FRDC FINAL REPORT 2007/003

Flow and fisheries: River flow impacts on estuarine prawns in the Gulf of Carpentaria

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1. Non Technical Summary

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OBJECTIVES:

1. Estimates of the impact of land use change on river flow, estuarine system productivity and ultimately prawn juvenile growth, survival and emigration
2. Identification of the mechanisms whereby the river flow regime affects banana prawn (*Penaeus merguiensis*) production and emigration from a river in the Gulf of Carpentaria, and how this impacts on recruitment to the fishery
3. Provide recommendations to water and fisheries managers on appropriate methods of assessing the effects of flows on estuarine prawn production

NON TECHNICAL SUMMARY:

OUTCOMES ACHIEVED TO DATE

The planned outcomes of this project were improved fisheries and resource management by identifying the effect of flow on estuarine fisheries. Specifically our research has shown that freshwater flows to a Gulf of Carpentaria estuary can affect banana prawns (*Penaeus merguiensis*) in the estuary by 1. resulting in emigration en masse to avoid low salinity water, 2. reducing food availability on the subtidal and intertidal intertidal mudflats in the creeks and river when flows are sustained for extended periods. We determined and

quantified the increased nutrient loads in the freshwater flow which is likely to increase food availability for banana prawns in the nearshore zone. Additionally, inundation of the saltflats is an important source of nutrients and carbon to the estuary and nearshore zone, in this nutrient-depauperate environment. A reduction in flooding, as a result of water diversion/regulation or climate change, is therefore likely to reduce the productivity of the estuary/nearshore system.

One of the key fisheries in the Gulf of Carpentaria is the Northern Prawn Fishery (NPF) worth an average of approximately $100M p.a. over the last 5 years. Development of water resources in Australia’s Tropical Rivers region is being considered for southern Gulf catchments and the Northern Prawn Fishery faces threats from land-based development, such as irrigation, and climate change. Estuaries are critical habitat for some commercial species, including the banana prawn, *Penaeus merguiensis*, during the juvenile phase of growth. Given the well-documented correlation between flows and banana prawn recruitment from the estuary to the offshore fishery, changes to river flows are likely to affect fisheries yields (Loneragan and Bunn 1997; Robins et al. 2005; Díaz-Ochoa and Quiñones 2008). However, there is not always a correlation suggesting that the underlying mechanisms are complex and multifaceted (Evans 1997).

This project therefore aimed to determine how river flow affected estuarine prawn production and emigration. Via the partnership between FRDC and the Tropical Rivers and Coastal Knowledge program (TRACK), the implications of land use change on river flow, estuarine systems and ultimately juvenile prawns, have been assessed. This report combines findings from both the FRDC and TRACK (CERF, LWA and Queensland Smart State) funding sources.

At the commencement of the study there were two hypotheses for the correlation between flow and banana prawn catch:

1. Low salinity causes physiological stress in banana prawns (*Penaeus merguiensis*), triggering emigration out of the estuary and into the fishery. Therefore the greater the flooding, the higher the catch.

2. Nutrient inputs from the catchment as a result of wet season flows stimulate primary productivity in the estuary, increasing food availability and hence growth of banana prawns in the estuary.

The study was undertaken over two years, covering two periods of fortnightly sampling from the late dry season (beginning of October) to the end of the wet season (end of March) which captured the annual period when banana prawn postlarvae and juveniles are typically found in the estuary. The study estimated the abundance of banana prawn emigrants from the Norman River, Gulf of Carpentaria over two years and quantified the population dynamics (abundance, distribution) of juvenile banana prawns over two summer periods. Environmental variables (rainfall, salinity, temperature, turbidity, flow, nutrients, chlorophyll *a*) were also examined. The first year of the study (2008/09) had the largest flood in the southern Gulf in 50 years, with the second year having a moderate flood. In the two years of our study (2008/09, 2009/10) floods in the Norman River resulted in all juvenile banana prawns emigrating from the estuary. In 2009 and 2010, they contributed to relatively high banana prawn catches in the fishery, i.e. 4889 and ~ 4500 t respectively. This supports hypothesis 1 that low salinity and estuarine inundation during flood events stimulate juvenile prawns to emigrate from the estuary (e.g. Vance et al. 1985; Robins et al 2005). Overall, prawn abundance in the estuary was similar between years. Consistent with previous studies, smaller juveniles occupied the smaller creeks and moved into larger creeks and the main river channel as they grew.

Hypothesis 2 was refuted, i.e. flows bring more nutrients from the catchment into the estuary stimulating estuarine production. The study also found that nutrient concentrations did not increase in the estuary during the wet season, but the total nutrient loads transported through the estuary did, only because of the high volume of water moving through the estuary. There was no evidence of an increase in chlorophyll *a* concentrations or primary productivity in either the water column or intertidal mudflats during the freshwater flows. Indeed, productivity and chlorophyll *a* concentrations typically decreased with freshwater flows.

The study identified two other key effects of flooding on the productivity of the estuary:

- A drop in salinity to zero for periods greater than a few days resulted in significant loss of meiofaunal abundance from the intertidal mudflats. Meiofauna are a key food source for the prawns and they did not recover until higher salinity was re-established.
- Flooding inundates the extensive coastal saltflats of the southern Gulf rivers and the study found that this habitat is an important, previously unidentified source of carbon, nitrogen and phosphorus. This is in the form of algal growth during inundation, as well as dissolved nitrogen and phosphorus release from the saltflats into the watercolumn. The saltflats are, therefore an important source of carbon and nutrients for the estuary and nearshore areas.

The implications of this research are that:

- Flow resulted in increased nutrient loads (but not higher nutrient concentrations) originating from the catchment and saltflats. This is transported to the coastal zone and is likely to play a critical role in promoting productivity. The scale of the effect will depend on the size of the flood each year. A proportion of these nutrients are likely to re-enter the estuary on spring tides, supplementing estuarine productivity.
- Lack of food may be a key driver in causing prawn emigration, in addition to the physiological cue of low salinity, particularly in wet years with sustained periods of low salinity. As a result, prawns enter a zone of increased productivity in the coastal zone. However, the degree to which catchment nutrients stimulate productivity in the coastal zone remains unknown.

A summary of the findings from the study, showing how freshwater flows have a range of impacts on the estuarine and nearshore systems, is shown in Figure 1.1.

In terms of prediction of how modifications to the flow regime on the Norman River will affect banana prawn production, the study has found:

- Wet season flow is critical to causing floodplain and saltflat inundation, resulting in quantified increased nutrient and carbon loads to the coastal zone
- Since the coastal zone is likely to be an area of high productivity, reduction in flow will reduce nutrient loads and hence coastal productivity

- Both the magnitude and duration of flooding are key elements, and either a reduction in wet season flows, or regulation of flow, will affect the productivity of the system.

In terms of recommendations to the fisheries and resource managers regarding appropriate methods of assessing the effects of flows on estuarine prawn production, this study has identified the importance of flow in terms of bringing nutrient loads to the nearshore area. However, it is not just the magnitude of the flow that is important. The duration and variability also appear to affect prawn emigration. Therefore metrics which incorporate magnitude, timing and duration of flow (rather than rainfall) would be the appropriate measures. The flow data from Glenore Weir, near Normanton (available from the DERM website), provides a reasonable estimate of the magnitude of flow. It is clear that the relationship between flow and prawn catch is more complex than simply a low salinity physiological cue. Therefore, in terms of impacts of flow modification on the fishy, understanding the links between flows, estuaries and the nearshore zone will be critical.

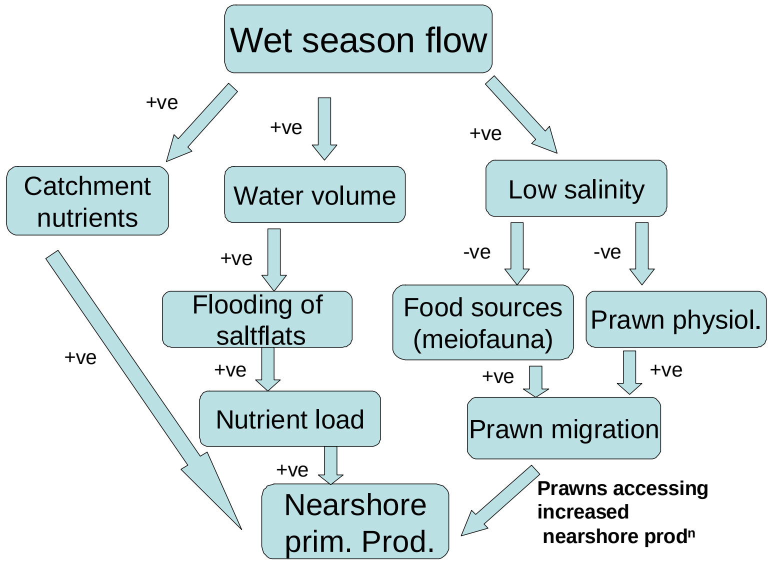

Figure 1.1: Diagrammatic representation of the effect of freshwater flow on processes within the estuary and the flow-on effects on the banana prawn

Keywords: banana prawns, Northern Prawn Fishery, estuarine production, flow

2. Acknowledgements

We wish to thank the following: Geoff Moore for undertaking two year's of field work, Mike O'Brien, Mark Williamson, Greg Jones, Phil Robson, Rob Musemeci and the staff from Raptis and Sons for logistical help in a myriad of ways, Rene Diocares for mass spectroscopy, Queensland Health for nutrient analyses, and Riki Gunn for use of her offices in Karumba, and an anonymous reviewer for providing input. The following were involved in the TRaCK component of the research: Andy Revill, Dominic Valdez, Stephen Faggotter, Melissa Duggan, Carolyn Polson, Christina Laurikaunen and Sebastian Knight for help with field and laboratory analyses, and Ian Webster for modelling inputs. TRaCK brings together leading tropical river researchers and managers from Charles Darwin University, Griffith University, University of Western Australia, CSIRO, James Cook University, Australian National University, Geoscience Australia, Environmental Research Institute of the Supervising Scientist, Australian Institute of Marine Science, North Australia Indigenous Land and Sea Management Alliance, and the Governments of Queensland, Northern Territory and Western Australia.

3. Background

One of the key fisheries in the Gulf is the Northern Prawn Fishery (NPF) worth an average of approximately $100M p.a. over the last 5 years. Ensuring sustainability of catch, particularly in the case of banana prawns, has been an ongoing challenge for stock assessment researchers, fisheries, managers and the fishing industry. FIRTA (86/13)/FRDC (89/13)-funded research conducted by CSIRO in the 1980s and '90s examined the life cycle of prawns in the Gulf of Carpentaria, including factors responsible for interannual variability in abundance. While the life cycle is now well understood, the factors affecting growth and survival, and how they impact on biomass in the fishery are less well understood. A study of the productivity of a Mozambiquean estuary in Africa has shown that when salinity drops below 30, primary production increases to support prawn growth in the estuary and nearshore, resulting in an increase in the catch of red-legged banana prawns (P. Monteiro, pers. comm.).Yet in Australia, simultaneous studies of the population of juvenile banana prawns and estuarine productivity have not been undertaken. The recently completed FRDC project (2004/024) 'Variation in banana prawn catches at Weipa: a comprehensive regional study', synthesized the available knowledge on both the prawn fishery and the prawn’s biology. The qualitative modelling found that early seasonal rainfall should increase catch, and statistical modelling confirmed that rainfall was one of the dominant environmental predictors of catch. However, the need to more accurately quantify the effect of environmental factors, including rainfall and food availability on early life history phases, i.e. larvae through to juveniles in the estuary, was acknowledged as a key impediment to predicting catch. The opportunity to co-invest in research to examine and quantify the cause-effect relationship between environmental factors and fisheries production arose with the successful funding of the Tropical Rivers and Coastal Knowledge (TRACK) program under the Commonwealth Environmental Research Fund (CERF), with co-funding from the National Water Initiative, and Land & Water Australia. This program involved 15 institutions, including Griffith University, QDPIF and CSIRO, with the research focus on the effect of land-based activities, and climate change on freshwater and coastal ecosystems, and the likely social and economic impacts. These include the likely future threat of decreasing water flow, and increasing nutrients and sediments due to the extraction of water for agricultural industries. The Principal Investigator and co-investigators of this proposal were TRACK participants. A coinvestment by TRACK and FRDC provided the means to understand the linkages between environmental factors and prawns in estuaries, and how changes in flow regime may impact on the fishery.

4. Need

The estuaries of Australia's tropical rivers support commercial fisheries for finfish, crustaceans and shellfish valued at over $220 million per annum. Development of water resources in Australia's Tropical Rivers region is being considered for the Flinders, Mitchell, McArthur, Roper, Daly and Victoria catchments. The Northern Prawn Fishery also faces threats from land-based development, such as irrigation, and climate change, including changes to sea level. Given the well-documented correlation between flows and banana prawn recruitment, changes to river flows, nutrients, sediments and contaminant inputs are likely to affect fisheries yields (Loneragan and Bunn 1997; Robins et al. 2005). In order to tackle the effect of land-based development, CERF-funded TRACK co-invested in research in the same river system. This provided the means to undertake fisheries-targeted research in the wider context of environmental, social and economic research specifically on the Norman River and estuary adjacent to the banana fishery in the south-east Gulf of Carpentaria. This project therefore determined how river flow affects estuarine prawn production and emigration. Via the partnership with TRACK, the implications of land use change on river flow, estuarine systems and ultimately prawn juveniles, were assessed.

5. Objectives

1. Estimates of the impact of land use change on river flow, estuarine system productivity and ultimately prawn juvenile growth, survival and emigration
2. Identification of the mechanisms whereby the river flow regime affects banana prawn production and emigration from a river in the Gulf of Carpentaria, and how this impacts on recruitment to the fishery
3. Provide recommendations to water and fisheries managers on appropriate methods of assessing the effects of flows on estuarine prawn production

6. Methods

The goals of the project were to undertake research and knowledge exchange to support the sustainable use, protection and management of Australia's Tropical Rivers

This included:

1. Estimation of the abundance of banana prawn emigrants from the Norman River, Gulf of Carpentaria over two years
2. Quantification of population dynamics (abundance, distribution) of banana prawn juveniles over two summer periods in the Norman River, Gulf of Carpentaria
3. Identification of the environmental variables (rainfall, salinity, temperature, turbidity, flow) correlated with banana prawn production and emigration from the Norman River, Gulf of Carpentaria
4. Identification of environmental surrogates for the timing of prawn emigration to better predict catch
5. Prediction of the effect of changes in river flow on estuarine productivity, and ultimately prawn production

To fulfil these goals the study had four main facets:

- Fortnightly sampling of banana prawns and water quality over two six month windows to determine the effect of freshwater flow on prawn productivity in the Norman River estuary in the southeast Gulf of Carpentaria (FRDC funding)
- Monthly sampling of sediment to determine algal biomass, meiofaunal abundance and species composition over two six month windows to determine the effect of freshwater flow on prawn productivity in the Norman River estuary in the southeast Gulf of Carpentaria (TRACK LWA funding)
- Intensive field campaigns to link water quality measured during the intensive sampling with process measures of physical, chemical and biological parameters aimed at determining the role of flow in stimulating estuarine production (TRACK Smart State and CERF funding)
- Modelling of nutrient loads from the Norman River catchment, and linking future catchment development with estuarine productivity, and more specifically banana prawn growth and survival (TRACK Smart State and CERF funding)

6.1 Study site

The Norman R. estuary was the chosen study site for the project. This site was chosen for the following reasons:

- It is adjacent to the southern Gulf prawn fishery and has previously been shown to supply juvenile prawns to the fishery
- Logistically, it is one of the few estuaries in the Gulf easily accessible throughout the wet season due to the proximity to the township of Karumba
- Studies of the juvenile banana prawn by CSIRO from the 1970's provide background information on prawn densities and key habitats within this estuary

The Norman R. estuary (140.82 °E, 17.463 °S) is a tide-dominated estuary in the southeast Gulf of Carpentaria. It is approximately 100 km long, reaching up to Glenore Weir, approximately 20 km upstream of the township of Normanton. The tidal range of the estuary is ~3-4 m with a diurnal tidal period. It has a relatively simple morphology, with a main river channel fringed by intertidal mudflats, above which is a narrow strip of mangrove forest (total area is 55.24 km^2, *Avicennia*-dominated) (National Land & Water Resources Audit (NLWRA) 2001, www.nlwra.gov.au). The channel area is 35.68 km^2. Beyond the mangroves are saltflats (356 km^2) which contain salt-impregnated bare earth with patches of typical saltflat vegetation such as salt couch and samphire. The saltflats are rarely inundated in the dry season but become flooded during the wet season. There are few tidal creeks feeding into the main river channel, but major creeks are Walker, Wills and Russell Creeks.

The catchment is 49588 km^2 in area much of which is low-lying flat country with little vertical relief. Catchments of the southeast Gulf have Tenesol and Dermosol soil types, with the lowlands having significant areas of Chromosols and Sodosols (Northern Australia Land and Water Science Review 2009). Both the lowland soils have low water-holding capacities. The vegetation is dominated by eucalypts and grassland with human use of the catchment being predominantly cattle grazing. The catchment is considered under stress in terms of human impact.

The Norman River is a tropical dryland river with a mean annual rainfall of 913 mm (at Normanton), with almost all the rainfall occurring in the summer wet season. The southern Gulf rivers are typically characterised as having predictable summer, highly intermittent flow (Kennard et al. 2010). The Norman River has a mean annual discharge of 2,346,000 ML (Fig. 6.1) (Smith et al. 2005). In the dry season the river is a series of disconnected waterholes, typical of southern Gulf rivers. There is little freshwater flow from the river to the estuary at this time of year. In the wet season, there is a dramatic increase in flow, which can result in extensive flooding of the catchment and coastal areas.

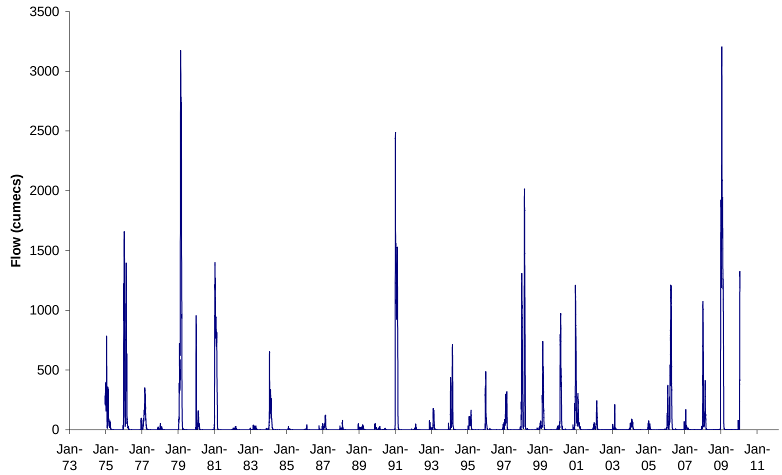

Figure 6.1: Flow (cumecs) at Glenore Weir gauging station on the Norman River.

6.2 Fortnightly sampling

The site chosen for the study was the Norman River estuary. This was chosen for three key reasons:

- It is one of the key estuaries supplying emigrant banana prawns to the southern Gulf of Carpentaria prawn fishery
- There has been previous research done by CSIRO in the 1970's on banana prawns in this estuary
- It is the most accessible estuary during the wet season, a key period for examining banana prawn growth and survival. This enabled regular sampling to occur

Fortnightly sampling was conducted over two years during the periods that juvenile banana prawns were likely to be in the estuary, i.e. October to March 2008/09 (interrupted by a major flood) and the same period in 2009/10. There were two main components to the sampling:

- Netting of banana prawns and associated biota throughout the estuary to determine the density and size of prawns at each site

- Water quality monitoring throughout the estuary with a focus on nutrient concentrations and algal biomass

6.2.1 Beam trawls

We used a 1.0 m x 0.5 m beam trawl (2 mm mesh, 1 mm mesh cod end) to sample benthic juvenile prawns. We trawled sites in both the main channel of the Norman River and in some of its tributaries (Fig. 6.2). Sampling times were based on the tides, with all sampling conducted at low tide. All trawl sites were on the muddy banks of the creeks or river and trawls were typically conducted in < 1m of water (although at times trawls were deeper) on these banks (see Vance et al 1998). Each trawl site was measured and marked with stakes at the beginning and end of each trawl path. The net was deployed at the first stake and trawls the known distance until it was adjacent to the second stake, then retrieved. Four sites were selected in the main channel and they had been trawled previously in the 1970's. These data are reported in Staples (1980a, 1980b). Primarily, the main channel sites were selected to estimate the abundance of juvenile prawns as they pass through the main-river channels as they leave estuaries; they also accumulate in the main reaches of large rivers when no significant emigration cues are evident (Staples 1980b). Secondarily, these sites were selected as the past data from the sites may assist our current understanding of the way banana prawns use the Norman River. The trawl distance at the main river sites was 100 m in 2008/09 and 200 m in 2009/10.

Ten sites were trawled in tributaries of the Norman River, four in the relatively large tributary Walker Creek, and five in smaller tributaries- the Jenny Lind Creek off Walker Creek, and Russell Creek off the main river, and one site in a very small gutter off the Norman River in the vicinity of the upper-most estuarine site. These sites were selected to estimate the abundance of the smallest benthic juvenile banana prawns as they use these upper-estuary water-bodies for their initial recruitment habitats (Vance et al. 1998). One site (R1) was in a very small side creek where the water was about 0.5 m deep at low spring tide. This habitat type often has high abundances of small juvenile prawns (3-5 mm CL) as they accumulate in the remnant water gutters as the tide ebbs (Vance et al. 1998; Kenyon et al. 2004). Three sites were in small creeks that were 2-3 m deep mid-channel at low tide. The sites in the Walker Creek were on the banks of a larger creek where mid-channel depth is 3-5 m. The trawls at the creek sites were made on banks that were trawlable for relatively short distances; some trawls measured only 30 m, while others were 60 m; the longest unimpeded trawls being 100 m (Table 6.1).

