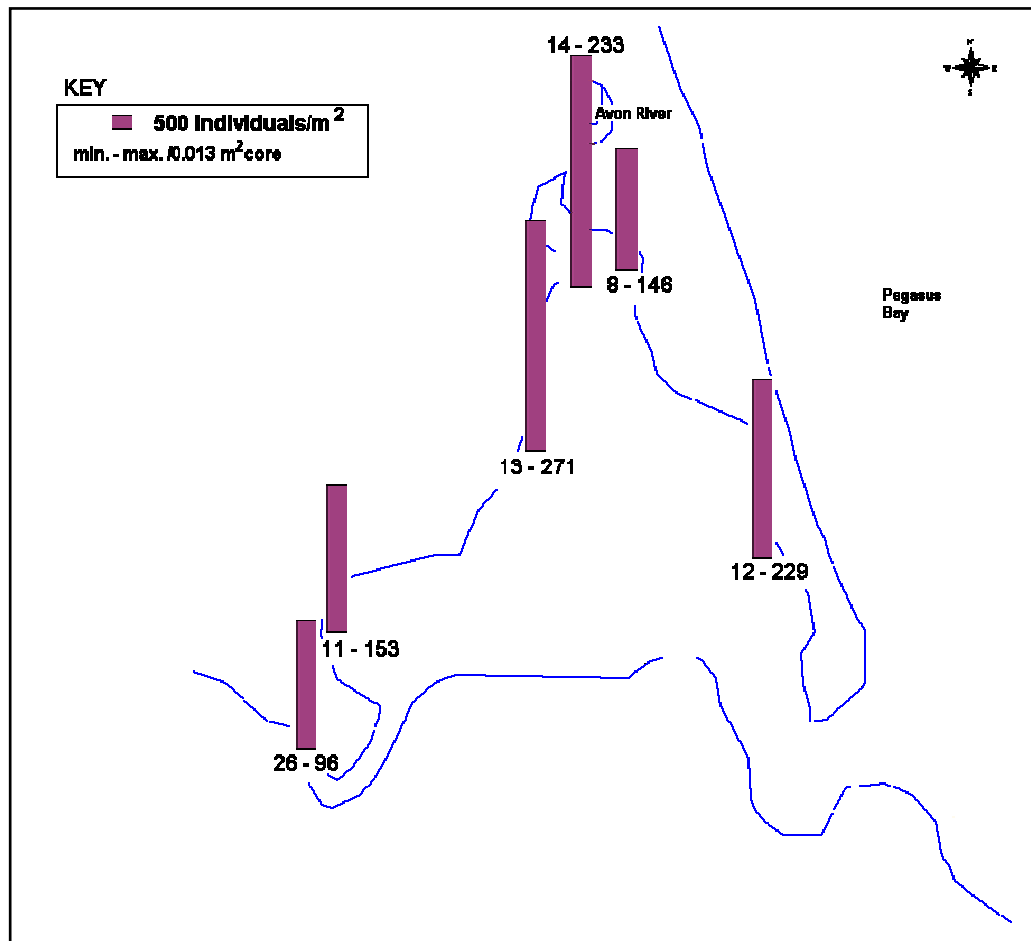


Figure 9 Average number of animal individuals per square metre living in the sediment at each site

In the estuary there were more individuals at Discharge Point than at any other site. However, the number of individuals at Discharge Point was similar to the number at the Avon River site. The average number of individuals at Plover Street was about 75%, at Humphreys Drive 65% and at Pleasant Point jetty 50%, of that at Discharge Point. The average number of individuals at the Heathcote River site was 55% of that at the Avon River site.

The proportion of individuals of each type of animal present at each site is shown in Figure 10.