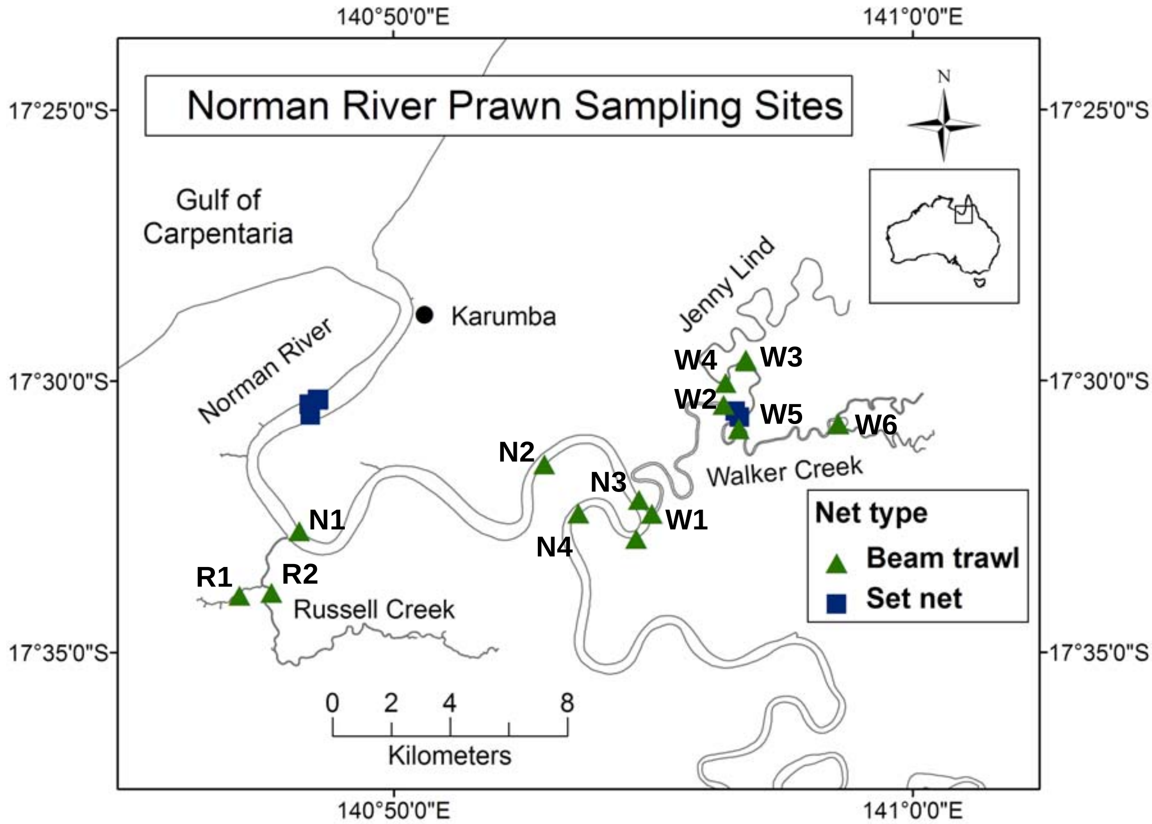

Figure 6.2: Beam trawl and set net sites in the Norman River Estuary.

Trawl samples were taken from October 2008 to March 2009 (interrupted) and from October 2009 to March 2010. The major flood affected the Norman River from early January to April 2009. Regular fortnightly beam trawls were undertaken from October to late December, 2009. However, a flood in 2009 made it impossible to trawl the sites in the estuary as the creek and river banks were inundated from January to March, 2009. In February 2009, opportunistic trawl samples were taken during flood conditions at R1 and N1; and near the mouth of the Norman River where the intertidal banks were exposed and beam trawls could be undertaken. Trawls were made throughout the 2009/10 season; however, some sites were not trawled on occasion due to flood effects (Table 6.1).

Salinity, temperature and secchi depth data were collected at each of the prawn trawl sites (Fig. 6.2). The collection of the abiotic data was also interrupted by the flood. The usual trawl sites were not visited; however, abiotic data were collected fortnightly from the Norman River at Karumba township. Windspeed data for Normanton Airport (9am reading on days of sampling) was accessed from the Bureau of Meterology (www.bom.gov.au).

Table 6.1: Sites in the Norman River estuary trawled in 2008/09 and 2009/10. The distance of the trawl and the time periods when trawling was impossible due to flooding are shown. In 2008/09, sites R1 and N1 were opportunistically trawled in February.

Description of trawl sites and untrawlable occasions in the Norman R estuary

Site	*Distance (m)*	*Trawled 08/09*	*Un-trawlable*	*Trawled 09/10*	*Un-trawlable*
R1	***80***	***8 times (Feb)***	***January to March***	***12 times***	***2 Feb***
R2	***70***	***7 times***	***January to March***	***13 times***	
W1	***100***	***7 times***	***January to March***	***13 times***	
W2	***100***	***7 times***	***January to March***	***13 times***	
W3	***30***	***7 times***	***January to March***	***12 times***	***2 Feb***
W4	***50***	***7 times***	***January to March***	***13 times***	
W5	***100***	***7 times***	***January to March***	***13 times***	
W6	***100***	***7 times***	***January to March***	***13 times***	
N1	***100/ 200***	***8 times (Feb)***	***January to March***	***13 times***	
N2	***100/ 200***	***7 times***	***January to March***	***13 times***	
N3	***100/ 200***	***7 times***	***January to March***	***13 times***	
N4	***100/ 200***	***7 times***	***January to March***	***13 times***	

6.2.2 Surface set nets

During October 2008 to March 2009 (interrupted) and from October 2009 to March 2010, we used two types of surface-deployed set nets to sample emigrant prawns in the estuary of the Norman River. A small mesh net (1.0 m x 0.5 m net, 2 mm mesh) and a large mesh net (2.0 m x 1.0 m net (28 mm mesh, 12 mm mesh cod end shroud) were deployed. The nets were deployed and collected during the ebb tide. The small net was deployed at two locations: a downstream site in the main river, and in the mouth of the Jenny Lind Creek, at the confluence with Walker Creek. The large net was deployed at two locations: the downstream site in the main river (two nets, one near the east bank and one near the west bank) and in the Walker Creek just downstream of the confluence with Jenny Lind Creek. The time at deployment, time at retrieval and hours deployed were recorded.

A major flood affected the Norman River from early January to April 2009 interrupting sampling. Regular two-weekly set nets were undertaken from October to late December in 2008. In 2009, a single 2.0 x 1.0 m set net was deployed on January 14th and 28th as flooding made it impossible to set the usual array of nets. During the 2009/10 season, the lesser flooding did not interrupt the deployment of the set nets.

6.2.3 Analyses

The abundances of banana prawns caught in the trawls were converted to prawns 100 m^{-2} for the analyses. The numbers of banana prawn caught in the set nets were expressed as prawns m^{-2} h^{-1}. The abundances of postlarval and juvenile banana prawns in the Norman River estuary declined to zero or near zero in the significant flood events of both years. Consequently, the prawn abundances in the beam trawls prior to flooding from sampling periods 1-7 (2008/09) and 1-8 (2009/10) only were modelled. The abundance estimates from both of the creeks (i.e. Walker (6 sites) and Russell Creeks (2 sites)) were combined for these analyses.

A generalised linear mixed model (GLMM) was fitted to the 'pre-rain' Norman River data (fortnights 1-7 for 2008/9 and fortnights 1-8 for 2009/10), the model was based on a *quasi - poisson* error distribution and included a random effect to account for potential correlation for repeated measures within sites. The *quasi-poisson* error distribution has been used as although the data are counts (indicating a *poisson* model), they are highly overdispersed. The random effect accounted for very little variability in the data for models based on both the 1-2 mm carapace length prawns (postlarvae) and the >3 mm carapace length prawns (juveniles). Due to the lack of support for a random effect and the simplicity of the analysis undertaken (due to data and time limitations) the remaining models are simplistic generalised linear models (GLMs) with a *quasi-poisson* error distribution and fixed effects for site and year.

6.2.4 The Flinders River

In February 2010 we visited the Flinders River about 20 km west of the Norman River. Our aim was to investigate if the trends in prawn abundance and nutrient availability in the river were similar or different to those in the Norman River. The river was in flood at the time of our visit; so the salinity in the river was zero or near zero for most of its length. Near the mouth, the water was mildly saline at depth on the flood tide. We trawled river banks and creeks from about 30 km upstream to the mouth of the river. We also trawled and seine netted the flood plain which was covered with about 50 cm of water in the mid-section of the estuary (Fig. 6.3).

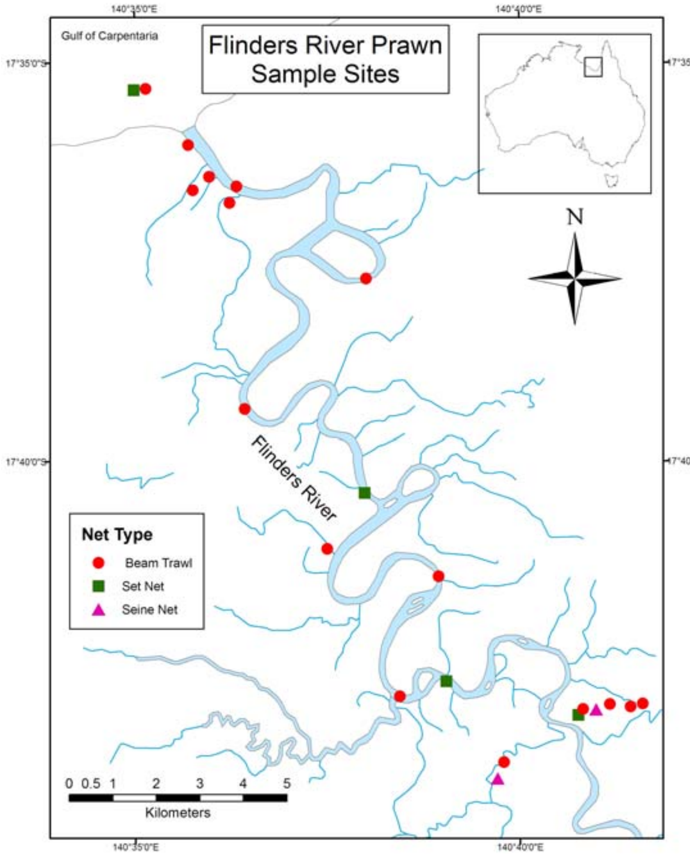

Figure 6.3: Beam trawl and set net sites in the Flinders River Estuary.

6.2.5 Water quality in Norman River

There were four sites sampled fortnightly for water quality parameters: one of the sites at the Karumba township was sampled at both low tide and high tide (CQ1, 2, Fig. 6.4). This site represented the bottom end of the estuary. There was also an upstream site (CQ3, 30 km upstream of Karumba) on the Norman River above two major tidal creeks, Walker and Russell. Additionally the mouths of the Walker and Russell Creeks were sampled as these creeks had a number of banana prawn sampling sites. In the second year, an additional site was sampled monthly at the wharf in the township of Normanton (NW, 80 km upstream of Karumba). This information was needed for calibrating the nutrient budget model developed by Ian Webster (TRACK funding, see Section 7.3.3). Additionally in each year, a sampling trip was conducted in June 2010 to assess the water quality in the mid-dry season.

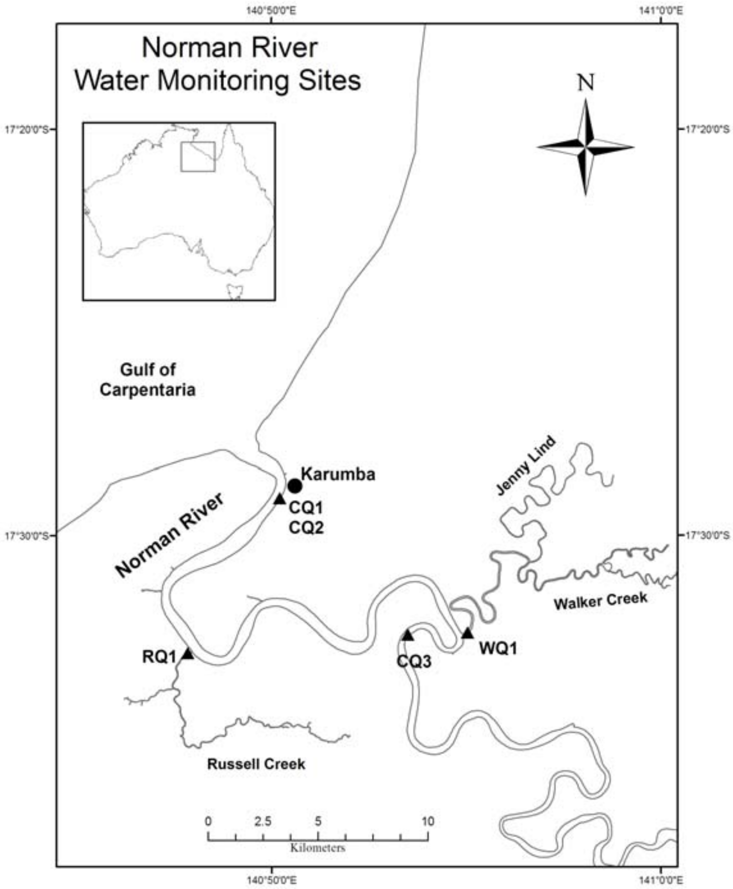

Figure 6.4: Water quality monitoring sites in the Norman River Estuary.

The following parameters were measured:

Nutrients

- Total nitrogen (TN), phosphorus (TP) concentrations (monthly)
- Ammonium (NH_4), nitrate/nitrite (NOX), phosphate (PO_4) concentrations (monthly)
- Dissolved organic nitrogen (DON) and phosphorus (DOP) concentrations (a subset of samples)

Chlorophyll *a* concentrations (fortnightly)

Total suspended solids concentrations (TSS) (fortnightly)

$\delta^{15}N$ and $\delta^{13}C$ stable isotope ratios of suspended particulate matter (fortnightly)

Physico-chemical parameters

- Temperature, salinity, oxygen, pH (fortnightly)
- Secchi disc readings (fortnightly)

For nutrients, chlorophyll and suspended solids, water samples were taken in the middle of the river or creek, with a van Dorn sampler. In the case of the Karumba township site, low and high tide samples were taken from a pontoon in the township. Two replicate van dorn samples were taken at the surface and bottom (1 m from the bottom) at each site and the water depth recorded. Subsamples were taken for total nitrogen and phosphorus by pouring water into 20 ml tubes, then placed on ice until frozen in the laboratory. For dissolved nutrients, samples were immediately filtered through 0.45 μm membrane filters, with a GF/F pre-filter, poured into 20 ml tubes, then placed on ice until frozen in the laboratory. Water subsamples for chlorophyll and TSS analyses were kept on ice until returned to the laboratory some hours later. Known volumes of water were then filtered onto pre-weighed and pre-combusted glass fibre filters (Whatman GF/F or Avantec GF75). Filters were frozen until analysed. The same filters were sequentially used for TSS and stable isotope analyses.

For physico-chemical parameters, a multisensor logger (Sonde) was used. This was calibrated before each field trip and measurements of temperature, salinity, oxygen, and pH were taken at 1 m intervals through the water column from surface to bottom. Secchi disc readings were also done to determine light attenuation.

Water samples for TN and TP were analysed using a persulfate digestion process and standard colorimetric methods (American Public Health Association, 1995). Water samples for NH_4, NOX and PO_4 were analysed using standard colorimetric methods (American Public Health Association, 1995).

For total suspended solids (TSS), glass fibre filters and dried at 60^{o}C, and reweighed. These filters were retained for stable isotope analyses of δ^{15}N and δ^{13}C on a mass spectrometer (GV Isoprime, Manchester UK). %N, and %C were also determined using a CHN analyser linked to the mass spectrometer.

For chlorophyll *a* concentrations, samples were extracted by sonicating filters for 1 min in cold 100% acetone, and measured either spectrophotometrically or spectrofluorometrically (Jeffrey and Welshmeyer 1997).

Data from all water quality analyses was stored in a database (Microsoft Access) noting sampling dates, times, depths and sites. Statistical analyses were conducted to determine correlations between water quality parameters using SAS software. Data was tested for normality.

Details of sampling and analysis methods for TRACK (CERF and Smart State) funded research is given in the TRACK 5.4 Final Report.

7 Results and Discussion

7.1 Banana prawn abundance and growth, and the effect of flow

7.1.1 Environmental conditions

In 2008/09 and 2009/10, over the initial three months of our sampling period, the salinity and temperature conditions in the Norman River and tributaries ranged from 20-40$^+$ and 25-32°C respectively. Salinity was about 20 in the upper reaches of Walker Creek in October, and over 50 in uppermost Russell Creek in December. In the lower estuary, salinity ranged from 30-37 (Figs. 7.1, 7.5). In both years, significant rainfall events in the catchment of the Norman River resulted in major flooding in the estuary of the river; the salinity dropped to zero and remained at zero for weeks. In 2009, the flood event was a one-in-50-year flood (peak flow > 3000 cumecs at Glenore Weir, Norman River); stream flows were massive and the salinity in the river quickly dropped to near zero for a period of 2 months (Fig. 7.17). In 2010, the flood event was a significant but lesser flood (peak flow ~ 1500 cumecs at Glenore Weir, Norman River); stream flows were significant, though the river took about one month for salinity in the lower estuary to reach near zero (Fig. 7.5, CSIRO unpublished data). It remained near zero for about one month and then oscillated from near zero on the low tide to about 17 at high tide until saline conditions re-established. Unlike salinity, in 2008/09 and 2009/10 temperature remained relatively constant over the 6 months of sampling. Temperature dropped by 2-3°C during January/ February due to reduced solar radiation from dense cloud cover during the monsoonal rains in the south eastern Gulf of Carpentaria (Fig. 7.7).

7.1.2 Prawn abundances

In both 2008/09 and 2009/10, significant flood events affected the estuary of the Norman River. After January in 2008/09, the conditions in the river estuary were non-navigable for small vessels attempting to tow nets to sample prawns. Sampling number 7 of the fortnightly sampling was the last full round of sampling conducted. In 2009/10, all samplings were concluded successfully. However, sampling number 8 was the last prior to the significant flood of 2010. In 2008/09, no samples were taken during the floods; apart from a few samples in navigable portions of the lower river in February. In 2009/10, prawns emigrated strongly from the river and few were caught in any trawls during samplings 9-13.

Prior to the effects of flooding in both years, the abundances of postlarval and juvenile banana prawns was highly variable both spatially and temporally in the Norman River estuary (Tables 7.2, 7.3). Average postlarval abundance at each site ranged from ~ 1 prawn 100 m^{-2} at some sites in Walker and Russell Creeks to >30 prawns 100 m^{-2} at others. In the Norman River, average postlarval abundance ranged from 6 to 60 prawns 100 m^{-2} during 2008/09, and from 0 to 12 prawns 100 m^{-2} during 2009/10. Average juvenile abundance at each site ranged from ~ 1 prawn 100 m^{-2} at one site in Walker Creek to >90 prawns 100 m^{-2} at others. In the Norman River, average juvenile abundance ranged from 2 to 15 prawns 100 m^{-2} during 2008/09, and from 15 to 33 prawns 100 m^{-2} during 2009/10.

During the significant flood events of 2008/09 and 2009/10, the abundances of postlarval and juvenile banana prawns in the Norman River estuary declined to zero or near zero prawns 100 m^{-2} during January and February. In 2010, prawns began to re-inhabit the estuary at the cessation of flooding. On March 12th and 28th, 2010, 3 juvenile prawns 100 m^{-2} and 125 prawn postlarvae 100 m^{-2} (respectively) were caught at the upstream and downstream sites in Russell Creek. At the most downstream site in Walker Creek, 32 prawn postlarvae 100 m^{-2} and one juvenile prawn 100 m^{-2} and were caught on March 28th. In the Norman River 134 and 62 prawn postlarvae 100 m^{-2} were caught and the two downstream sites in the river on March 27th. These catches were made at a time when the saline influence was evident in the river following the floods.

7.1.3 Statistical analysis of prawn abundance in beam trawls

7.1.3.1 Creek Habitats

Comparing years, there was no significant difference in the abundance of either postlarval or juvenile banana prawns in the creek habitats that were sampled (Table 7.1). In 2008/09, the abundance of postlarval prawns in the creeks was 1.4 times that of 2009/10. In

2009/10, the abundance of juvenile prawns in the creeks was 1.65 times that of 2008/09. For both postlarval and juvenile banana prawns, there were significant differences in abundance between sites in the creeks.

7.1.3.2 River Habitats

Comparing years, there were significant differences in both the abundance of postlarval and juvenile banana prawns in the river habitats that were sampled (Table 7.1). In 2008/09, the abundance of postlarval prawns in the river was 4.9 times that of 2009/10. In 2009/10, the abundance of juvenile prawns in the rivers was 3 times that of 2008/09. For both postlarval and juvenile banana prawns, there were no significant differences in abundance between sites in the river.

Trends in abundance were consistent between years and across habitats, with greater abundance of postlarvae in 2008/09 and greater abundances of juvenile banana prawns in 2009/10.

Table 7.1: GLMM model outcomes comparing beam trawl catches of postlarvae and juvenile banana prawns between years in the Norman River and Walker/Russell Creek; and within years between the river and creeks. The sign in the bracket indicates whether an increase or decrease was detected between 2008/9 and 2009/10; and between rivers and creeks.

Comparing years within	***GLMM modelling***		
	Prawn	***Site p-value***	***Year p-value***
- the Norman River	***Postlarvae***	***0.340***	***0.002 (-)***
	Juvenile	***0.249***	***0.019 (+)***
- Walker/Russell Creeks	***Postlarvae***	***0.005***	***0.406 (-)***
	Juvenile	***<0.001***	***0.063 (+)***
Comparing the Norman River with the two Creeks		***Fortnight p-value***	***Year p-value***
– 2008/2009	***Postlarvae***	***<0.001***	***<0.001 (R)***
	Juvenile	***0.034***	***<0.001 (C)***
- 2009/ 2010	***Postlarvae***	***<0.001***	***0.4 (R)***
	Juvenile	***0.044***	***0.033 (C)***

7.1.3.3 Comparing creeks and rivers

In 2008/09, there were significantly more banana prawn postlarvae in the river than the creeks; and significantly more juvenile prawns in the creeks than the river (Table 7.1). The mean abundance of postlarvae in the river was 5 times greater than in the creeks, while the mean abundance of juveniles in the creeks was 4.6 times higher than in the river. As well, there were significant differences in the abundance of both postlarvae and juveniles between sampling fortnights.

In 2009/10, there was no significant difference in the abundance of banana prawn postlarvae between the creeks and the river (1.4 times the creeks). However, as in 2008/09, there were significantly more juvenile banana prawns in the creeks (mean abundance 2.5 times higher) than the river. As in 2008/09, there were significant differences in the abundance of both postlarval and juvenile prawns between sampling fortnights.

Table 7.2: Mean number of postlarval prawns (P. merguiensis) caught (each fortnight) per 100 m^{-2} for river and creek sites during 2008-2009 (7 fortnights) and 2009-2010 (8 fortnights) in the Norman River estuary prior to the influence of floodwaters, with standard deviation (S.D.) and coefficient of variation (C.V.).

Estuary reach				***Site***				
(2008-09)		***N1***	***N2***	***N3***	***N4***			***All sites***
Norman R	***Mean***	***46.0***	***42.0***	***60.29***	***6.43***	.	.	***38.67***
	S.D.	***75.12***	***63.69***	***88.55***	***7.30***	.	.	***53.87***
	C.V.	***163%***	***152%***	***147%***	***114%***	.	.	***139%***
(2009-10)		***N1***	***N2***	***N3***	***N4***			
	Mean	***0.0***	***7.44***	***12.5***	***11.56***	.	.	***7.88***
	S.D.	***0.0***	***12.39***	***23.29***	***20.23***	.	.	***16.57***
	C.V.	***na***	***167%***	***186%***	***175%***	.	.	***210%***
(2008-09)		***W1***	***W2***	***W3***	***W4***	***W5***	***W6***	
Walker Ck	***Mean***	***4.76***	***0.95***	***31.43***	***6.29***	***1.19***	***8.71***	***8.89***
	S.D.	***10.47***	***2.52***	***56.30***	***10.09***	***2.49***	***14.66***	***19.72***
	C.V.	***220%***	***265%***	***179%***	***161%***	***209%***	***168%***	***222%***
(2009-10)		***W1***	***W2***	***W3***	***W4***	***W5***	***W6***	
	Mean	***0.63***	***6.5***	***16.67***	***5.25***	***5.13***	***1.63***	***5.97***
	S.D.	***1.76***	***16.10***	***34.55***	***13.31***	***12.55***	***4.60***	***17.25***
	C.V.	***283%***	***248%***	***207%***	***253%***	***245%***	***283%***	***289%***
(2008-09)		***R1***	***R2***					
Russell Ck	***Mean***	***6.79***	***1.19***	.	.	.	.	***3.99***
	S.D.	***8.75***	***1.85***	.	.	.	.	***5.76***
	C.V.	***129%***	***156%***	.	.	.	.	***144%***
(2009-10)		***R1***	***R2***					
	Mean	***7.81***	***0.36***	.	.	.	.	***4.08***
	S.D.	***16.87***	***1.01***	.	.	.	.	***12.17***
	C.V.	***216%***	***283%***	.	.	.	.	***298%***

Table 7.3: : Mean number of juvenile prawns (P. merguiensis) caught each fortnight per 100 m^{-2} for river and creek sites during 2008-2009 (7 fortnights) and 2009-2010 (8 fortnights) in the Norman River estuary prior to the influence of floodwaters, with standard deviation (S.D.) and coefficient of variation (C.V.).

Estuary reach				***Site***				
(2008-09)		***N1***	***N2***	***N3***	***N4***			***All sites***
Norman R	***Mean***	***15.0***	***5.71***	***4.43***	***2.29***	.	.	***6.86***
	S.D.	***14.61***	***3.82***	***5.62***	***2.87***	.	.	***7.80***
	C.V.	***97%***	***67%***	***127%***	***126%***	.	.	***114%***
(2009-10)		***N1***	***N2***	***N3***	***N4***			
	Mean	***33.81***	***15.0***	***16.63***	***17.13***	.	.	***20.64***
	S.D.	***86.57***	***21.13***	***16.55***	***19.80***	.	.	***44.76***
	C.V.	***256%***	***141%***	***100%***	***116%***	.	.	***217%***
(2008-09)		***W1***	***W2***	***W3***	***W4***	***W5***	***W6***	
Walker Ck	***Mean***	***0.95***	***17.38***	***70.0***	***22.29***	***20.24***	***20.57***	***25.24***
	S.D.	***1.31***	***19.72***	***106.51***	***27.24***	***21.85***	***11.57***	***39.12***
	C.V.	***138%***	***113%***	***152%***	***122%***	***108%***	***56%***	***155%***
(2009-10)		***W1***	***W2***	***W3***	***W4***	***W5***	***W6***	
	Mean	***24.25***	***70.13***	***96.67***	***17.0***	***34.0***	***6.0***	***41.34***
	S.D.	***31.42***	***118.75***	***141.65***	***18.73***	***21.19***	***4.72***	***79.95***
	C.V.	***130%***	***169%***	***147%***	***110%***	***62%***	***79%***	***193%***
(2008-09)		***R1***	***R2***					
Russell Ck	***Mean***	***92.86***	***7.14***	.	.	.	.	***50.0***
	S.D.	***98.57***	***5.83***	.	.	.	.	***69.24***
	C.V.	***106%***	***82%***	.	.	.	.	***138%***
(2009-10)		***R1***	***R2***					
	Mean	***148.13***	***18.21***	.	.	.	.	***83.17***
	S.D.	***254.20***	***14.28***	.	.	.	.	***186.41***
	C.V.	***172%***	***78%***	.	.	.	.	***224%***

7.1.4 Statistical analysis of prawn abundance in set nets

7.1.4.1 Creek Habitats

Comparing years, there were no significant differences in the abundance of juvenile banana prawns emigrating from creek habitats (Table 7.4). In 2009/10, nearly three times the number of small banana prawns emigrated from the Jenny Lind Creek than in 2008/09 (Table 7.5). However, due to the variation in catch over time, the difference was not significant. In the large mesh net, the numbers of emigrants caught were similar between years, though lower than in the small mesh net.

Table 7.4: GLM model outcomes comparing set net catches (2 and 28 mm mesh size) between years in the Norman River and Walker Creek).

Estuary reach	***Probability***	***2 mm mesh***	***28 mm mesh (W)***	***28 mm mesh (E)***
Norman River	***p***	***0.9318***	***0.586***	***0.985***
Walker Creek	***p***	***0.1063***	***0.5015***	

7.1.4.2 River Habitats

Comparing years, there were no significant differences in the abundance of juvenile banana prawns in either of the net types used to catch emigrants (Table 7.5). In the 2 mm mesh net, the abundance of emigrants varied by fortnight, but about 22-24 prawns m^{-2} h^{-1} were caught in both years. There were 3-4 times as many prawns caught in the large mesh net set on the western side of the river than the one set on the east (Table 7.5) and the mean numbers caught in each of the nets did not differ between years.

Table 7.5: : Mean number of juvenile prawns (P. merguiensis) caught m^{-2} h^{-1} in river and creek set nets during 2008-2009 and 2009-2010) in the Norman River estuary prior to the influence of floodwaters, with standard deviation (S.D.) and coefficient of variation (C.V.).

Estuary reach	***Statistic***	***Net***		
		2 mm mesh	***28 mm mes (W)***	***28 mm mes (E)***
(2008-09)		***N1***	***N1***	***N4***
Norman River	***Mean***	***23.47***	***35.88***	***8.78***
	S.D.	***26.36***	***43.96***	***8.71***
	C.V.	***112%***	***123%***	***99%***
(2009-10)		***N1***	***N1***	***N4***
	Mean	***21.83***	***24.39***	***8.88***
	S.D.	***45.88***	***46.06***	***13.17***
	C.V.	***210%***	***189%***	***148%***
(2008-09)		***W3***	***W3***	
Walker Creek	***Mean***	***40.36***	***6.03***	
	S.D.	***42.48***	***7.57***	
	C.V.	***105%***	***125%***	
(2009-10)		***W3***	***W3***	
	Mean	***113.04***	***4.23***	
	S.D.	***130.89***	***4.09***	
	C.V.	***115%***	***97%***	

7.1.4.3 Temporal and spatial trends in creeks and rivers

In 2008/09, in the tributary creeks in the Norman River estuary 20-150 postlarval prawns 100 m^{-2} were found in the Jenny Lind Creek and the upper-most site in the Walker River (Figs 7.1). In 2009/10, postlarvae were present in the Jenny Lind and Walker Creeks in late 2009 and contributed to abundant juvenile prawns in both the tributaries and main river. In 2008/09, the highest abundances of postlarval banana prawns were found at the lower three of the four main channel sites in the Norman River estuary. Abundances reached 200 prawns 100 m^{-2}. The postlarvae were abundant in October and November 2008, but not common in December (Fig. 7.1). In 2009/10, postlarvae were not as abundant in the main river in October/ November.

In 2008/09, the high abundances of immigrating postlarvae are reflected in high abundances of small juvenile prawns in the Jenny Lind and Russell Creeks shortly afterwards. Sixty to 300 small juvenile prawns 100 m^{-2} were caught at some sites during October to December 2008 (Fig. 7.1). These animals were the surviving postlarvae that had grown to juveniles and recruited to the upper estuary. They remained abundant in the small creeks within the estuary during October to early December 2008. The juvenile prawns probably would have moved to the main river in early 2009. However, the flood in early January caused prawns to immediately emigrate from the estuary. Interestingly in 2008, juvenile prawns were most abundant at the uppermost-creek site (R1) in October and early November; but December they had left the uppermost reach of this creek.

In 2009/10, high abundances of small juvenile prawns again are found in the Jenny Lind, Walker and Russell Creeks. Fifty to 400 small juvenile prawns 100 m^{-2} were common at some sites during October to December 2009 and up to 60 100 m^{-2} were caught at some sites in January 2010 (Fig. 7.1). They remained abundant in the small creeks from October 2009 to early January 2010. Again in 2009, juvenile prawns were most abundant at the uppermost-creek site (R1) in late December (700 prawns 100 m^{-2}); but January they had left the uppermost reach of this creek.

Banana prawn abundance in beam trawls

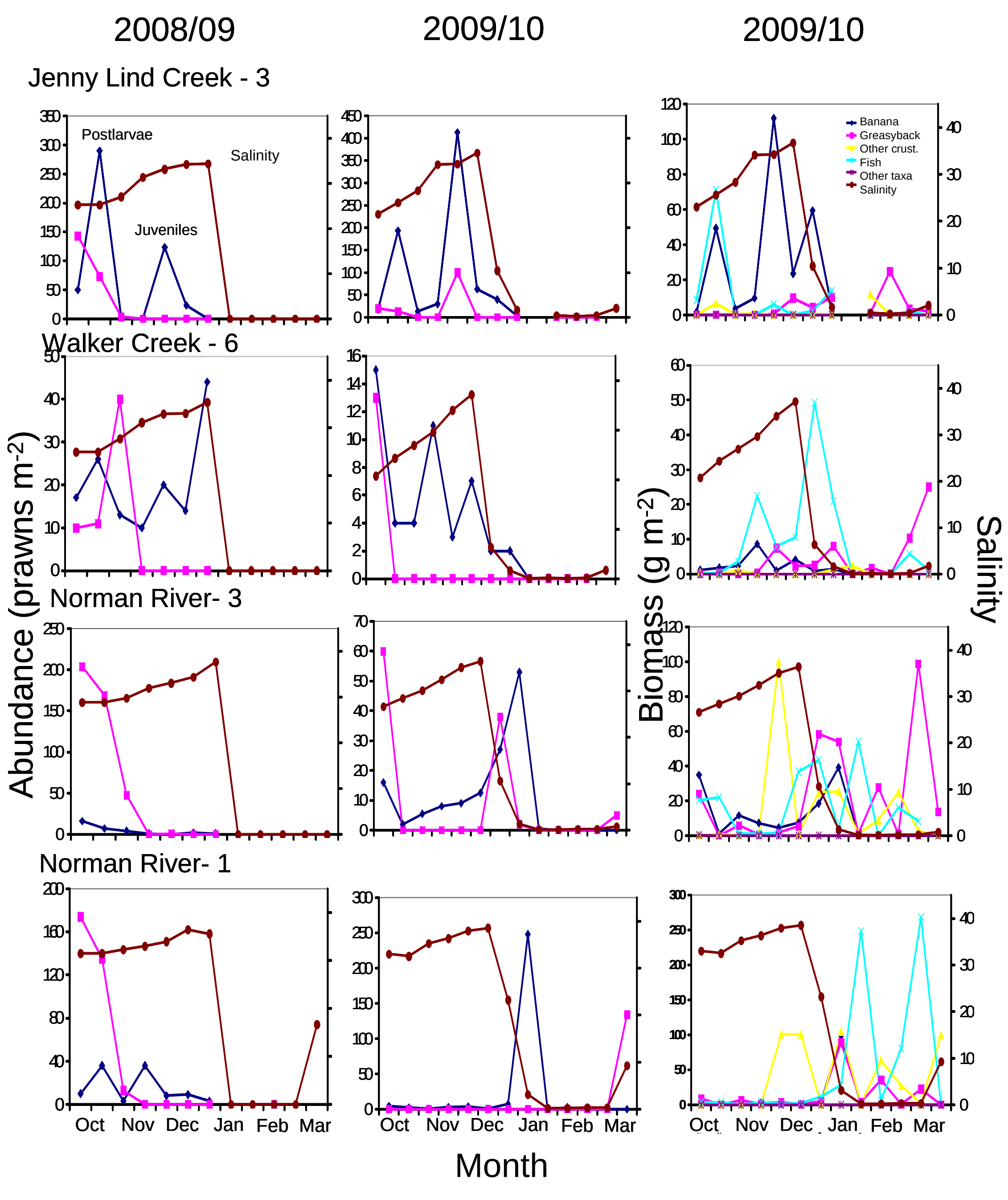

Figure 7.1. The abundance of postlarval and juvenile banana prawns (Penaeus merguiensis), and the biomass of greasyback prawns (Metapenaeus insolitus), other crustaceans, fish, and other taxa at W3 in the Jenny Lind Creek, W6 in the Walker Creek, and N3 and N1 in the Norman River estuary in 2008/09 and 2009/10.

In 2009/10, in the Jenny Lind Creek the biomass of banana prawns shows a similar trend to that of abundance, although by January there seems to be fewer larger prawns (Fig. 7.1). Prior to the flood, the biomass of banana prawns dominated the trawl catch, though fish were also common. However, during and after the flood the biomass of greasyback prawns was greatest. At the upstream site in the Walker River, fish dominated the biomass of the catch, and both banana and greasyback prawns were common (Fig.7.1). At the onset of the flood, the biomass of fish increased significantly; while the biomass of greasyback prawns remained high. During the flood, the biomass of banana prawns was near zero.

In 2008/09, the numbers of juvenile prawns were most abundant in the Norman River in October and November (up to 40 prawns 100 m^{-2}). They were most abundant at the most-downstream site in the river; usually less than 10 prawns 100 m^{-2} were found at any time at any other river site (Fig. 7.1). In 2009/10, the numbers of juvenile prawns again were most abundant at the most-downstream site in the river, but they were much more abundant (up to 250 100 m^{-2}, Fig. 7.1) than in the first year of sampling. At other river sites they were common at 60 to 70 prawns 100 m^{-2}. Juvenile prawns were most abundant in the Norman River in January 2010, at least a month later than in 2008/09. Relatively few juvenile banana prawns were caught in the main river in 2008/09. They never used the bank habitats of the main river in significant numbers in early 2009, and they emigrated down the river channel.

In late 2009 and early 2010, juvenile prawns were abundant on the mud-bank habitats of the main river for a short time. They were much more abundant in 2009/10 (up to 250 100 m^{-2}) than in 2008/09 (Fig. 7.1). Then, the January/ February flood caused them to emigrate. The 2010 flood was not as large or as long in duration as the 2009 flood; so juvenile prawns were abundant in the smaller creeks and the main river of the estuary into January and early February 2010.

In 2009/10 in the Norman River, the biomass of banana prawns was low prior to January, apart from a catch of prawns at N3 in early October. The biomass of *Macrobrachium* species dominated the catch at both sites (Fig. 7.1). In mid-January at the onset of the flood, the biomass of banana prawns peaked at both N3 (just downstream of the confluence with Walker Creek) and N1 (at 99 g 100 m^{-2}), in the lower estuary (as does their abundance). The biomass of greasyback prawn also increased significantly with the flood flows. Fish, greasyback prawns and *Macrobrachium* species remained common during the flood; while no banana prawns were caught.

At the same time as prawns were occupying benthic habitats in the estuary, prawns were emigrating from the estuary. In both 2008/09 and 2009/10, large numbers of juvenile prawns were leaving the Jenny Lind Creek during November and December (Fig. 7.2). In, 2008, up to 100 prawns m^{-2} h^{-1} were caught in the 2 mm net in November. In, 2009/10, up to 300 prawns m^{-2} h^{-1} were caught in the 2 mm net during November to early January. Just below the confluence of the Jenny Lind and Walker Creeks, fewer larger prawns (10-20 m^{-2} h^{-1}) were caught in the 28 mm net emigrating down the Walker Creek. Clearly, in both seasons the trend for emigration matches the presence and decline of prawn numbers in the smaller upper creeks in November and their emergence in large-creek habitats in December/January.

At the mouth of the Jenny Lind Creek, prior to the flood, banana prawns dominate the biomass of the set net catch. Once the flood is underway, fish and greasyback prawns dominate the biomass of the set net catch and no banana prawns are caught (Fig. 7.2).

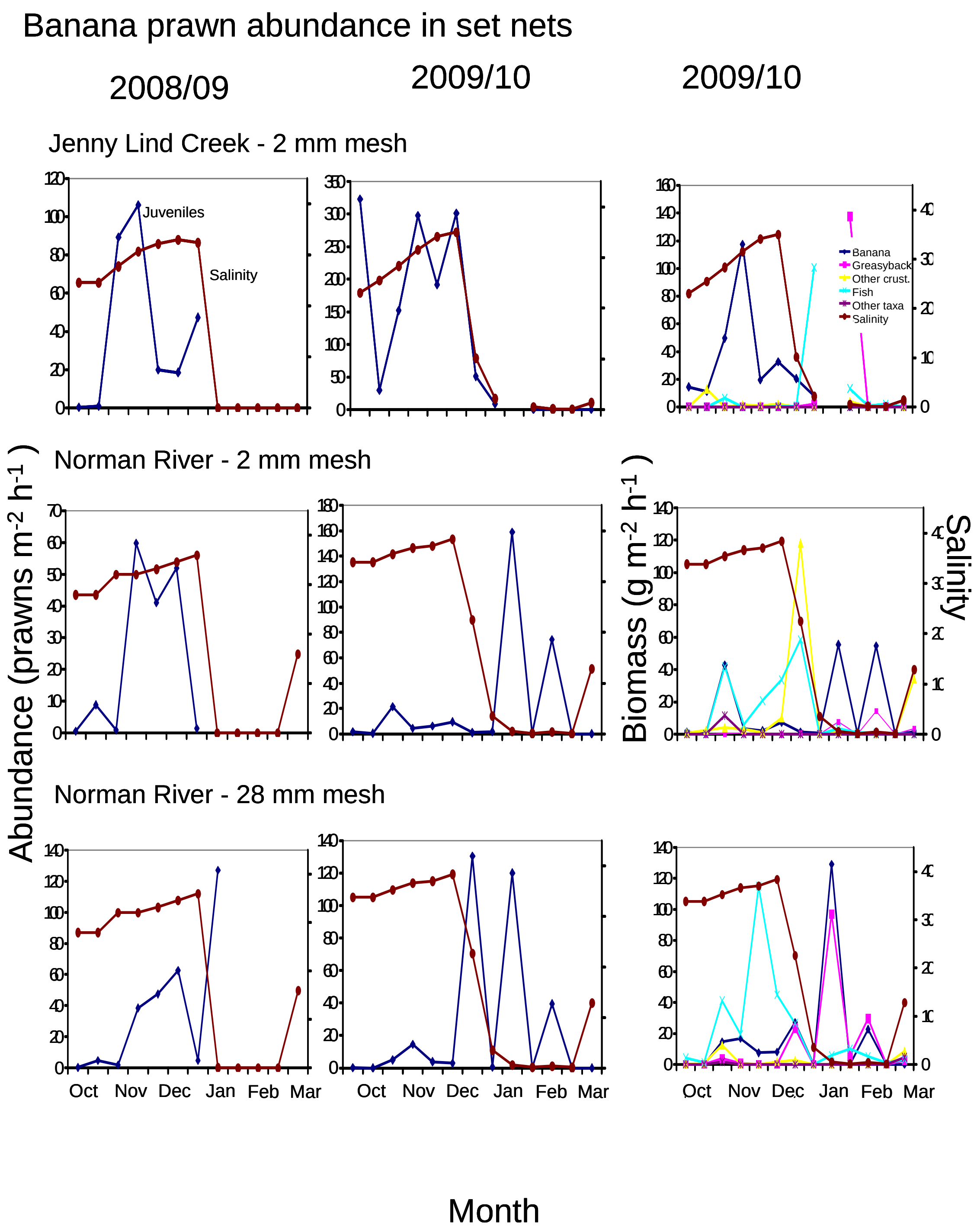

Figure 7.2: The abundance of juvenile banana prawns (Penaeus merguiensis), greasyback prawns (Metapenaeus insolitus), other crustaceans, fish and other taxa caught in a 1m x 0.5m set net (2 mm mesh) and a 2m x 1 m set net (28 mm mesh), and salinity in the mouth of the Jenny Lind Creek (at Walker Creek confluence) in the Norman River estuary; and in the lower Norman River in 2008/09 and 2009/10.

In 2008/09, in the Norman River, prawns emigrated strongly from the river in November and December. About 50 prawns m^{-2} h^{-1} were caught in both the 2 mm and 28 mm mesh set nets before the flood (Fig. 7.2). However, 120 prawns m^{-2} h^{-1} were caught in the large mesh set net on January 14th (near the west river bank) after the flood had began (Fig. 8a). The large mesh net was also deployed on January 28th near the east bank as flood-flow seemed less in this location. Only one prawn was caught during the 3 hour deployment.

In 2009/10, prawns again emigrated strongly due to flooding, but the greatest numbers of emigrants occurred in January and February 2010. Up to 160 prawns m^{-2} h^{-1} were caught in the 2 mm mesh net in February; and peaks of 120 prawns m^{-2} h^{-1} were caught in the 28 mm mesh set nets in January and February (Fig. 7.2). During the 2010 flood event, fewer emigrants were caught in February, and like 2009, no prawns were caught in March as the river was fresh.

1n 2009/10, fish and banana prawns dominated the 2 mm mesh set net catch in the Norman River prior to the flood (Fig. 7.2). At the onset of the flood, the biomass of fish and *Macrobrachium* species peaked in the catch. During the flood over February, the catch of banana prawns was high and pulsed, but dominated other taxa.

During the major 2009 floods, attempts were made to deploy the set nets in the Norman River; but none were set after the end of January as the flooded river was too dangerous. The 2010 flood caused the salinity in the river to drop to zero; however, the rate of the flood water was not a strong as in 2009 and navigation and setting the nets was still possible.

1n 2009/10, as was found for the small mesh net, fish and banana prawns dominated the 28 mm mesh set net catch in the Norman River prior to the flood (Fig. 7.2). At the onset of the flood, the biomass of fish dropped significantly; and the catch of banana and greasyback prawns was high. However, the biomass of both these species peaked during the flood over February. They dominated other taxa.

7.1.4.4 Prawn growth

An estimate of the growth rate of juvenile prawns in the Norman River estuary has been made from the Walker Creek/Jenny Lind complex; where large numbers of juvenile prawns were abundant for several months. Over the 12 week period from 8th October to 31st December 2008 the mean size of the juvenile prawns in Walker Creek increased from an average of 3.81 mm CL to 10.87 mm CL; a 7 mm increase (Fig. 7.3). However, several cohorts were evident during this time. Tracking the average size of the prawns from a distinct cohort from 4th November to 31st December shows they grew from 1.87 mm CL to 10.87 mm CL; a 9 mm increase over 8 weeks. Tracking this cohort suggests they grow about 1.1 mm wk^{-1}; a rate similar to growth rates measured in the Norman River in the past (1.2 mm week in November/December; Staples 1980b).

Over a 14 week period from 12th October 2009 to 18th January 2010 the means size of juvenile banana prawns in Walker Creek increased from an average of 3.92 mm CL to 10.27 mm CL; a 6.3 mm increase (Fig. 7.3). However, about four cohorts were evident over the period. Tracking a distinct cohort of the prawns from 12th October to 8th December shows they grew from 1.88 mm CL to 13.0 mm CL; an 11 mm increase over 8 weeks (1.4 mm wk^{-1}). Tracking this cohort of the prawns from 12th October to 23rd November 2009 shows they grew from 1.88 mm CL to 10.85 mm CL; a 9 mm increase over 6 weeks; 1.5 mm wk^{-1}, a faster growth rate than 2008.