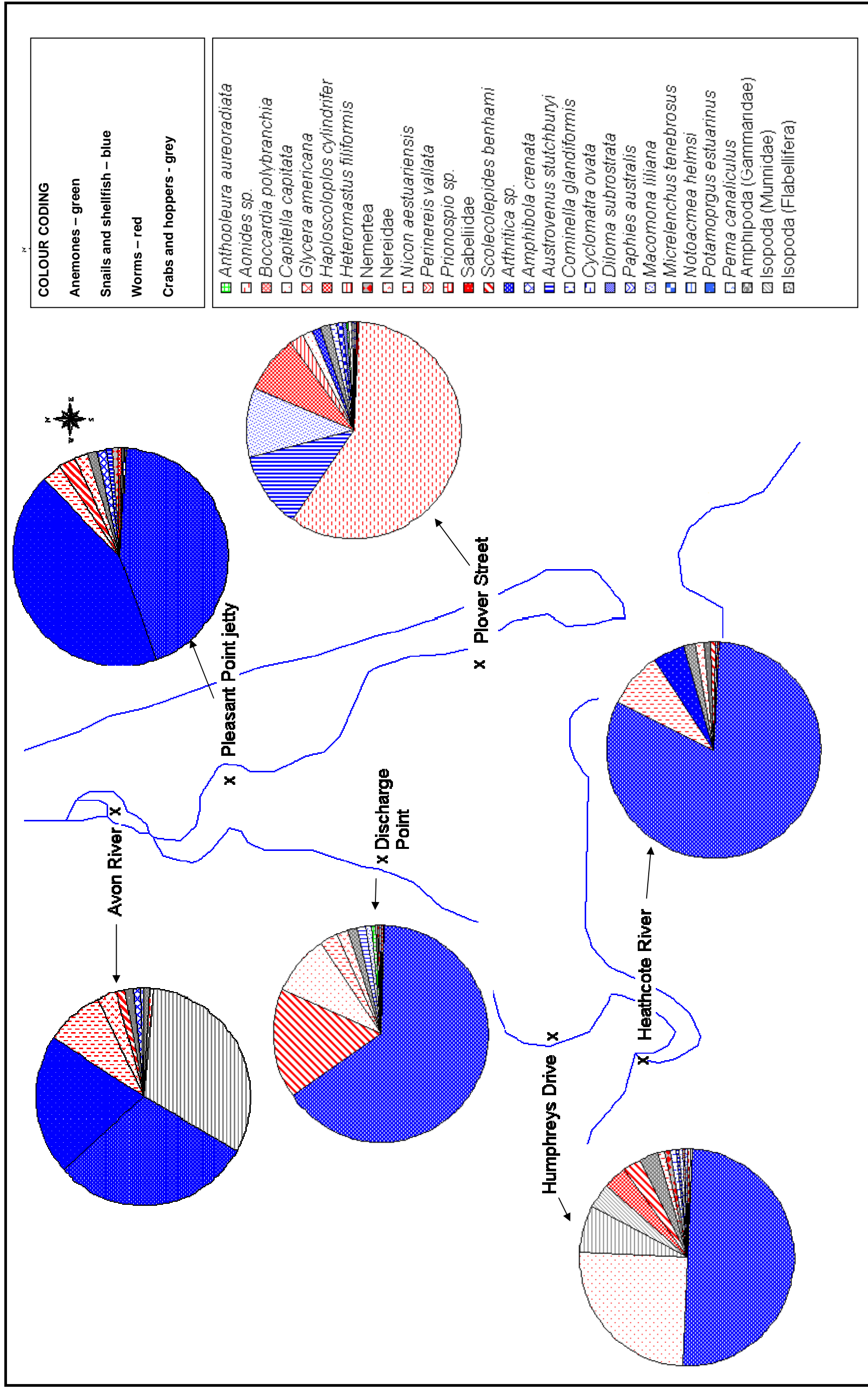


Figure 10 Proportion of individuals of each type of animal living in the mud

Size of cockles (Austrovenus stutchburyi)

The length distribution of the cockles present in the fifteen quadrats at each site are shown in Figure 11.