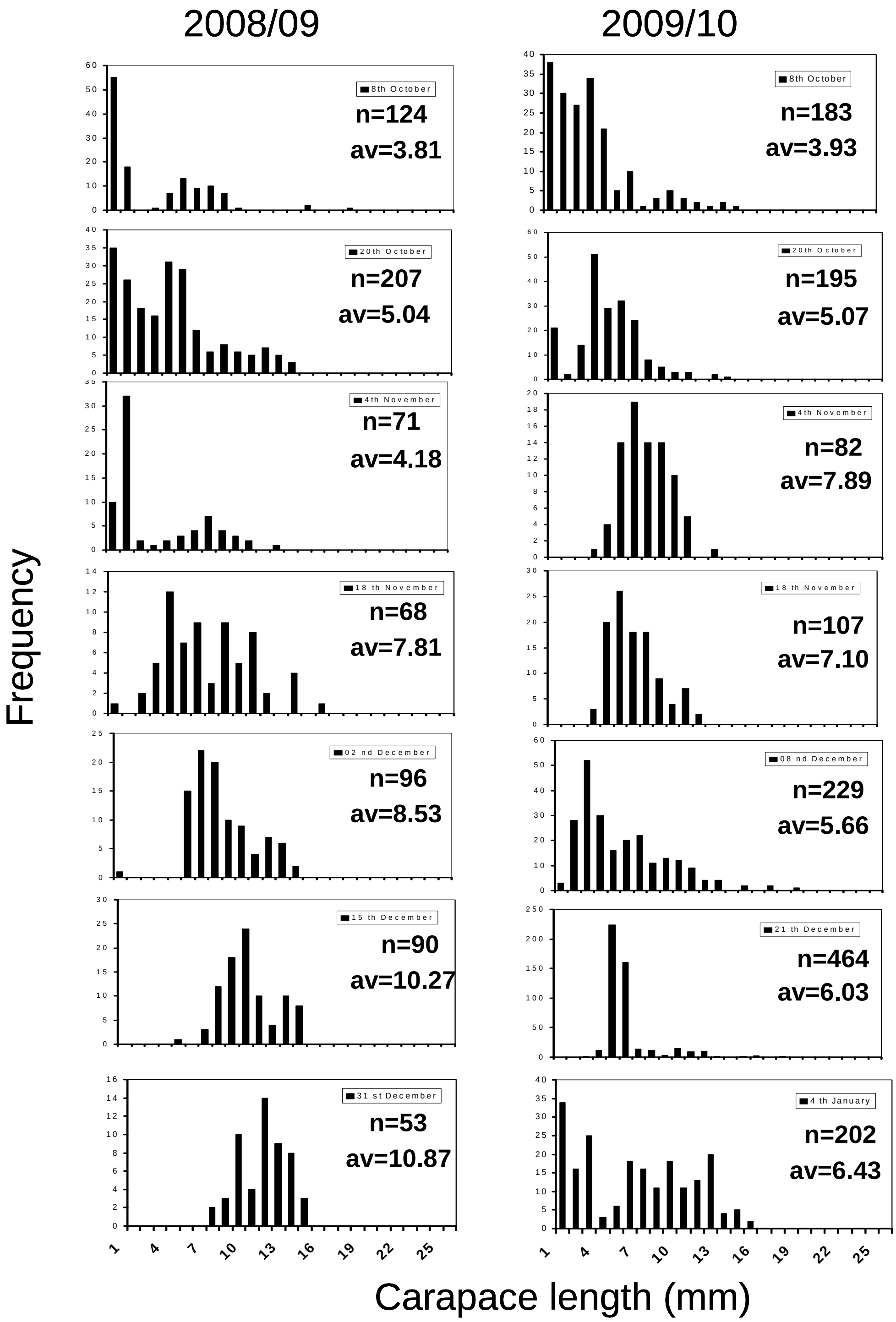

Figure 7.3: Carapace length (mm) of juvenile banana prawns during seven sampling periods during October to December 2008, and October 2009 to January 2010 in the Walker Creek. av = average carapace length.

7.1.4.5 The Flinders River

The salinity of the Flinders River was < 1 at all sites that were sampled; it was near zero at most sites. The prawns that dominated the catch of all trawls and seine nets in the Flinders River were the greasyback prawn, *Metapenaeus insolitus*. No banana prawns were caught in the mid-estuary upstream of a point about 20 km from the mouth. Most banana prawns were caught in side creeks near the river mouth (Fig. (). At the mouth of the river where both prawn species were found, at least 5 times as many greasyback prawns were caught as banana prawns.

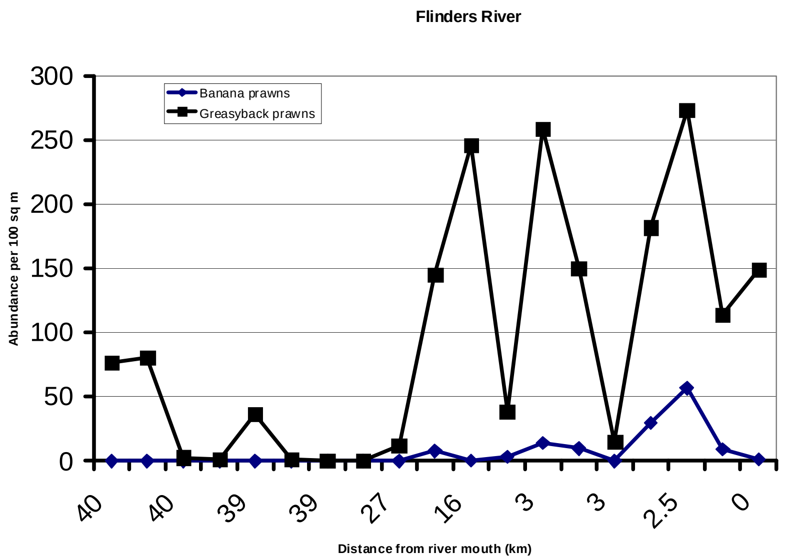

Figure 7:4: Abundance of juvenile banana and greasyback prawns (# 100 m^{-2}) in the Flinders River in February 2010, while the river was in flood. The salinity at all sites was near zero.

While trawls were made in the river channel; seine nets were the only tool of use to catch prawns on the floodplain. On the flood plain, the water depth was too shallow to allow the passage of a vessel. Since Seine nets were used, the method was not directly comparable to the trawls. However, our aim in the Flinders River was to investigate the use of the floodplain by crustaceans; not necessarily to obtain comparable estimates of abundance with the river channel or the Norman River.

7.1.5 Discussion

In the creek habitats in both years, the abundance of postlarval and juvenile banana prawns were variable in both time (by fortnight) and space (along the creek) but not between years.

Small waterbodies in mangrove forests or mangrove-lined saltpans are the primary habitats for postlarval and small juvenile banana prawns. Thus, the similar abundances in each year that we sampled were to be expected.

The abundance of benthic postlarvae (0 -150 prawns 100 m^{-2}) and juvenile banana prawns (0 -300 prawns 100 m^{-2}) was similar to abundances measured in the Norman River by Staples and Vance (1986) in the 1970's. However, at the same sites as sampled by Staples (1980a) we found fewer prawns than the highest numbers found in the Norman River in 1975 and 1976. In the 1970's, the catches at the same sites in the Norman River varied by two orders of magnitude from month to month and by site; temporal and spatial variation similar to what we found 30 years later. Like Staples and Vance (1986), we found juvenile prawns to be most abundant in the Norman River in January and February (in 2010); yet the abundances they caught were considerably higher than what were found in the main river. Our comparable higher abundances were found in the small tributaries of the Norman River; habitats not sampled by Staples and Vance (D. Vance, pers. comm.).

Small tributaries were sampled by Vance et al. (1998) in the Embley River estuary, north east Gulf of Carpentaria. They found mean abundances of 1000 juvenile prawns 100 m^{-2}; again higher abundances than we measured in the Norman River tributaries. However, the abundances that they found in the river habitats were lower than abundances in creeks; a result similar to our creek vs. river abundances. The higher abundances of small juvenile prawns in the creeks reflect the prawn's primary use of these small waterbody habitats following settlement.

The catch of emigrant prawns in the Norman River estuary in 2008-10 was generally higher than those reported by Staples (1980b). Often > 100 prawn m^2 h^{-1} were caught and in the Jenny Lind Creek, and over 300 prawn m^2 h^{-1} were recorded.

In 2008/09, prior to effects of the flood, high numbers of postlarval prawns were encountered in the river; the following year this was not the case. Postlarvae are spawned offshore and they advect up the rivers using the tides (Condie et al. 1999; Rothlisberg et al. 1996; Vance and Pendrey 2008). They pass through the expansive waterbodies in the lower estuary to access the protected small creeks and gutters where they settle to a benthic existence and grow (Vance et al. 1998). The abundance of immigrants is sporadic and pulsed (Staples 1980a); many prawns can enter an estuary over a short period of time. On the ebb tide, small prawns settle from the water column to await the next flood tide to move further upstream. In 2008/09 we happened to sample a pulse of postlarvae as they moved upstream. In 2009/10, we missed a major pulse of postlarval prawns; except at the end of the season when we caught 0.9 prawns m^{-2} at N1 in March. These prawns were entering the estuary at the end of the recruitment season after the floods had ceased.

In 2008/09, the abundance of juvenile prawns in the river was one third that of 2009/10. Juvenile prawns move from smaller to larger waterbodies as they grow and emigrate (Staples and Vance 1986; Vance et al. 1998). In 2008/09, the prawns had not moved from the creek prior to the onset of the 50-year flood. The prawns emigrated at flood onset: large numbers of small juvenile prawns left the creeks. Although we were not able to sample the river rigorously during the flood, the prawns probably moved directly through the river as emigrants. They were caught in abundance in the set nets in the lower estuary during the early flood. Physiological evidence suggests the prawns would not have been able to tolerate the freshwater flows and not remained in the river (Staples and Heales 1991).

In 2009/10, the small prawns left the creeks at the onset of the flood, however, as the flood was smaller the drop in salinity was not immediate and they lingered in the estuary before they emigrated. In 2009/10, our trawls captured prawns as they migrated downstream and before they left the river altogether. One month after the first flood event, all juvenile prawns had left Walker Creek; they were not caught after January 2010. Emigrants continued to be caught in the main river channel during February and March, though very few were caught on the banks of the river after early February.

The set net data show that the rate of emigration of banana prawns was the same in both years, despite the flood magnitude in 2009 being three times that of 2010. This result is not surprising as both floods caused the salinity to drop to zero; juvenile banana prawns would have responded in the same manner in both years.

Our data support the hypothesis that “freshwater flows and estuarine inundation during flood events stimulate juvenile prawns to emigrate from the estuary”. Flood flows have been shown to stimulate emigration of juvenile banana prawns in the Norman River in the

1970s (Staples 1980b; Vance et al. 1985) and the Embley River in the 1990s (Vance et al. 1998); so this result is expected. However, other aspects of this study add information to assist in explaining the significant percentages of variation in banana prawn commercial catch that cannot be attributed to environmental variables such as pre-season rainfall and temperatures. Investigation of the seasonal levels of chlorophyll and the abundance of meiofauna show that chlorophyll levels drop by two thirds and that both the diversity and abundance of meiofauna decline to negligible levels with a significant drop in salinity (See TRACK Section 7.3.2). They would not be available as food items for any juvenile banana prawns that may remain in the estuary despite the flood. The loss of food would stimulate banana prawns to emigrate in search of better food resources.

Our data do not support the hypothesis that "freshwater inputs to the estuary during the wet season result in nutrient loads being transferred from the catchment to the estuary, with flow-on benefits for the juvenile prawns". The levels of nutrients in estuarine waters do not increase appreciably during the floods (see Section 7.2). The volume of water moving through the estuary continues to dilute nutrients to levels similar to the pre-flood environment. During the major flood of 2008/09, the primary productivity in the water column was very low compared to at the end of the dry season in 2009, and during the smaller flood of 2009/10. Together with the significant freshwater input changing the ecology of the estuary from a marine to a freshwater system and the loss of marine-adapted food resources; the flooded estuary is not an environment that enhances the resource base for banana prawns.

Our data do provide support for the hypothesis that "the inundation of coastal land, especially saltflats, over the wet season results in a peak in productivity and an expansion of resource availability for prawns". Our studies showed that a spike of nutrients was released and there was substantial algal growth when the saltflats were inundated (see TRACK Section 7.3.6). However, in years of high flood they probably are swept from the estuary with the flood water. In years of small floods, the nutrients released from inundated saltflats may be retained in the estuary and become available to resident banana prawns.

Our investigations from the Flinders River show that greasyback prawns (*Metapenaeus insolitus*) probably benefit from the release of nutrients and algal growth on the inundated saltflats. We found no banana prawns, but thousands of greasyback prawns on the flooded saltflats. Clearly, these prawns potentially are capable of eating the algae or any meiofauna stimulated by the nutrients the algae produce as the flats are flooded. The greasyback prawns seem to be stimulated to spawn by the floods and they invade the habitats created by the floodwaters on the usually dry saltflats. As well, we caught large numbers of greasyback prawns emigrating from the mouth of the Flinders River and the Norman River during the floods. Greasyback prawns seem to be able to access different food resources than banana prawns during the floods and benefit from their dominance of the crustacean community in flooded estuaries.

The modelling of the nutrient budgets for the Norman River showed that 4300 t of nitrogen and 800 t of phosphorus (2008/09), and 2500 t of nitrogen and 400 t of phosphorus (2009/10), were exported from the estuary during the floods in respective years (see TRACK Section 7.3.3). While these nutrients may not support the production of juvenile banana prawns in the estuary, they would support the production of subadult banana prawns in the nearshore/offshore environment after they had emigrated. Other CSIRO Marine and Atmospheric Research (CMAR) projects suggest that the nearshore environment is a key filter for the final abundance and catch of the commercial stock (see CMAR project "An integrated Monitoring Project for the Northern Prawn Fishery (NPF)" (AFMA 2008/0827)).

The abundance of the recently recruited sub-adult prawns is measured annually (since 2003) at a range of sites offshore from the Norman River estuary. The index in 2009 was 14.96±5.89; a high index relative to most other years; in 2008 it was 10.90±7.93, but in all other years it has been <4. Given the magnitude of the 2009 floods, a high abundance of prawns in the adjacent fishery could be expected (Vance et al. 1985; Gillanders and Kingsford 2002; Robins et al 2005). The fishery catch in 2009 was 4700 t; again a relatively high catch (average over 1990-99 = 3,863 t; average over 2000-08 = 3,946 t) (Evans 2008).

Interestingly, the index of sub-adult banana prawn abundance in 2010 was much lower than in 2009 (at 3.58±0.75); despite our emigration data showing comparable levels of juvenile emigration in 2009 and 2010. Despite a low index, indications are that the catch for 2010 was relatively high. An NPF Industry spokesman estimated the 2010 catch to be about

4500 t (Rob Kenyon, pers. comm.). As well, in 2008 the index was 10.9±7.93, yet the catch was 5816 t. Clearly, the survival and growth of sub-adult prawns in the nearshore environment is determined by other factors than just the numbers that leave the estuary, and investigating productivity in the coastal zone remains a key question.

7.2 The effect of flow on water quality

The water quality data collected in the study has been summarised below. In the interests of simplifying the findings, not all data is shown. Only those data which either reflect a more general pattern or spatial/temporal specific data is included. For information on all the data, see Appendix 1.

7.2.1 Physico-chemical parameters

Salinity was used as a measure of freshwater flow in the Norman R. estuary. The water column was mostly well mixed, as reflected in the low variability in salinity with depth through the water column. From October to December each year, the upstream sites in the estuary became hypersaline. In the first year (2008/09), salinity dropped rapidly between the last sampling in December 2008 and the first sampling in January 2009, when the wet season began (Fig. 7.5). Salinity remained at zero at all sites, irrespective of the tidal cycle, until late March 2009, when it began to increase again at the downstream sites, CQ1 (incoming tide) and CQ2 (outgoing tide). Salinity did not increase significantly at the upstream site CQ3. By June 2009, the salinity at the downstream sites was seawater salinity, but remained brackish at the upstream site.

In the second six month season, the situation was similar with hypersaline conditions developing at the downstream sites until the end of December 2009, when the wet season began and salinity dropped substantially at all sites. Salinity reached zero at the upstream site CQ3 for an extended period, and for a lesser duration CQ2 (outgoing tide). Salinity at CQ1 (incoming tide) was lower than seawater but only reached zero on one sampling occasion. This shows that tidal exchange was occurring in the second year. Additional monthly sampling was conducted at Normanton (NW), 80 km upstream of Karumba, in the second year. Salinity was brackish then dropped to zero after the decrease in late December 2009, and remained low until the end of the sampling period in March 2010.

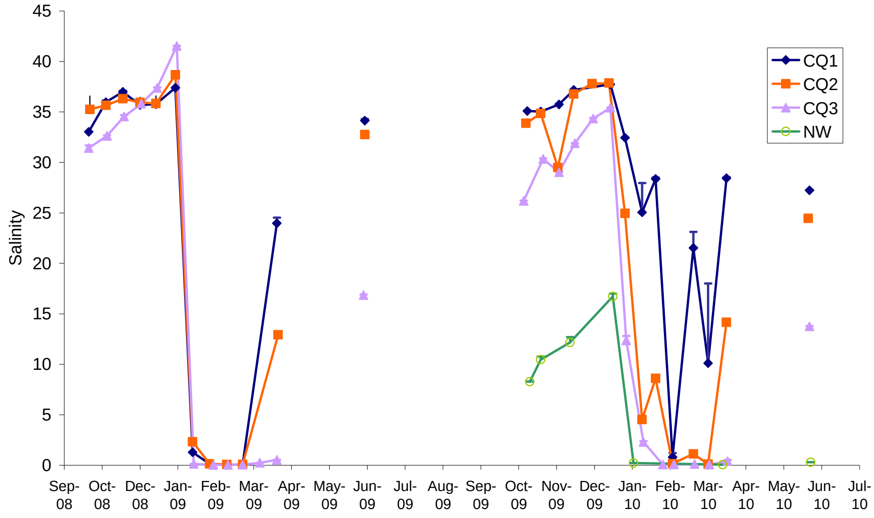

Figure 7:5: Mean (±SD) salinity at three of the six sites sampled fortnightly on the Norman R estuary. CQ1 and CQ2 are the incoming and outgoing tides respectively at Karumba township, CQ3 is 30 km upstream, and NW is at Normanton wharf, 80 km upstream.

Salinity (as conductivity) was also measured every 30 min using a logger at the wharf at Karumba from January 2009 to March 2009, and again from December 2009 to May 2010 (Fig. 7.6). The logger data highlighted the high degree of fluctuations in conductivity in the second year as a result of variation in freshwater flow. The fortnightly salinity measurements (CQ1, CS2) at the same site correlated well with the logged data.

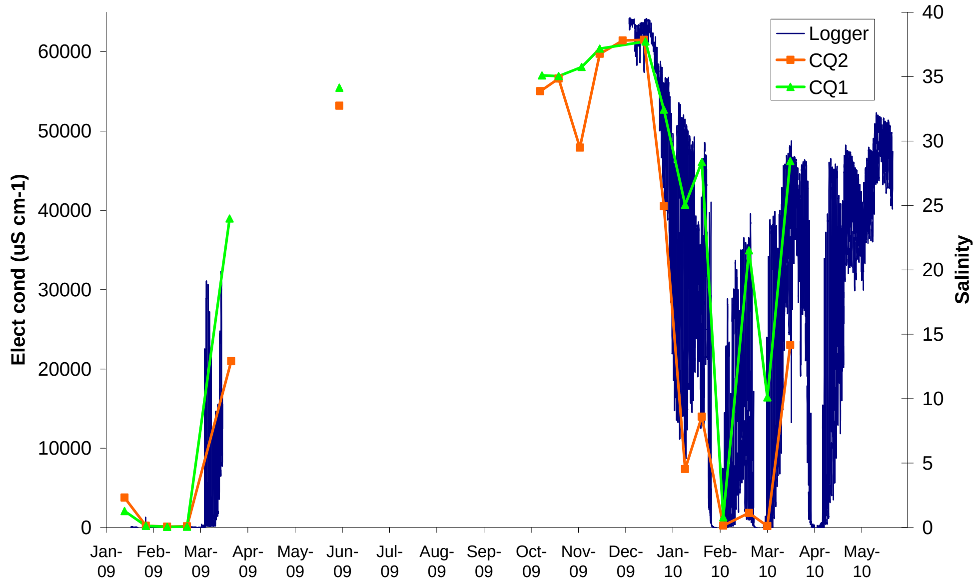

Figure 7:6: Conductivity ($\mu s\ cm^{-1}$) measured every 30 min using a logger (CSIRO unpubl. Data), and salinity measured fortnightly (CQ1 = incoming tide, CQ2 = outgoing tide) near the surface at the wharf at the Karumba township.

Across the sampling sites, the mean water temperature was typically 28 to 32°C, and gradually increased in the late dry season (October to December) (Table 7.6). The reductions in temperature were generally associated with the large freshwater inflows during flooding (Fig. 7.7).

Table 7.6: Mean (±SD) of physico-chemical profile data for all sites across the two years of the study. Data for NW was only collected on the second year. CQ1 is incoming tide.

Parameter	NW	CQ3	WQ1	RQ1	CQ2	CQ1
Temperature (°C)	28.93 (3.74)	29.34 (2.25)	29.29 (2.13)	28.35 (1.91)	29.49 (2.68)	29.48 (3.01)
pH	7.62 (0.37)	7.46 (0.44)	7.58 (0.45)	7.86 (0.36)	7.72 (0.38)	7.76 (0.57)
DO (mg L^{-1})	6.69 (2.82)	5.40 (1.25)	5.32 (1.37)	5.37 (1.35)	5.32 (1.05)	5.30 (1.38)
Secchi (m)	0.40 (0.24)	0.17 (0.06)	0.22 (0.12)	0.19 (0.15)	0.24 (0.23)	0.38 (0.54)

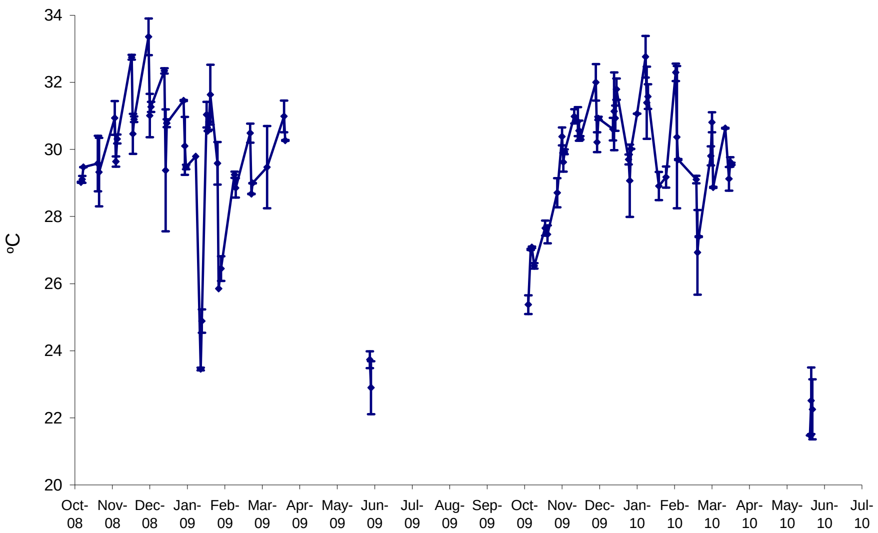

Figure 7:7: Mean (±SD) temperature (°C) of all sites sampled fortnightly on the Norman R estuary.

Dissolved oxygen (DO) was similar between sites but varied over the seasons (Table 7.5, Fig. 7.8). In the first year, data was only available after the wet season commenced, as the probe malfunctioned during the earlier part of the season. DO was initially higher during the period of high flow in the first year but decreased late in the wet season. In the second year, DO decreased over the dry season, and was variable but lower over the wet season. DO did not drop to concentrations that were detrimental to aquatic animals (typically < 2 mg L^{-1}), although it should be remembered that data is for daytime DO concentrations, and night-time DO values are likely to be lower.

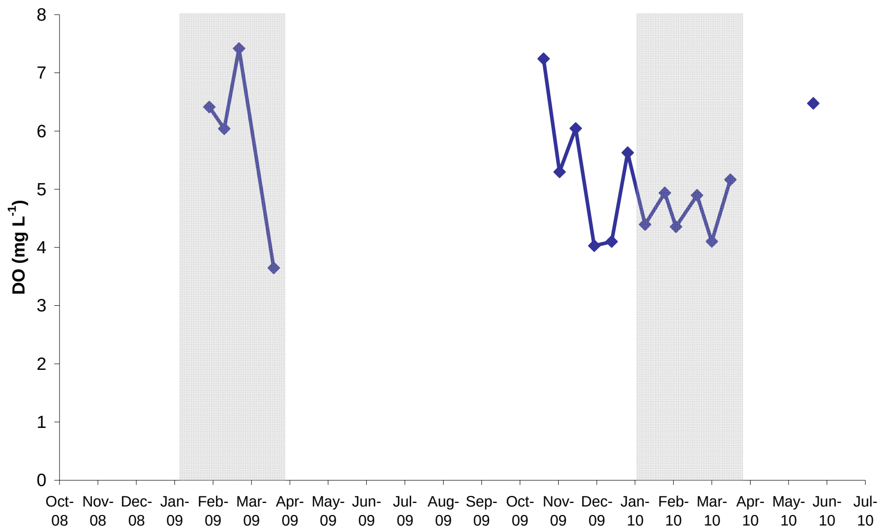

Figure 7.8: Mean (± SD) dissolved oxygen (DO) (mg L^{-1}) at the bottom of the water column of a representative site (CQ3) sampled fortnightly on the Norman R estuary. Shaded zone represents periods of decreased salinity during wet season.

pH and Secchi depth varied between sampling occasions within sites but were similar between sites (Table 7.6). For correlations between parameters see Table 7.8.

7.2.2 Nutrient concentrations

Over the two years, concentrations of TN, TP and the dissolved forms, NH_4, NO_2/NO_3 and PO_4, were highly variable between sampling sites with no obvious downstream trends (Table 7.7). For correlations between parameters see Table 7.8.

Table 7.7: Mean (±SD) of nutrient, TSS and chlorophyll a data for all sites across the two years of the study. Data for NW was only collected on the second year. CQ1 is incoming tide.

Parameter	NW	CQ3	WQ1	RQ1	CQ2	CQ1
TN (mg L^{-1})	0.567 (0.177)	0.521 (0.140)	0.464 (0.106)	0.523 (0.173)	0.520 (0.190)	0.435 (0.190)
TP (mg L^{-1})	0.046 (0.025)	0.080 (0.030)	0.067 (0.023)	0.107 (0.071)	0.083 (0.053)	0.072 (0.057)
NH_4 (mg L^{-1})	0.022 (0.023)	0.012 (0.007)	0.018 (0.014)	0.025 (0.021)	0.020 (0.022)	0.013 (0.011)
NO_2/NO_3 (mg L^{-1})	0.050 (0.036)	0.068 (0.075)	0.064 (0.080)	0.042 (0.036)	0.043 (0.040)	0.020 (0.020)
PO_4 (mg L^{-1})	0.007 (0.003)	0.009 (0.006)	0.009 (0.007)	0.015 (0.019)	0.007 (0.004)	0.006 (0.005)
Chl *a* (µg L^{-1})	3.90 (1.99)	3.89 (3.12)	3.39 (2.56)	3.40 (2.96)	4.65 (3.75)	4.14 (3.79)
TSS (mg L^{-1})	144.21 (140.00)	274.78 (188.60)	263.07 (211.73	361.63 (211.49)	430.42 (530.46)	349.43 (338.14)
Molar TN:TP	30.23	15.6	16.9	14.3	17.69	17.9

TN concentrations were more variable in the second year than the first (Fig. 7.9). Over the dry season, TN concentrations increased, particularly downstream in both years, but then decreased initially with the increase in freshwater flow.

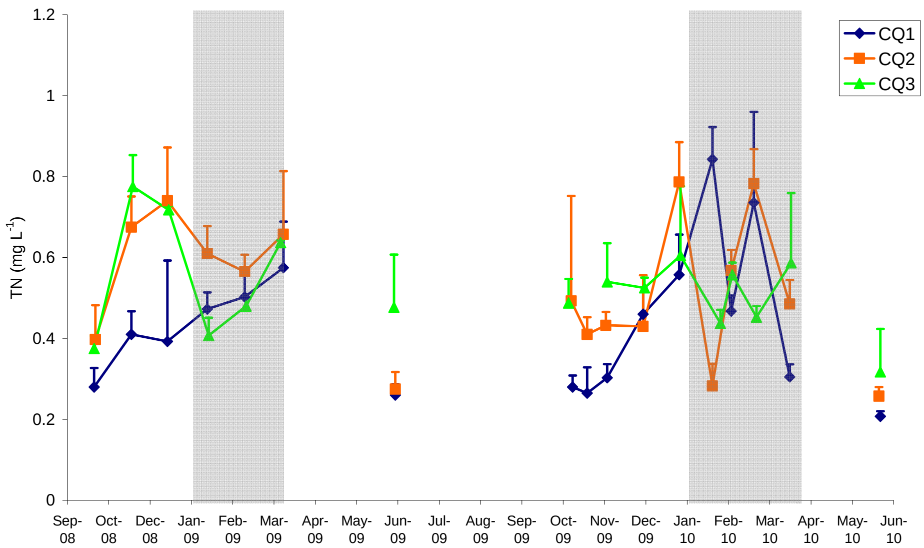

Figure 7:9: Mean (±SD) TN concentrations (mg L^{-1}) at three of the six sites sampled fortnightly on the Norman R estuary. CQ1 and CQ2 are the incoming and outgoing tides respectively at Karumba

township, and CQ3 is 30 km upstream. Shaded zone represents periods of decreased salinity during wet season.

Mean TP concentrations were also more variable in the second year than the first (Fig. 7.10). TP concentrations did not change with freshwater flow at most sites, although Russell Creek (RQ1) contributed a very high TP concentration to the system in the first wet season. RQ1 received overflow from the Flinders R. system. Other TRACK research has shown that the Flinders R. system has higher TP concentrations than the Norman R. system (see Section 7.3.4).

Molar TN:TP ratios were typically a little lower than the ratios required for optimal algal growth (17:1 for coastal waters, Sterner et al. 2008) at most sites, with the exception of the upstream site at Normanton which was higher than 17:1 (Table 7.7). This suggests that this upstream site was more likely to be P limited than N limited, while the converse was true for other sites, i.e. N limited rather than P limited. Nutrient bioassays conducted as part of the TRACK research confirm this (see Section 7.3.5).

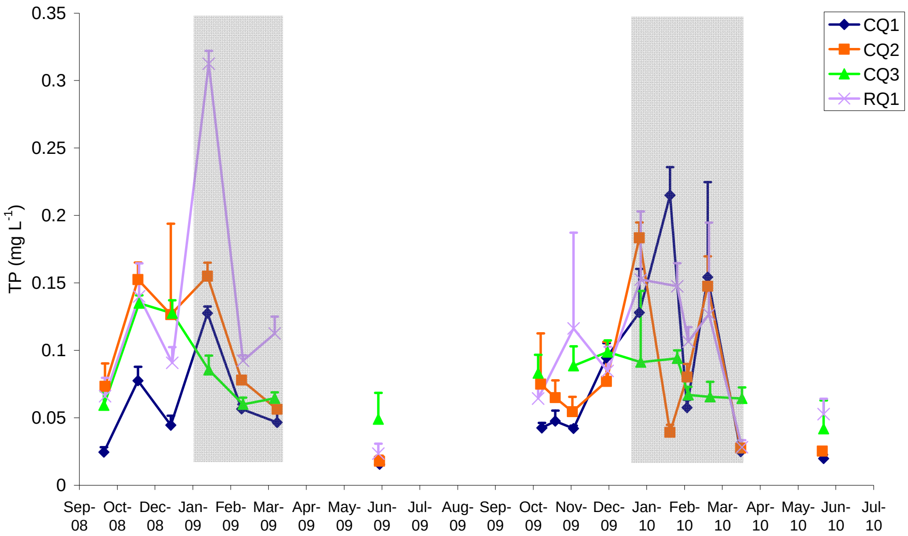

Figure 7.10: Mean (±SD) TP concentrations (mg L^{-1}) at four of the six sites sampled fortnightly on the Norman R estuary. CQ1 and CQ2 are the incoming and outgoing tides respectively at Karumba township, CQ3 is 30 km upstream and RQ1 is at the mouth of Russell Ck. Shaded zone represents periods of decreased salinity during wet season.

NH_4 concentrations increased at a number of sites immediately after the wet season commenced in year 1 but in year 2, the increase in NH_4 only occurred immediately at the upstream site, NW (Fig. 7.11). At the downstream site, the increase occurred over three months. The scale of the flooding was not as great in the second year as the first. Incoming and outgoing tides (CQ1 and CQ2) had similar concentrations on most occasions.

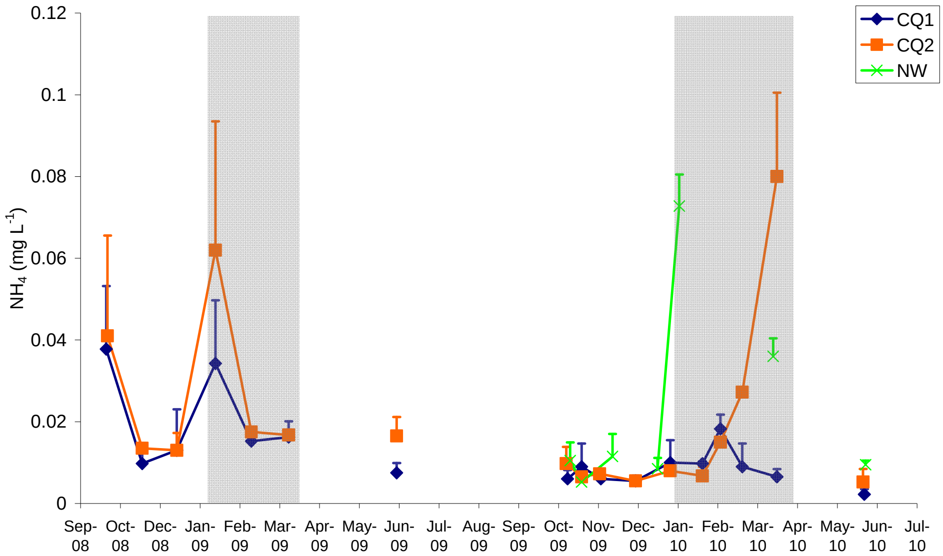

Figure 7.11: Mean (±SD) NH_4 concentrations (mg L^{-1}) at three of the six sites sampled fortnightly on the Norman R estuary. CQ1 and CQ2 represent sampling on the incoming and outgoing tides respectively at Karumba township, and NW is Normanton Wharf, 80 km upstream of Karumba. Shaded zone represents periods of decreased salinity during wet season.

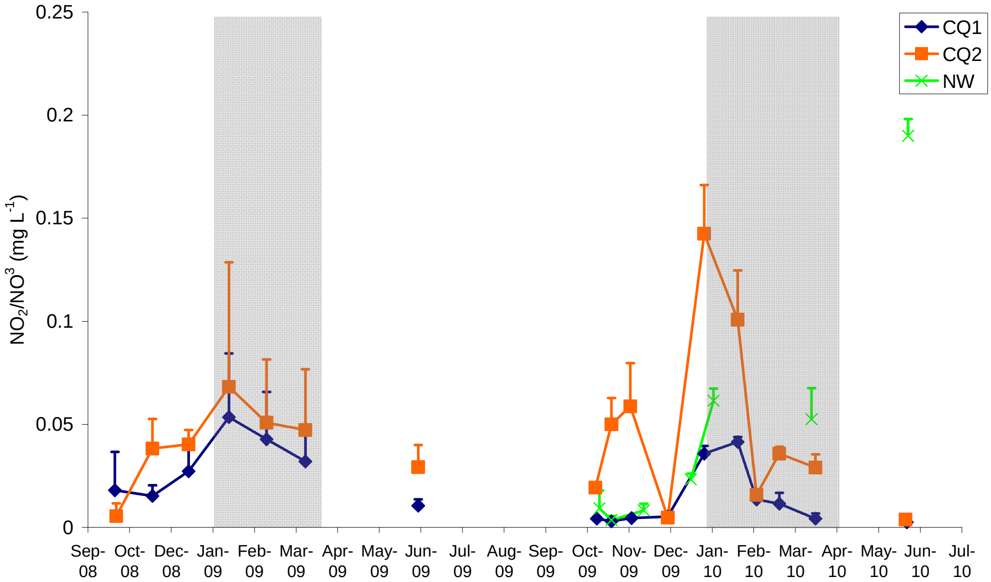

Figure 7.12: Mean (±SD) NO_2/NO_3 *concentrations (mg L^{-1}) at three of the six sites sampled fortnightly on the Norman R estuary. CQ1 and CQ2 represent the incoming and outgoing tides respectively at Karumba township, and NW is Normanton Wharf, 80 km upstream of Karumba. Shaded zone represents periods of decreased salinity during wet season.*

NO_2/NO_3 concentrations initially increased when salinity decreased at the start of the wet season in both years across both the upstream (NW) and the downstream sites (CQ1 and CQ2) (Fig. 7.12). After this time, NO_2/NO_3 concentrations decreased again.

PO_4 concentrations increased at the downstream site when salinity decreased at the start of the wet season (Fig. 7.13). Consistent with the TP concentrations, PO_4 concentrations increased substantially at the mouth of Russell Creek after the wet season commenced. PO_4 made up 25% of the TP concentration at Russell Creek at this time. In contrast in the second year, there was no evidence of an increase in PO_4 concentrations at the start of the wet season.

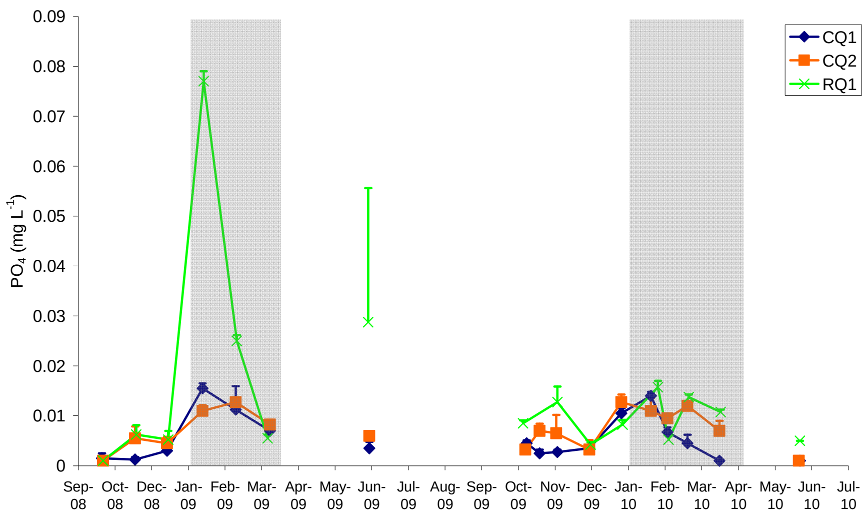

Figure 7.13: Mean (± SD) PO_4 concentrations (mg L^{-1}) at three of the six sites sampled fortnightly on the Norman R estuary. CQ1 and CQ2 are the incoming and outgoing tides respectively at Karumba township, and RQ1 is the mouth of Russell Creek (10 km upstream from the mouth of the Norman River. Shaded zone represents periods of decreased salinity during wet season.

Additional analyses for dissolved organic N (DON) and P (DOP) concentrations were also done on two occasions, once in the wet season and once in the dry season, in the second year. The %DON relative to the TN pool was typically greater than 50% (Fig. 7.14). There was little evidence of a difference between dry and wet seasons. The second largest percentage was particulate N (PN) followed by a small proportion of DIN (NH_4, NO_2/NO_3). In the case of P, the highest fraction (>60%) was the particulate P (PP). The percentage DOP and PO_4 was similar with no obvious differences between the dry and wet season.

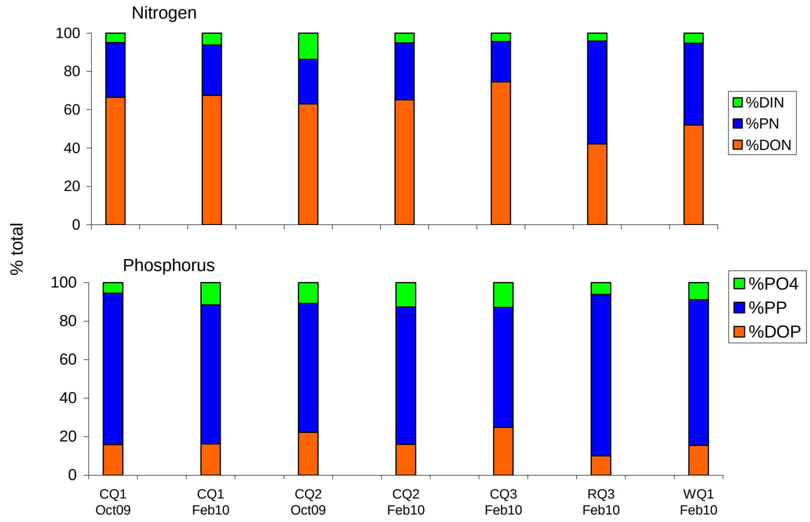

Figure 7.14: Mean percentage N and P fractions in the water column at a range of sites in the Norman R estuary.

In addition to the regular nutrient sampling, a number of transects down the length of the Norman R. from Normanton to Karumba were undertaken. Two transects for measurement of TN and TP were undertaken during each wet season (Fig. 7.15). In both years TP concentrations decreased to 40 km upstream then plateaued, and concentrations were higher in the second year. The converse was true for TN concentrations in the first year which increased up the river to 40 km upstream, then plateaued. Overall concentrations were higher in the first year.

In the second dry season (November 2009), two transects were sampled for TN and TP concentrations (Fig. 7.16). There was no obvious trend in TP or TN concentrations in the upstream transects on either sampling occasion.

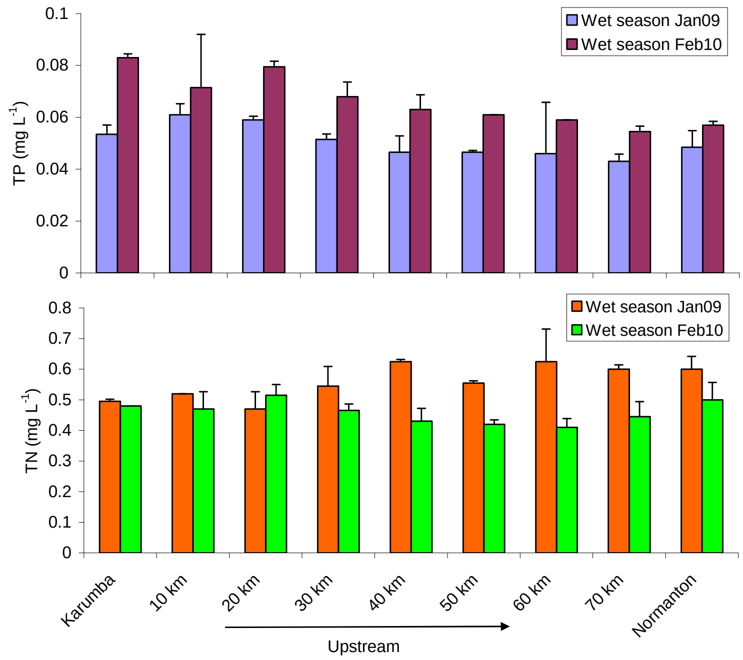

Figure 7.15: Mean (±SD) TN and TP concentrations (mg L^{-1}) in the water column in a transect up the Norman R estuary from Karumba to Normanton in the two wet seasons (January 2009, February 2010).

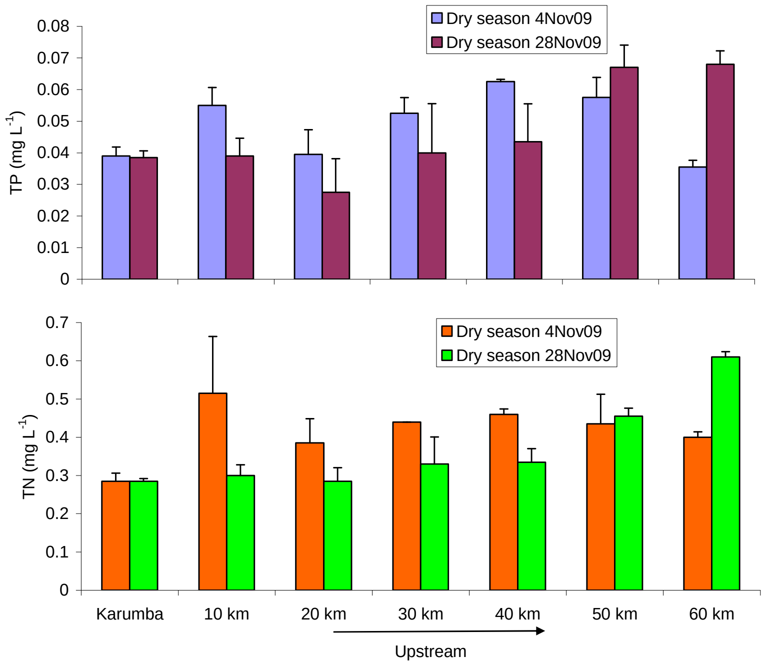

Figure 7.16: Mean (±SD) TN and TP concentrations (mg L^{-1}) in the water column in a transect up the Norman R estuary from Karumba to 60 km upstream on two occasions in the second dry seasons (November 2009). Note: It was not possible to sample further upstream due to the shallow water.