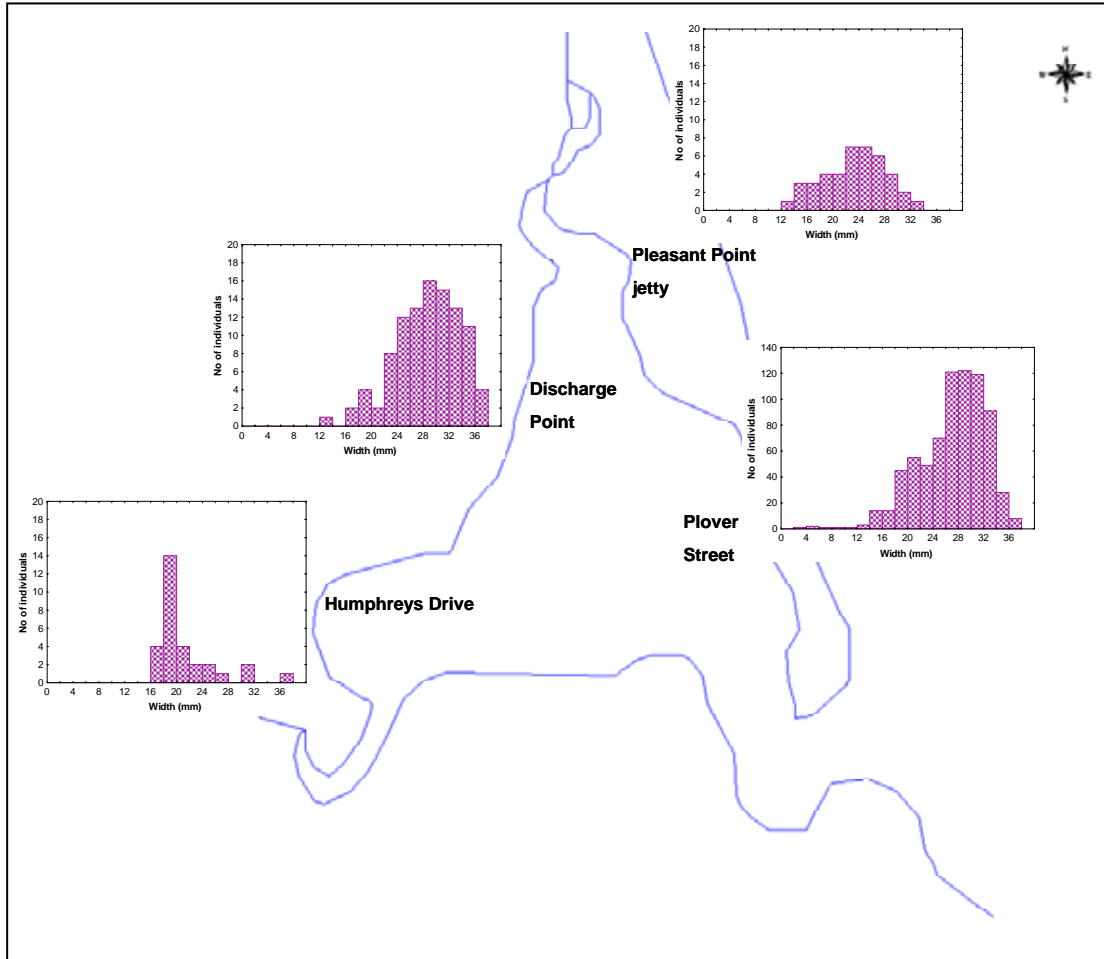


Figure 11 Length (mm) distribution of cockles at each site

No cockles were found at the river sites. Cockles were present at all sites within the estuary.

The cockles sampled ranged in length from 4-41 mm. There were no cockles smaller than 12 mm at Pleasant Point jetty, Discharge Point and Humphreys Drive, with five individual (1%) at Plover Street smaller than 12 mm. At Humphreys Drive most of the cockles were from 16-22 mm in length, while at both Plover Street and Discharge Point the cockles were typically larger with most from 22-34 mm in length. There were more large cockles at Plover Street than at the other sites.

4 Conclusions

Sediments

The sediment in the tidal reaches of both rivers was mostly mud (mud = silt+clay) while in the estuary it was mostly sand. There were small differences in the grain size between sites in the estuary with less silt at the sites on the eastern side than those on the western side of the estuary.

Biota

There were differences in the types and abundance of animals living on and in the sediments between sites.

The typically lower number of different types of animals in the tidal reaches of the Avon and Heathcote rivers than in the estuary is likely because of the lower salinity at these sites.

It is likely that there were more types of animals living on the surface of the sediment at Humphreys Drive than at any estuary site because of the extensive seaweed coverage of the mudflat there. The people collecting and analysing the samples did note that there were lots of animals living on and under the seaweed.

At all sites there were a range of types of animals living in the sediment. The types of animals and their abundances differed between sites. That is, in term of the type and abundance of animals present, each site was biologically different.

Overall

Annual monitoring of the sediments and biota at these estuary and river sites will provide up to date information on their state and allow for comparisons over time. In particular it will allow us to determine if there are changes to the sediments and biota as a result of the removal of the wastewater discharge to the estuary.

5 References

Robertson, B., Gillespie, P., Asher, R., Frisk, S., Keeley, N., Hopkins, G., Thompson, S and Tuckey, B. 2002. Estuarine environmental assessment and monitoring: A national protocol. Part A. Development, Part B. Appendices, and Part C. Application. Prepared for supporting Councils and the Ministry for the Environment, Sustainable Management Fund Contract No 5096. Part A. 93p. Part B 159p. Part C. 40p plus field sheets.



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