7.2.3 Chlorophyll a and TSS

Chlorophyll *a* concentrations in the water column were typically higher earlier in the dry season compared to late dry season or the wet season, with values close to zero recorded when freshwater flow first commenced (Fig. 7.17). The second year had more variable concentrations at the downstream site on both in the incoming and outgoing tide.

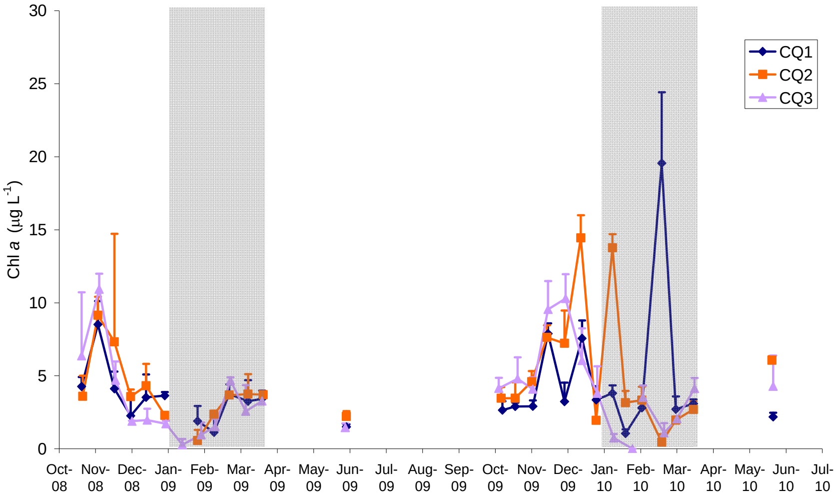

Figure 7.17: Mean (±SD) chlorophyll a concentrations (µg L^{-1}) at three of the six sites sampled fortnightly on the Norman R estuary. CQ1 and CQ2 are the incoming and outgoing tides respectively at Karumba township, and CQ3 is 30 km upstream. Shaded zone represents periods of decreased salinity during wet season.

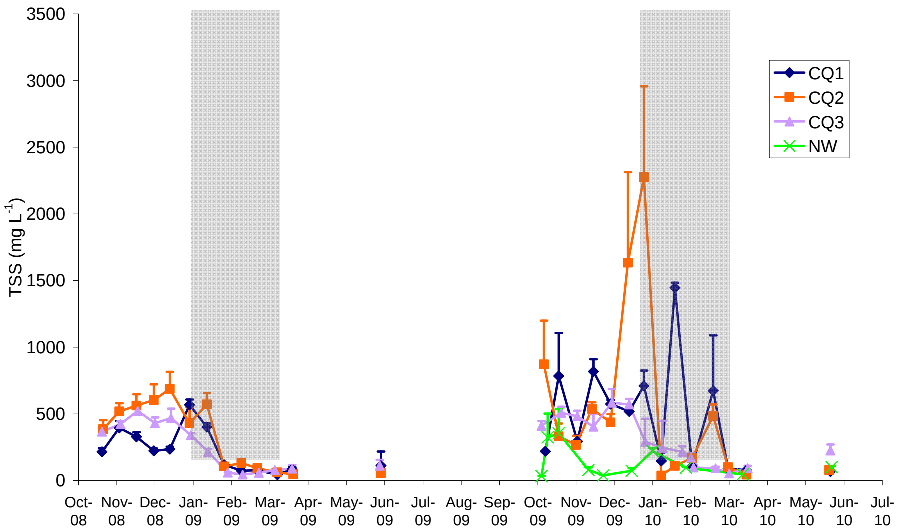

Figure 7.18: Mean (±SD) TSS concentrations (mg L^{-1}) at four of the six sites sampled fortnightly on the Norman R estuary. CQ1 and CQ2 are the incoming and outgoing tides respectively at Karumba township, CQ3 is 30 km upstream, and NW is Normanton wharf (80 km upstream of Karumba). Shaded zone represents periods of decreased salinity during wet season.

Contrary to expectations, TSS concentrations were higher prior to the wet season in both years at CQ3 (Fig. 7.18). Concentrations were more variable at the downstream site with a large peak in TSS just prior to the wet season. The upstream site, NW, typically had lower TSS concentrations.

7.2.4 Correlations between water quality parameters

Salinity was positively correlated with TSS ($P<0.01$) and chlorophyll *a* concentrations ($P<0.005$), and negatively correlated with NH_4 ($P<0.05$) and PO_4 concentrations ($P<0.005$), when data for all sites and sampling times were combined (Table 7.8). Therefore, the decrease in salinity associated with the wet season had a negative effect on algal biomass in the water column. TSS concentrations were also affected by freshwater flow and this is likely to be due to a change in the size of soil particles in the river rather than the reduction in chlorophyll *a* concentrations, as TSS and chlorophyll *a* were not significantly correlated.

Temperature was positively correlated and both NH_4 and PO_4 were negatively correlated with chlorophyll *a* concentrations ($P<0.05$). This suggests that temperature also played a controlling factor in algal production in the estuary. Secchi depth was also correlated with TSS, TN and TP concentrations, while windspeed (at Normanton) was correlated with chlorophyll *a* concentrations and salinity ($P<0.005$).

TSS concentrations were highly correlated with both TN and TP, suggesting that a significant proportion of the TN and TP concentrations were in particulate form, and that similar factors were controlling their concentrations. This is consistent with the N and P speciation data (Fig. 7.14). TN and TP were also correlated with each other suggesting that the source of these nutrients was similar.

Salinity was negatively correlated with PO_4 and NH_4 concentrations suggesting that freshwater inputs increased dissolved nutrient concentrations, but did not affect TN and TP concentrations.

*Table 7.8: Correlation matrix for water quality parameters across all sites and sampling dates in the Norman R. estuary. *** P<0.005, **P<0.01, *P<0.05.* n = 78.

Parameter	**TSS**	**TN**	**TP**	**Chl *a***	**NH_4**	**PO_4**	**NO_2/NO_3**	**Secchi**	**Temp.**	**Salinity**	**Windspeed**
TSS		**0.347***	**0.689***	0.176	-0.149	-0.016	0.025	**-0.540***	0.097	**0.480****	0.115
TN			**0.723***	-0.031	0.200	**0.416***	**0.484***	**-0.502***	**0.396***	-0.074	-0.192
TP				-0.062	0.091	**0.385***	**0.287***	**-0.856***	-0.221	-0.022	-0.142
Chl *a*					**-0.230***	**-0.370***	-0.152	-0.180	**0.291***	**0.340***	**0.329***
NH_4						0.165	-0.177	**-0.291****	0.203	**-0.289***	-0.059
PO_4							**0.650***	**-0.232***	**-0.117**	**-0.452***	-0.183
NO_2/NO_3								-0.070	-0.096	0.053	-0.068
Secchi									**-0.184**	0.155	-0.107
Temp.										0.174	-0.009
Salinity											**0.331***

7.3 Summary of TRACK research findings (CERF, Smart State and LWA funding)

7.3.1 Summary of TRaCK

The TRACK program brings together a large number of research, state and federal agencies to provide the science and knowledge that governments, communities and industries need for the sustainable use and management of Australia's tropical rivers and coasts. The program has received $18.6 million over the last 4 years from a range of funding agencies including:

$8M, Commonwealth Environmental Research Facility (CERF) Research Hub

$5M, National Water Commission

$3M, Land & Water Australia

$2M, Qld Smart State Fund

$0.6M, Fisheries R&D Corporation (this includes this FRDC grant and the sister project: Halliday's Flow and Fisheries project which focussed on Barramundi and other estuarine fish species)

Additionally, there has been $11M in in-kind support from the partners, bringing the total value of the initiative to $29.6M.

There have been three main geographic regions for the studies:

Fitzroy R., Western Australia

Daly R, and Darwin Harbour, Northern Territory

Southern Gulf of Carpentaria rivers, i.e. Flinders, Norman and Mitchell

These regions have been identified as regions most likely to be subject to future or ongoing human development. This was based on extensive consultation with state and federal agencies.

There were a range of biophysical and ecological projects undertaken by TRaCK in the southern Gulf rivers and estuaries that were relevant to the FRDC study:

1. Determining the effect of freshwater flow on primary and secondary producers on the intertidal mudflats (Melissa Duggan, PhD student, Griffith University)
2. Determining ecosystem productivity in the Norman River estuary and how this is affected by freshwater flow (Griffith University, CSIRO)

3. Identifying the sources and fate of nutrients in the Flinders River (Griffith University, CSIRO)
4. Correlating flow with finfish production in southern Gulf rivers (Qld DEEDI)

These studies provide key information of the state and functioning of the rivers and estuaries of the southern Gulf. They complement the research being undertaken by this FRDC project to give insights into how future pressures on the water resources of the southern Gulf are likely to impact on the banana prawn fishery.

Below is a summary of the findings for Projects 1 to 3. Project 4 will not be discussed as it is the subject of an FRDC final report (CI: I. Halliday).

7.3.2 Effect of freshwater flow on mudflat production in the Norman R. estuary

Melissa Duggan, PhD student

Michele Burford, Principal Supervisor, Griffith University

Melissa Duggan is undertaking a PhD project on the effect of freshwater flow on primary and secondary production on intertidal mudflats in the Norman R. estuary. Previous studies have found that meiofauna (microscopic animals living in marine, freshwater and estuarine sediments) are an important food source for juvenile prawns (Wassenberg and Hill 1993), and her work has focussed on this group of animals. For consistency with the FRDC research, sampling was undertaken at the same sites and times as banana prawn sampling. She has completed her first year of data analysis. Her research to date has shown that chlorophyll *a* concentrations on the intertidal mudflats decreased in the 2008/2009 wet season when the salinity declined, across all sampling sites (Fig. 7.19). However concentrations were no lower than in November 2008.

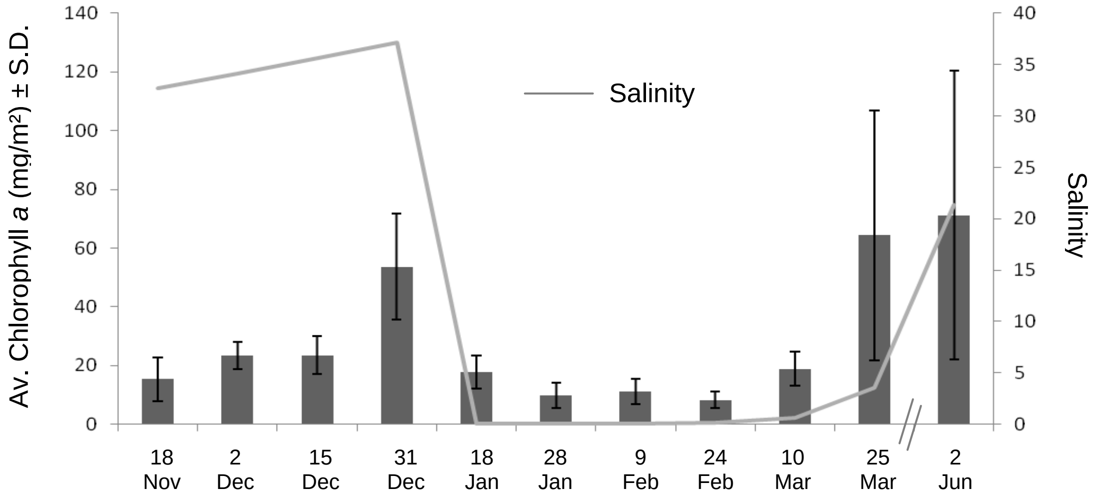

Figure 7.19: Mean (± SD) chlorophyll a concentrations and mean salinity of the overlying water at all mudflat sites sampled fortnightly on the Norman R estuary from November 2008 to March 2009, with a final sampling period in June 2009.

Meiofaunal abundance was dominated by nematodes in the first year (2008/09) at all sites (Fig. 7.20, only one site shown). The abundance in meiofauna decreased prior to the wet season, and decreased further with the reduction in salinity associated with freshwater flows. They remained very low until June 2009, when densities increased, including a substantial increase in the density of copepods.

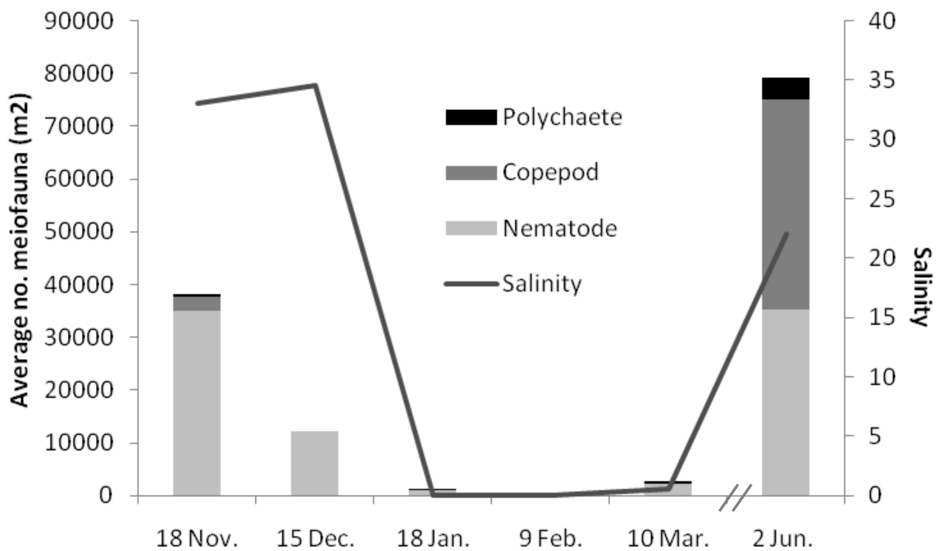

Figure 7.20: Mean (± SD) meiofaunal densities and mean salinity of the overlying water at one of the mudflat sites sampled monthly on the Norman R estuary from November 2008 to March 2009, and again in June 2009. This site is representative of the trends at all sites.

These findings are significant in terms of the implications for food availability for banana prawns. A contributing factor to prawn emigration from the estuary may, in fact, be the reduced food availability in the estuary as salinities increased, then decreased during the wet season. It should be noted, however, that the 2009 flood was a 1:50 year event and the duration of the flood was much longer than most years and resulted in little or no tidal exchange during this time. Further work is underway to determine the relationship between salinity and meiofaunal abundance. Preliminary data from controlled experiments showed that after seven days in freshwater, meiofaunal abundance was significantly reduced. Preliminary data from the second year of sampling, where flooding was less sever, indicates that the initial drop in salinity results in a drop in meiofaunal abundance. However, tidal exchange is still present at times during the second wet season of flooding, so meiofauna do not disappear entirely and numbers recover quickly. Therefore the duration of flooding, and resulting decrease in salinity, is likely to be an important contributor to meiofaunal abundance.

7.3.3 Quantifying nutrient budgets in the Norman R. estuary

Ian Webster, Andy Revill, CSIRO

Michele Burford, Matt Whittle, Graeme Curwen, Griffith University,

Nutrient budgets were developed for the Norman R estuary to determine how important freshwater inputs were to promoting productivity within and beyond the estuary. The budgets were based on the nutrient measurements collected in the 2008/2009 and 2009/2010 sampling seasons, and quantification of bathymetry and flow undertaken during intensive field trips. To estimate the dissolved fluxes during the dry season, a hydrodynamic model was developed for calculating horizontal excursions of water parcels and for estimating the effective depth of the estuary between Karumba and Normanton. A second model of solute transport was developed and calibrated using measured longitudinal profiles of salinity to estimate long-channel diffusion coefficients.

Integrated across the hydrograph, the flows down the estuary during the 2008-2009 wet season are estimated to have delivered 4300 T of N and 800 KT of P. Over a period of 90 days, the average rate of delivery would be 48 and 8 T d^{-1} of N and P which is two orders of magnitude larger than the delivery of particulate nutrients during the dry and three orders of magnitude larger than the rate of delivery of dissolved nutrients. Similar calculations were undertaken for the 2009-2010 wet season with an estimated load across the 4 months of the wet season of 2500 and 400 T of N and P, respectively. These loads are of the order of half those delivered through the previous wet season. This is comparable to another dryland tropical river, the Fitzroy R. in Queensland, where 2450 T of N was transported out of the estuary during the summer wet season (Webster et al. 2005).

Figures 7.21 and 7.22 provide the fluxes of dissolved inorganic nitrogen (DIN) and filterable reactive phosphorus past Karumba from the 2008-2009 and the 2009-2010 sampling periods are plotted together by month. The ‘longitudinal’ fluxes are calculated from measurements obtained during the two longitudinal transects of the estuary (see Figs. 7.21, 7.22).

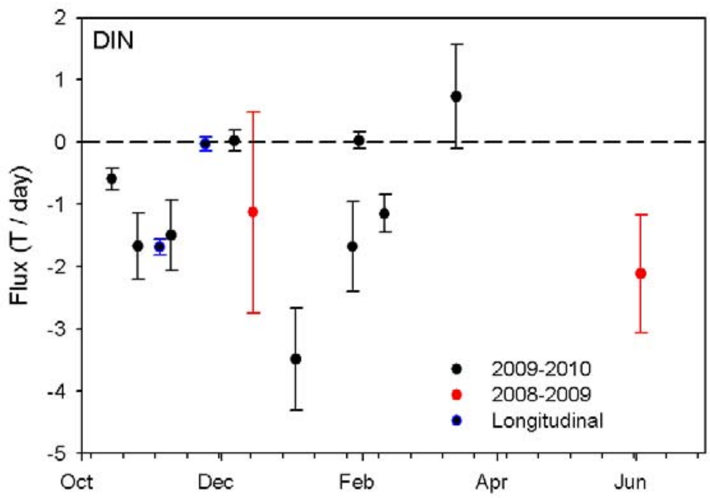

Figure 7.21: Calculated flux of dissolved inorganic nitrogen (DIN, T d^{-1}) past Karumba. Negative values are fluxes to the sea.

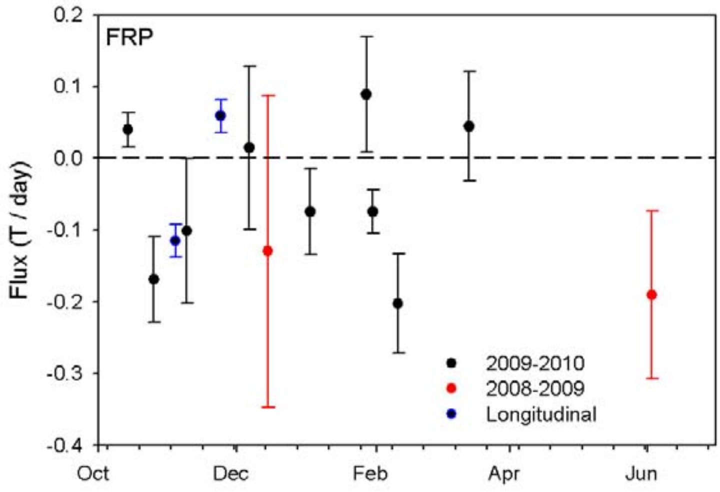

Figure 7.22: Calculated flux of phosphate (FRP, T d^{-1}) past Karumba. Negative values are fluxes to the sea.

It is interesting to calculate these nutrient fluxes to the nutrient flux that would be inferred from the change in estimated total mass of DIN and FRP between the times of the longitudinal surveys. Integrating the measured DIN concentration along the length of the estuary yields a mass of 12.6 T of N on 4 November 2009 which reduces to 4.9 T on the 24 November. The calculated rate of loss of N over the 20 d is thus 0.39 T d^{-1}. For FRP, the masses of P at the beginning and ends of the period are 1.33 and 0.93 T implying a loss rate of 0.02 T d^{-1}. These rates are lower than the loss rates calculated for the October-December periods shown in Figures 7.21 and 7.22 suggesting that fluxes of DIN and FRP out of the estuary is a more dominant loss process for these dissolved nutrients than internal processes such as sedimentation, incorporation into benthic plants and denitrification.

7.3.4 Water quality in the adjacent Flinders R. estuary

Michele Burford (Griffith University)

Rob Kenyon (CSIRO)

Graeme Curwen (Griffith University)

A sampling trip was undertaken to the Flinders R. estuary in the wet season of 2010 (February 2010). This estuary system is also in the southern Gulf and contributes juvenile prawns to the southeast banana prawn fishery (NPF). The study aimed to determine how comparable the water quality was between the Norman and Flinders R. estuaries during the wet season, and whether inferences can be made about the effect of freshwater flows on the Flinders, and other southern Gulf rivers, based on our understanding of the Norman River. Water quality sampling, including TN, TP, NH_4, NO_2/NO_3, PO_4 and TSS, was undertaken in and beyond the estuary as a comparison with the Norman R. estuary. TN, NH_4, and TSS concentrations were similar between the Flinders and Norman R. estuaries (samples taken within one week of each other). However TP, NO_2/NO_3 and PO_4 concentrations were higher in the Flinders R. estuary than the Norman R. estuary (Figs. 7.23, 7.24, 7.25). This may also explain why higher TP and PO_4 concentrations were measured at the mouth of Russell Creek on the Norman R. estuary in the previous wet season. At this time, flooding resulted in overflow from the Bynoe/Flinders R. system to the Norman R. via Russell Creek.

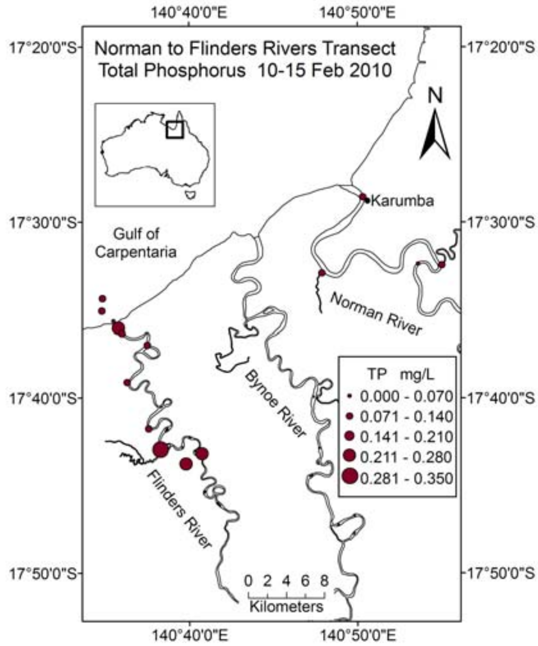

Figure 7.23: TP concentrations (mg L^{-1}) down the Norman and Flinders R. estuary during the wet season in February 2010.

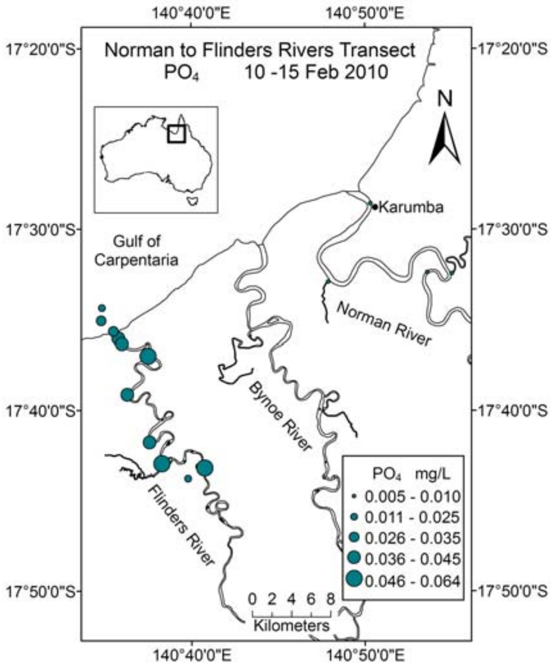

Figure 7.24: PO_4 concentrations (mg L^{-1}) down the Norman and Flinders R. estuary during the wet season in February 2010.

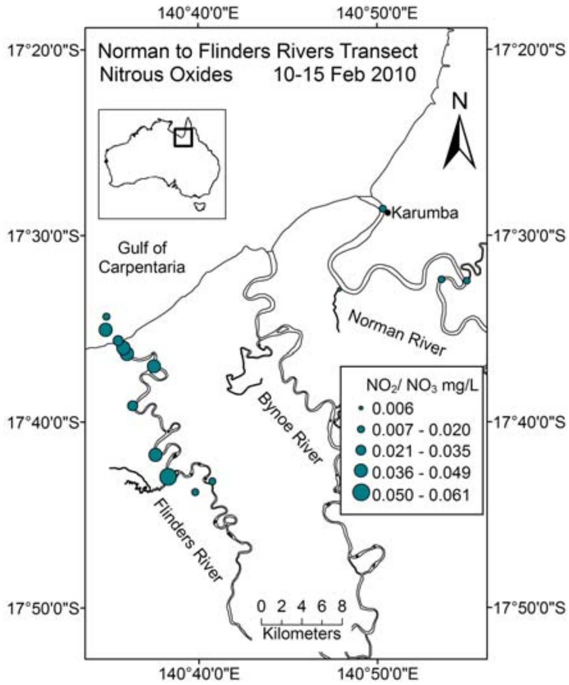

Figure 7:25: NO_2/NO_3 concentrations (mg L^{-1}) down the Norman and Flinders R. estuary during the wet season in February 2010.

7.3.5 Measurement of primary productivity and nutrient responses

Michele Burford, Dominic Valdez, Stephen Faggotter (Griffith University)

In addition to measures of algal biomass, as chlorophyll *a* concentrations, primary production was also measured in the water column (^{13}C-uptake method) and sediment (oxygen chamber flux method) at a range of sites and sampling occasions. This information provides a means of assessing the relative productivity of this system compared with other tropical estuaries, and whether algal production is affected by freshwater inputs.

Primary productivity in the water column was highest in the dry season (November 2009) and the second wet season (February 2010) and was much lower in the first wet season (January 2009) (Fig. 7.26). This probably reflects the scale of the freshwater flow – in the first year the period of freshwater flow was much longer and the volumes of water involved were much greater, compared with the second wet season. Therefore there appears to be a threshold beyond which primary productivity is affected.

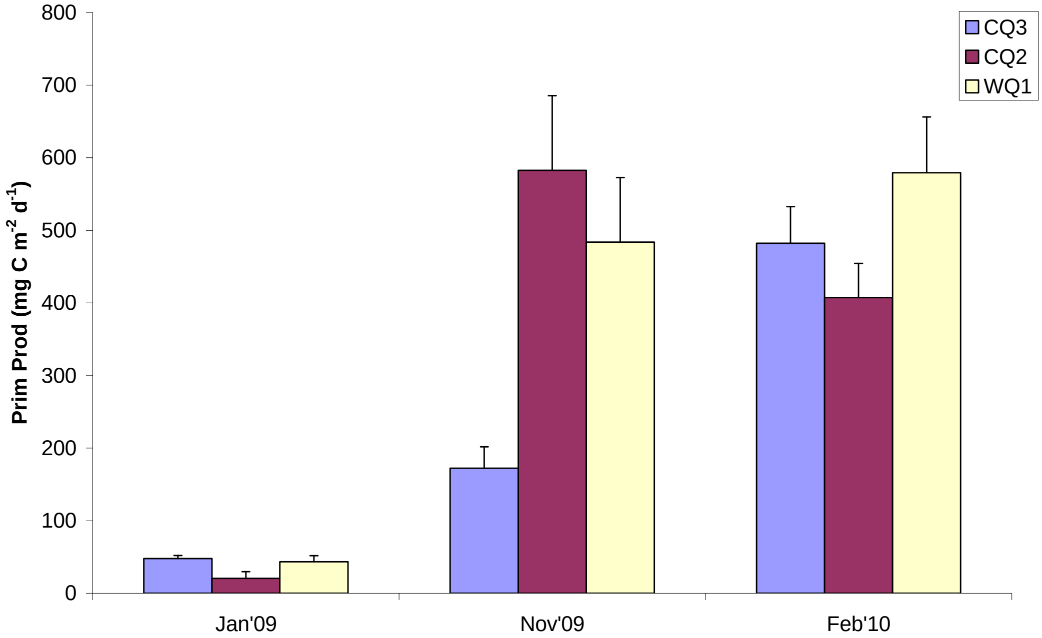

Figure 7.26: Mean primary productivity (mg C m^{-2} d^{-1}) in the water column in the wet (January 2009, February 2010) and the dry (November 2009) seasons.

Primary productivity rates measured in the water column were comparable with a tropical Indian estuary, and the Fly River delta in Papua New Guinea (Robertson, et al. 1993, Sharma et al. 2009). Primary productivity was also measured on the intertidal mudflats during the second season (October 2009 and February 2010). In October 2009, gross primary production rates were higher than consumption rates on a daily basis (Fig. 7.27). In February 2010, when the wet season had commenced, there was no primary production on the intertidal mudflats. This is consistent with the reduction in chlorophyll *a* measured on the intertidal mudflats (see Fig. 7.19).

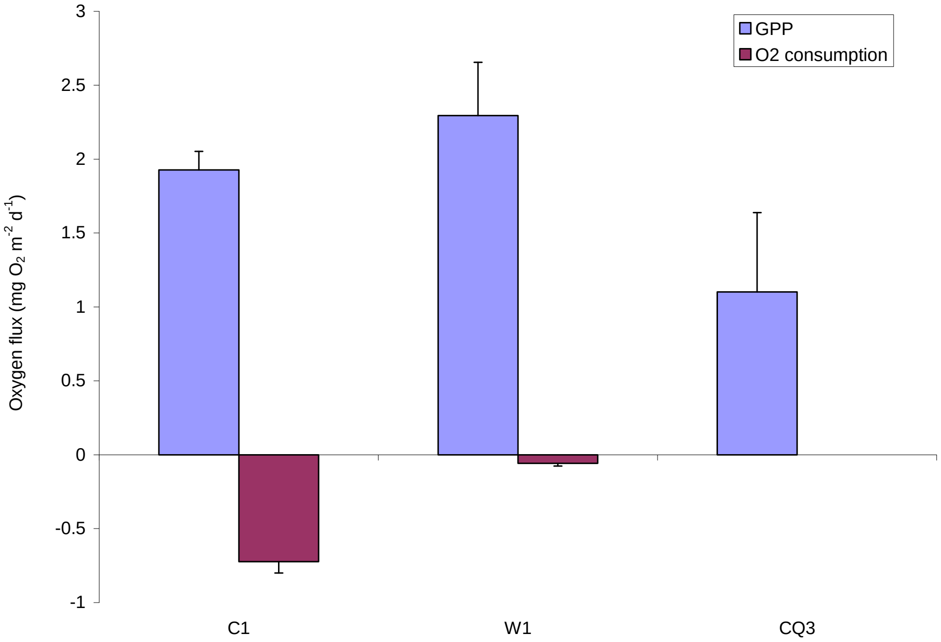

Figure 7.27: Primary productivity measurements (mg O_2 m^{-2} d^{-1}) in the sediment during the dry season (November 2009). GPP = gross primary productivity.

In terms of potential future increases in nutrient loads in the catchment, the response of phytoplankton to nutrients was also determined on three sampling occasions using algal bioassays and measuring the photosynthetic yield response using a PHYTOPAM (Walz) (Ganf and Rea 2007). There was evidence of nitrogen, and nitrogen plus phosphorus stimulation of photosynthesis at many sites on all three sampling occasions (Fig. 7.28). Photosynthesis was not stimulated by phosphorus. Therefore it appears to be a nitrogen rather than phosphorus-limited system.

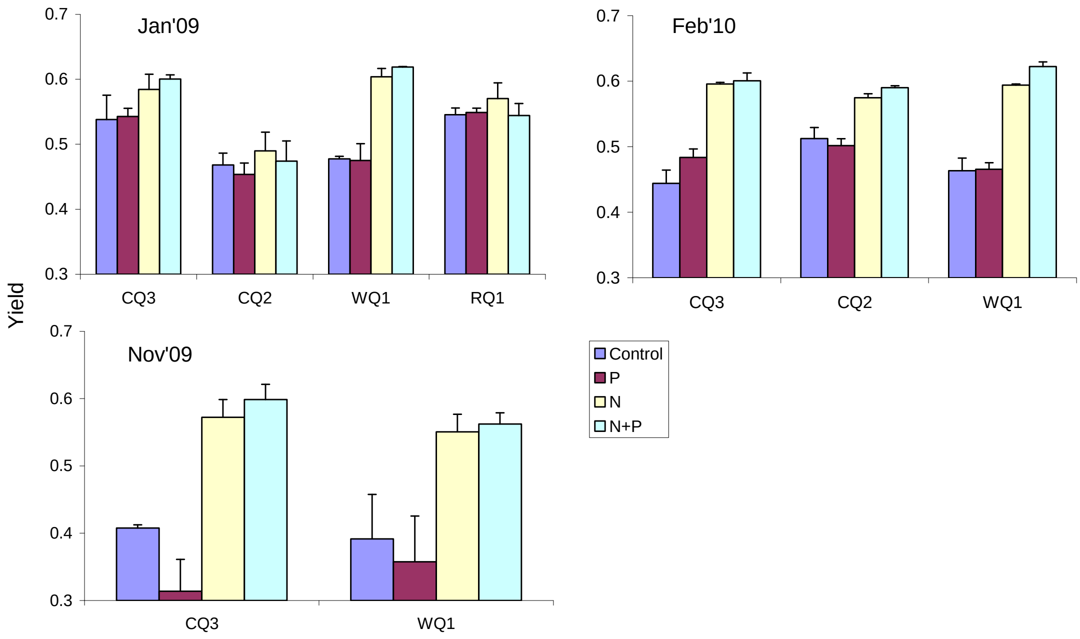

Figure 7.28: PHYTOPAM yield responses to nutrients (N, P, N+P) in the water column in the wet (January 2009, February 2010) and the dry seasons (November 2009).

7.3.6 Algal production and nutrient release on inundated saltflats

Michele Burford, Dominic Valdez, Stephen Faggotter (Griffith University)

Saltflats make up a large area of the coastal habitat in the southern Gulf. In the Norman R. system, they make up 356 km^2. These saltflats are dry most of the time with flooding only occurring on the highest astronomical tides or storm surges. There is therefore considerable potential for these habitats to provide a food source for estuarine/freshwater organisms during flooding. A series of experiments were conducted to determine whether inundation of coastal saltflats resulted in algal growth and nutrient release. As the saltflats are very difficult to access in the wet season, experiments were conducted by collecting saltflat material with a spade during the dry season, then doing manipulative experiments with the material. The experiments included:

- Determining the spatial variability in algal growth and nutrient release
- Determining the effect of light and salinity on algal growth
- Quantifying both biomass production and algal primary productivity (oxygen production)

The experiments showed that there was a high degree of spatial variability in algal growth and nutrient release across the Norman R. estuary saltflats. However, there was a trend of increasing algal biomass (chlorophyll *a* concentrations) across the nine days of the experiment (Fig. 7.29). Microscopic analysis showed that the algal community was two cyanobacterial genera highly adapted to extreme environments, i.e. *Phormidium* and *Schizothrix*. Additionally there was a major increase in nutrient concentrations (NH_4, NO_2/NO_3, PO_4) in the overlying water with inundation, especially in the first 24 h after inundation (Fig. 7.30).

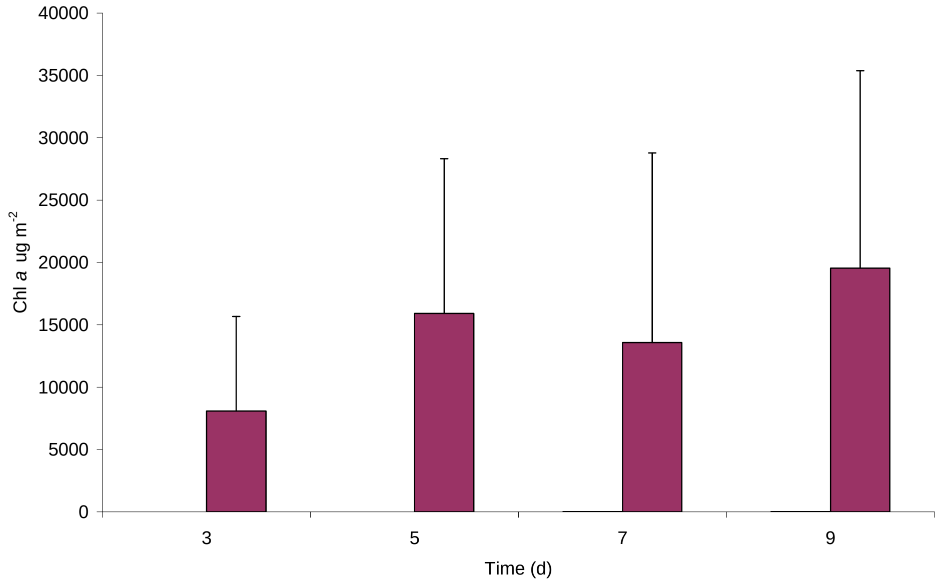

Fig. 7.29: Chlorophyll a concentrations (μg m^{-2}) on the surface of saltflats over time since inundation on day 1.

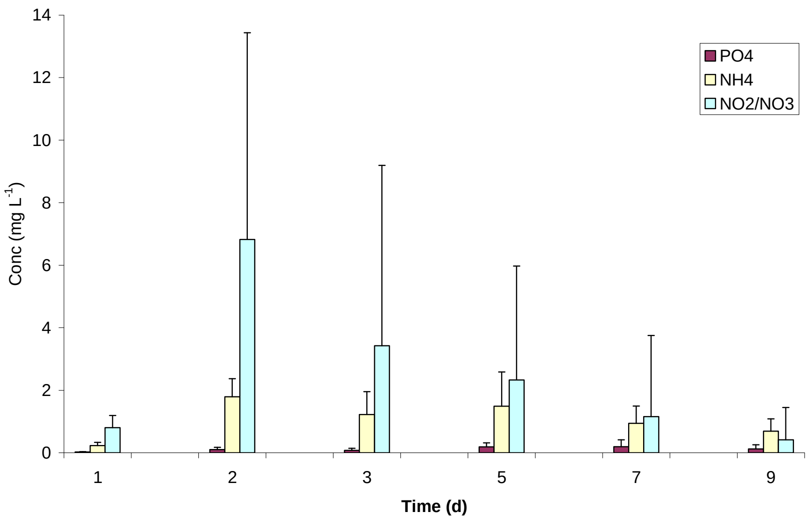

Fig. 7.30: Nutrient concentrations (mg L^{-1}) in the 5 cm deep overlying water over time since inundation.

The light, salinity and nutrient responses, in terms of biomass, and growth rates, were determined to provide the information to model the growth of algae depending on the depth of inundation with water. Light levels and NH_4 were the factors which correlated with increases in chlorophyll *a* concentrations. Salinity was not a controlling factor. The area of inundation of both the catchment and saltflats was determined using remote-sensing data (Figs. 7.31, 7.32, 7.33). This will be combined with the experimental data to quantify the total area of algal production and nutrient release.

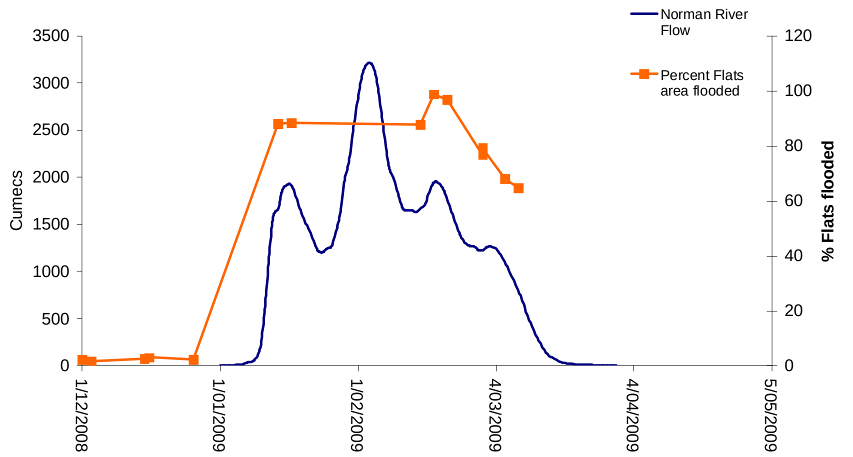

Fig. 7.31: Calculated area of inundation of saltflats based on remote-sensed data for the Norman River saltflats for 2008/09 wet season.

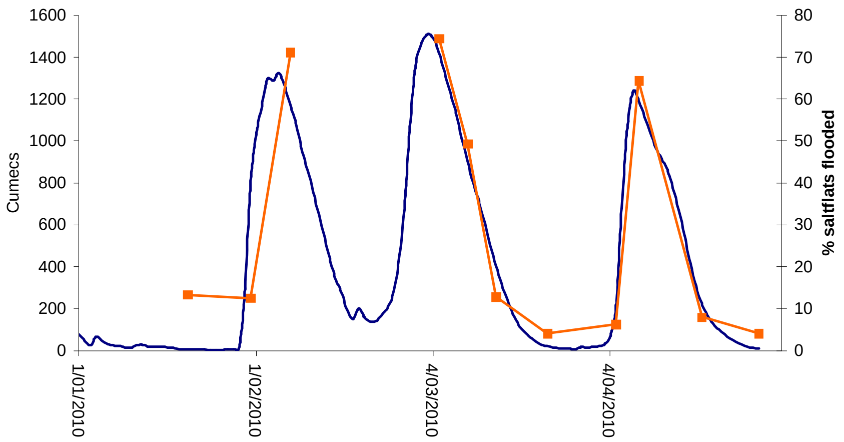

Fig. 7.32: Calculated area of inundation of saltflats based on remote-sensed data for the Norman River saltflats for 2009/10 wet season.

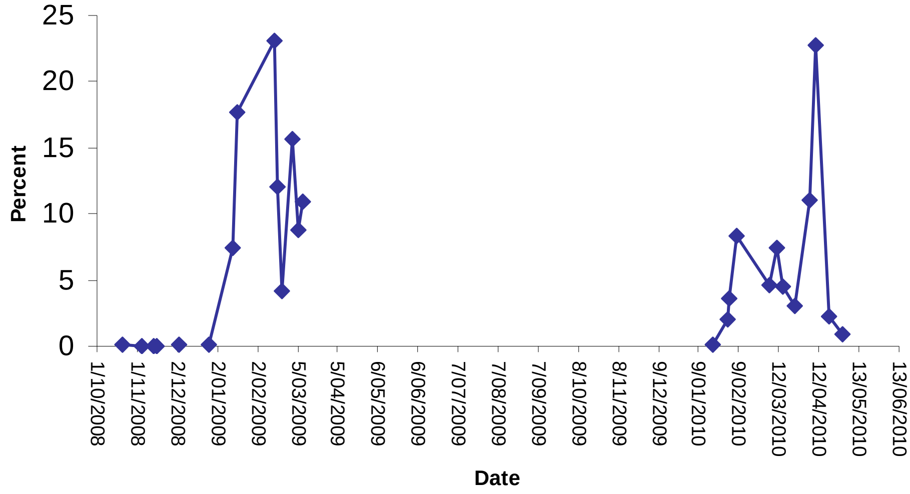

Fig. 7.33: Calculated area of inundation of whole catchment based on remote-sensed data for the Norman River catchment for both years of the study.

7.4 Effects of future catchment development

The southern Gulf of Carpentaria has been flagged by the Queensland State Government as a region likely to have future agricultural development, including irrigated agriculture and the potential for ponded pastures (Smith et al. 2005, Northern Australia Land and Water Science Review 2009). The State Government has also developed a Water Resource (Gulf) Plan (2007). An ecological assessment of the rivers for the Water Resource Plan found that the river basins of the Gulf have had only limited development of water resources and contain an almost negligible area of intensive land use (Smith et al. 2005). There has been, however, a range of impacts associated with extensive land uses (predominantly rangeland cattle grazing), ecological threats (predominantly weeds) and limited areas of intensive land and water resource use. However, overall the rivers maintain a high level of natural integrity.

Future development of the southern Gulf could result in the following potential effects on the river-estuary system:

- Water flow regulation by building dams on or off the river system would reduce the hydrological variability in flow essential to maintain the freshwater and estuarine ecosystems

- Water abstraction for agriculture, mining, etc would reduce the scale of flooding during the wet season, and hence reduce the productivity of the system. Additionally, it would reduce the refugial areas for freshwater ecosystems in the dry season.
- Increased intensity of agriculture would increase erosion and fertilizer application, increasing nutrients and suspended sediment loads entering the rivers and transported into the estuarine zones

In order to determine how future catchment development might impact on rivers in the southern Gulf, research was undertaken within the TRACK project to determine sources and fate of nutrients in the Flinders River system. This river system is adjacent to the Norman R. and has the same eco-hydrological characteristics as the Norman R (Kennard et al. 2010). Both rivers have extensive floodplains which are inundated in the wet season. The rivers become a series of disconnected waterholes in the dry season. The study examined water quality in five freshwater waterholes on the river system which persist throughout the dry season. TN and TP concentrations in the waterholes were similar to those in both the Norman and Flinders R. estuaries during the wet season (Figs. 7.34, 7.35). This supports the finding from the FRDC project that floodwaters from upstream do not result in increased nutrient concentrations, and that waterhole nutrient concentrations reflect nutrient concentrations on the floodplain during flooding.

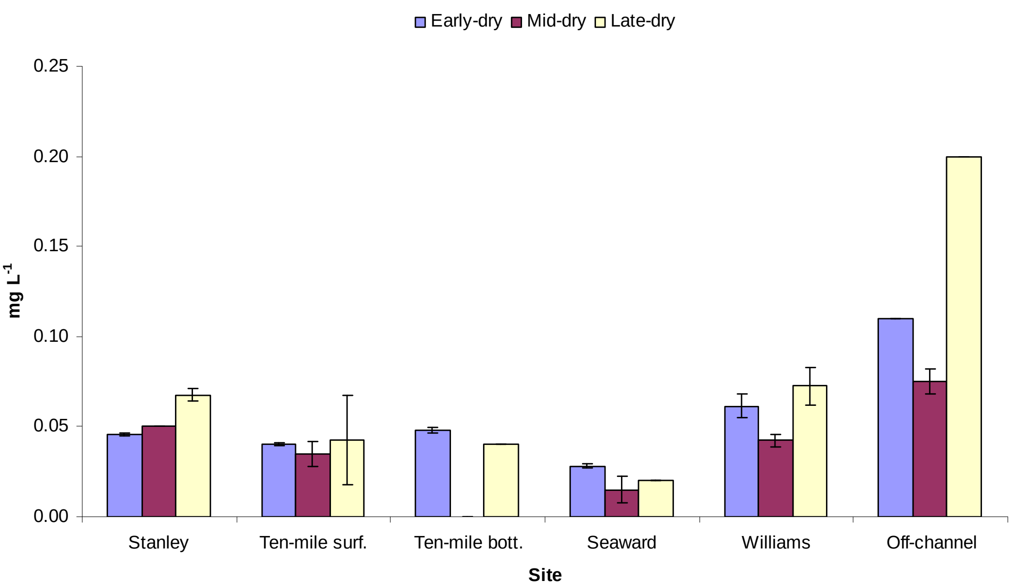

Figure 7.34: Mean (± SD) water column total phosphorus concentrations (mg L^{-1}) in five waterholes in the main channel of the Flinders River system and an off-channel site over dry season (surf = surface, bott = bottom). Note – Bars without ± SD indicate no difference among replications.

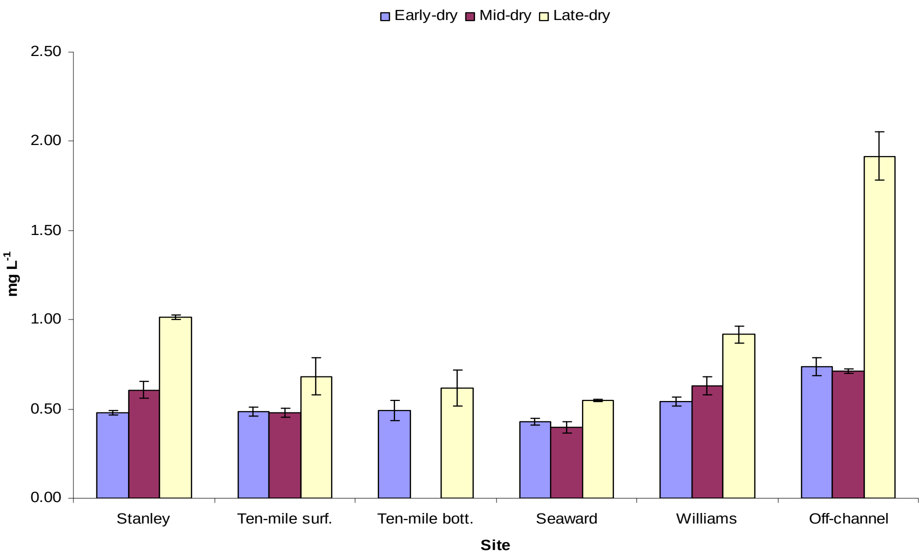

Figure 7.35: Mean (± SD) water column total nitrogen concentrations (mg L^{-1}) in five waterholes in the main channel of the Flinders River system and an off-channel site over dry season (surf = surface, bott = bottom). Note – Bars without ± SD indicate no difference among replications.

In terms of prediction on the effect of future changes in the flow regime on banana prawn production, the study has found:

- Wet season flow is critical to causing floodplain and saltflat inundation, resulting in increased nutrient and carbon loads to the coastal zone
- Since the coastal zone is likely to be an area of high productivity, reduction in flow will reduce coastal productivity
- Both the magnitude and duration of flooding are key elements, and either the reduction in wet season flows, or regulation of flow, will affect the productivity of the system

8. Benefits and Adoption

This two year study is the first to have gained major insights into why there is a link between flow and fisheries catch for banana prawns. The main findings are that flow is important in promoting productivity but not via the mechanism previously thought, i.e. enhanced productivity in the estuary. In fact, flooding as a result of increased flow promotes saltflat productivity, and causes nutrient release. The nutrient loads from this source, and the catchment in general, are transported out to the coastal zone in a flood plume. The highly turbid water is flocculated when entering the region of higher salinity.

Therefore catchment nutrients are likely to stimulate productivity in the coastal zone. Flooding of the southern Gulf agricultural land only resulted in increased nutrient loads by virtue of the increased water volume, not higher nutrient concentrations. In this nutrient-limited system, any increase in nutrients from higher intensity agriculture is likely to result in increasing algal production downstream.

Our study also found that the coastal saltflats were a significant, previously unidentified, source of nutrients. The implications of this are that maintaining the magnitude of the wet season flow is critically important for promoting productivity, but is likely to be more important for juvenile prawns that have emigrated out of the estuary, than those in the estuary.

The key beneficiaries identified were the commercial fishing industry and resource managers. The prawn fishery now has new information that substantiates the importance of maintaining freshwater flows that flood the landscape during the wet season. Additionally, resource managers have new information on how modifications to the volumes of freshwater entering the estuary, saltflats and coastal zones are likely to impact on productivity. Given that the volume of water, rather than the concentration of nutrients, dictates the nutrient loads, any changes in water volume will affect nutrient loads, and hence productivity.

Previous studies and FRDC project 2007/002 “Flow impacts on estuarine finfish of the Gulf of Carpentaria” (CI: I. Halliday) have shown that there is also a correlation between flow and catches of fish (barramundi, threadfin salmon) and other crustaceans, e.g. crabs (Robins et al. 2005). Research into the life cycle of these species is less well advanced than that for the banana prawn life cycle. However, the improved understanding of how freshwater flows impacts on estuarine, saltflat and coastal productivity is also relevant to these recreational and commercial fisheries.

9. Further Development

The results of the study highlight the need for a more integrated approach to land and water management. Flooding of the catchment plays an important role in providing new sources of carbon and nutrients to fuel productivity. Any future changes to flow, either from direct human activities, i.e. water abstraction, regulation or from climate change, will affect productivity downstream.

Based on the outcomes of the research, our aim for future research is to test the hypothesis that the coastal zone becomes the key habitat for banana prawns during wet season flow when they emigrate from the estuary. The high flow moves nutrients offshore and stimulates productivity, increasing food availability in this area.

Additionally, a key question is whether the Norman R. estuary is typical of the southern Gulf rivers. Our sampling on the Flinders R estuary would suggest that the characteristics of the nutrients being discharged from the two catchments are similar. However, it is still necessary to determine whether postlarval and juvenile prawn densities are similar.

10. Planned outcomes

The outputs from study, identified in the proposal, were:

a. Regular presentations to stakeholders (Research Assessment Group for the NPF, NORMAC REC, NORMAC board, Water resource managers, local community groups in Gulf, TRACK consortium)

b. Articles in newsletters and fishing magazines, and press releases (e.g. Land & Water Australia, FRDC, fishing magazines)

c. Milestone reports throughout the project, with a final report at the end of the project

d. Scientific publications in peer reviewed journals, and scientific presentations

a. Regular presentations to stakeholders

A number of presentations were given to a range of stakeholders including the Northern Prawn Fisheries peak body, Queensland resource managers, the northern Gulf NRM group, other TRaCK researchers and the industry partner on the project, Raptis & Sons. The presentations gave updates on the research findings.

In January 2009, a meeting was held with Queensland resource managers, principally the Department for the Environment and Resource Management (DERM) in Brisbane, to share results from the project and identify their information needs. Additionally these projects will be discussed in the context of the wider Tropical Rivers and Coastal Knowledge program, and it's objectives.

In May 2009, Michele Burford gave a presentation on the status of the FRDC project during at TRaCK consortium meeting in Brisbane.

In October 2009, Rob Kenyon and Michele Burford gave a presentation on the research to the Northern Prawn Fishery Resource Advisory Group (RAG) in Cleveland, Queensland. A number of the fishing company representatives expressed their support for the research being undertaken.

Michele Burford gave a presentation on the research to the Northern Gulf Regional Management Group (NGRMG) at their annual general meeting in Mareeba, Queensland in October 2009. The interest of the participants in this presentation was rated as high, and Michele Burford has been invited to give another presentation in Mareeba in September 2010.

b. Articles in newsletters, press releases etc.

A number of articles and press releases were produced throughout the lifetime of the project.

A press release was produced by Griffith University in December 2007 to announce the commencement of the project (as required by FRDC). This resulted in seven articles in the printed and electronic media as outlined below:

Western Advocate	Newspaper article	25.12.07
Geelong Advertiser	Newspaper article	25.12.07
Kalgoorlie Miner	Newspaper article	25.12.07
Courier Mail	Newspaper article	25.12.07
Northern Territory News	Newspaper article	25.12.07
Hoovers Online	Online article	05.01.08
Western Cape Bulletin	Newspaper article	09.01.08

In January 2009, Michele Burford wrote an article for the Karumba Chronicle to communicate the research to local residents.

A press release on the research was released by TRACK, with input and approval from FRDC, in November 2009. This resulted in Michele Burford being interviewed by three regional ABC radio stations. Additionally a journalist from Network 10 visited Karumba during the intensive field trip in December 2009 and prepared a story on the research and Northern Prawn Fishery. This story received national coverage.

In May 2010, an article was written for the TRACK newsletter incorporating this project and the sister project in the theme: Flow and Fisheries (Halliday et al.).

c. Milestone reports

Five milestone reports were delivered to FRDC on time and on budget. All reports were approved by FRDC.

d. Scientific talks and publications

In August 2008, Michele Burford gave a presentation on the FRDC and associated Tropical Rivers and Coastal Knowledge research at the Coast to Coast conference in Darwin.

Scientific publications are planned from the combined FRDC and TRaCK studies. The topics for these publications are shown below:

- Role of flow in affecting banana prawn productivity in Norman R estuary
- Role of catchment nutrients in promoting ecosystem productivity in the Norman R estuary
- Contribution of coastal saltflats to estuarine and nearshore productivity
- Characterising catchment carbon sources
- Effect of flow on infaunal abundance & species composition in Norman R estuary
- Carbon flows in an estuarine food web in the wet and dry season
- Modelling the effect of flow on estuarine productivity

The planned outcomes of this project were improved fisheries and resource management by identifying the effect of flow on estuarine fisheries and identifying suitable monitoring programs beyond the lifetime of the project to assess potential effects of changes in flow or nutrient/sediment loads. By communicating the outputs of the project to the relevant stakeholders, we will ensure that the outcomes of improved fisheries and resource management have the potential to be achieved. However, ultimately the decision to utilise the outputs from the project is with the fishers, fishery and resource managers. One of the objectives of our study was to provide recommendations to water and fisheries managers on appropriate methods of assessing the effects of flows on estuarine prawn production. Given that the volume of flow is a key factor affecting nutrient loads to the estuary and nearshore environment, this is likely to be an appropriate measure for assessing the effect of flows on prawn production. However, the connection between increased coastal production and flow remains to be established.

The outputs to date, outlined above, have provided targeted communication of the results of the study to a range of interest groups, and via a range of mechanisms. However, the most insightful findings have only recently been produced as the data analysis and synthesis has occurred. Therefore, this final report provides the first mechanism for communicating the synthesized findings of the study. Further communication of the results, via articles in FRDC and other magazines, press releases, and scientific talks and publications is planned.

11. Conclusion

The study achieved the objectives of:

1. estimating the impact of land use change on river flow, estuarine system productivity and ultimately prawn juvenile growth, survival and emigration
2. Identifying the mechanisms whereby the river flow regime affects banana prawn production and emigration from a river in the Gulf of Carpentaria, and how this impacts on recruitment to the fishery
3. Providing recommendations to water and fisheries managers on appropriate methods of assessing the effects of flows on estuarine prawn production

In the first year of our study (2008/09) floods in the Norman River decreased the salinity to zero for an extended period and resulted in all juvenile banana prawns emigrating from the estuary. These immigrants contributed to high banana prawn catches in the fishery. This supports the hypothesis that low salinity and estuarine inundation during flood events stimulate juvenile prawns to emigrate from the estuary (e.g. Vance et al. 1995, Robins et al 2005). However, emigration began before the salinity dropped. This coincided with a decrease in meiofaunal abundance. It may be that food became limiting. PhD work is continuing on the second year to determine the effect of a moderating flooding year on meiofaunal abundance.

In the second year (2009/10), prawn densities were similar to the first year, but prawns remained in the estuary for longer. This is likely to because the duration of low salinity was much shorter in the second year.

Hypothesis 2 was refuted, i.e. flows bring more nutrients into the estuary stimulating estuarine production. The study also found that nutrient concentrations did not increase in the estuary during the wet season, but the total nutrient loads transported through the estuary did, because of the high volume of water moving through the estuary. There was no evidence of an increase in chlorophyll *a* concentrations or primary productivity in either the water column or intertidal mudflats during the freshwater flows. Indeed, productivity and chlorophyll *a* concentrations typically decreased with freshwater flows.

However the study did identify two other key effects of flooding on the productivity of the estuary:

- The drop in salinity of more than a few days resulted in significant loss of the meiofaunal community from the intertidal mudflats. This community is a key food source for the prawns which did not recover until higher salinity was re-established
- Flooding inundates the extensive coastal saltflats of the southern Gulf rivers and the study found that this habitat is an important, previously unidentified source of carbon, This is in the form of algal growth during inundation, as well as nitrogen and phosphorus release from the saltflats into the watercolumn. Therefore the saltflats are likely to be an important source of carbon and nutrients for the estuary and nearshore areas.

The implications of this research are that:

- Flow resulted in increased nutrient loads from the catchment, saltflats and estuary, which were transported to the coastal zone promoting productivity. A proportion of these nutrients are likely to re-enter the estuary on spring tides.
- There is preliminary evidence for a lack of food being a key driver in causing prawn emigration, in addition to the physiological cue of low salinity. As a result prawns enter a zone of increased productivity in the coastal zone. However, the degree to which catchment nutrients stimulate productivity in the coastal zone remains unknown.

In terms of prediction of how modifications to the flow regime on the Norman River will affect banana prawn production, the study has found:

- Wet season flow is critical to causing floodplain and saltflat inundation, resulting in increased nutrient and carbon loads to the coastal zone
- Since the coastal zone is likely to be an area of high productivity, reduction in flow will reduce nutrient loads and hence coastal productivity
- Both the magnitude and duration of flooding are key elements, and either a reduction in wet season flows, or regulation of flow, will affect the productivity of the system.

In terms of recommendations to the fisheries and resource managers regarding appropriate methods of assessing the effects of flows on estuarine prawn production, this study has identified the importance of flow in terms of bringing nutrient loads to the nearshore area. However, it is not just the magnitude of the flow that is important. The duration and variability also appear to affect prawn emigration. However, the two year study only examined estuarine and saltflat productivity, and did not have the resources to also measure productivity in the nearshore area. This environment remains poorly understood with few previous studies of the coastal ecosystems of the Gulf, which have focussed on seagrass beds.

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Appendix 1: Intellectual Property

The intellectual property arising from the project is data and information on the effect of flow on banana prawns in estuaries.

Appendix 2: Staff

Associate Professor Michele Burford (Griffith University)

Mr Robert Kenyon (CSIRO)

Mr Matthew Whittle (Griffith University)

Mr Graeme Curwen (Griffith University)

Mr Geoff Moore (Griffith University)

TRACK-funded research staff

Dr Andy Revill (CSIRO)

Dr Ian Webster (CSIRO)

Mr Dominic Valdez (Griffith University)

Mr Stephen Faggotter (Griffith University)

Ms Melissa Duggan (Griffith University, PhD student)

Appendix 3: Nutrient, TSS and chlorophyll data

Table 1.1: TSS (mg L^{-1}), chlorophyll a (Chl, μg L^{-1}) and nutrient data (mg L^{-1}) from all sites and sampling occasions.

Date	Time	Site	Depth	Rep	TSS	Chl	TP	TN	NH4	FRP	NOX
20/10/2008	6:45:00 PM	CQ1	S	1	200.9	3.92	0.029	0.3	0.033	0.001	0.003
20/10/2008	6:45:00 PM	CQ1	S	2	182.333	4.901	0.02	0.27	0.018	0.001	0.001
20/10/2008	6:45:00 PM	CQ1	B	1	232.44	4.704	0.025	0.22	0.051	0.003	0.037
20/10/2008	6:45:00 PM	CQ1	B	2	242.92	3.528	0.024	0.33	0.049	0.001	0.031
21/10/2008	1:30:00 PM	CQ2	S	1	314.45	4.41	0.061	0.34	0.028	0.001	0.001
21/10/2008	1:30:00 PM	CQ2	S	2	339.8	4.41	0.057	0.31	0.059	0.001	0.006
21/10/2008	1:30:00 PM	CQ2	B	1	451.467		0.083	0.47	0.064	0.001	0.014
21/10/2008	1:30:00 PM	CQ2	B	2	434.733	1.96	0.092	0.47	0.013	0.001	0.001
20/10/2008	9:00:00 AM	CQ3	S	1	341	11.761	0.05	0.35	0.02	0.001	0.005
20/10/2008	9:00:00 AM	CQ3	S	2	406.467	7.841	0.057	0.36	0.009	0.001	0.012
20/10/2008	9:00:00 AM	CQ3	B	1	368.4	1.96	0.074	0.42	0.02	0.002	0.015
20/10/2008	9:00:00 AM	CQ3	B	2	349.467	3.92	0.056	0.37	0.011	0.001	0.005
21/10/2008	10:05:00 AM	RQ1	S	1	396.333	1.96	0.051	0.35	0.044	0.001	0.011
21/10/2008	10:05:00 AM	RQ1	S	2	400.133	1.96	0.058	0.54	0.018	0.001	0.002
21/10/2008	10:05:00 AM	RQ1	B	1	450.933		0.079	0.89	0.049	0.001	0.012
21/10/2008	10:05:00 AM	RQ1	B	2	449.133	1.96	0.076	0.53	0.021	0.001	0.013
20/10/2008	10:15:00 AM	WQ1	S	1	266.75	4.41	0.03	0.34	0.037	0.006	0.1
20/10/2008	10:15:00 AM	WQ1	S	2	244.55	2.94	0.033	0.32	0.015	0.001	0.005
20/10/2008	10:15:00 AM	WQ1	B	1	262.5	3.92	0.042	0.31	0.045	0.005	0.15
20/10/2008	10:15:00 AM	WQ1	B	2	266.9	1.47	0.041	0.31	0.008	0.001	0.001
3/11/2008	6:30:00 PM	CQ1	S	1	348.2	9.353					

3/11/2008	6:30:00 PM	CQ1	S	2	358.45	6.143					
3/11/2008	6:30:00 PM	CQ1	B	1	446.267	9.518					
3/11/2008	6:30:00 PM	CQ1	B	2	429.533	9.05					
3/11/2008	11:15:00 AM	CQ2	S	1	474.05	8.571					
3/11/2008	11:15:00 AM	CQ2	S	2	456.2	7.647					
3/11/2008	11:15:00 AM	CQ2	B	1	585.533	10.47					
3/11/2008	11:15:00 AM	CQ2	B	2	554.267	9.862					
4/11/2008	10:55:00 AM	CQ3	S	1	438.8	11.665					
4/11/2008	10:55:00 AM	CQ3	S	2	422.2	11.895					
4/11/2008	10:55:00 AM	CQ3	B	1	390.467	9.611					
4/11/2008	10:55:00 AM	CQ3	B	2	436.467	10.555					
4/11/2008	9:00:00 AM	RQ1	S	1	259.44	7.1					
4/11/2008	9:00:00 AM	RQ1	S	2	288.32	6.578					
4/11/2008	9:00:00 AM	RQ1	B	1	402.7	7.648					
4/11/2008	9:00:00 AM	RQ1	B	2	382.6	7.563					
5/11/2008	9:45:00 AM	WQ1	S	1	224	8.262					
5/11/2008	9:45:00 AM	WQ1	S	2	263.44	5.552					
5/11/2008	9:45:00 AM	WQ1	B	1	360.15	9.571					
5/11/2008	9:45:00 AM	WQ1	B	2	364.55	8.385					
17/11/2008	6:15:00 PM	CQ1	S	1	303.92	4.704	0.079	0.41	0.014	0.002	0.02
17/11/2008	6:15:00 PM	CQ1	S	2	296.8	4.704	0.064	0.34	0.004	0.001	0.008
17/11/2008	6:15:00 PM	CQ1	B	1	369.7	4.704	0.078	0.41	0.013	0.001	0.016
17/11/2008	6:15:00 PM	CQ1	B	2	344.05	2.352	0.089	0.48	0.008	0.001	0.017
17/11/2008	11:00:00 AM	CQ2	S	1	499.733		0.14	0.7	0.013	0.005	0.057
17/11/2008	11:00:00 AM	CQ2	S	2	516.133	1.568	0.15	0.6	0.012	0.004	0.026
17/11/2008	11:00:00 AM	CQ2	B	1	543.067	15.682	0.15	0.63	0.015	0.009	0.042
17/11/2008	11:00:00 AM	CQ2	B	2	687.6	4.704	0.17	0.77	0.014	0.004	0.028
18/11/2008	1:10:00 PM	CQ3	S	1	499.333	4.704	0.13	0.69	0.009	0.015	0.18
18/11/2008	1:10:00 PM	CQ3	S	2	490.867	4.704	0.14	0.8	0.018	0.007	0.097

18/11/2008	1:10:00 PM	CQ3	B	1	580.067	6.273	0.13	0.74	0.011	0.012	0.16
18/11/2008	1:10:00 PM	CQ3	B	2	518.333	3.136	0.14	0.87	0.014	0.007	0.093
18/11/2008	9:30:00 AM	RQ1	S	1	430.25	7.057	0.11	0.86	0.029	0.006	0.047
18/11/2008	9:30:00 AM	RQ1	S	2	414.75	7.057	0.14	0.81	0.045	0.005	0.035
18/11/2008	9:30:00 AM	RQ1	B	1	485.467	7.841	0.14	0.73	0.038	0.009	0.054
18/11/2008	9:30:00 AM	RQ1	B	2	574.267	6.273	0.17	0.85	0.038	0.005	0.036
19/11/2008	9:20:00 AM	WQ1	S	1	264.6	4.704	0.064	0.46	0.018	0.006	0.097
19/11/2008	9:20:00 AM	WQ1	S	2	289.08	0.941	0.07	0.5	0.01	0.004	0.059
19/11/2008	9:20:00 AM	WQ1	B	1	474	4.704	0.11	0.62	0.013	0.006	0.072
19/11/2008	9:20:00 AM	WQ1	B	2	491.267		0.13	0.62	0.011	0.004	0.068
1/12/2008	6:00:00 PM	CQ1	S	1	208.067	2.395					
1/12/2008	6:00:00 PM	CQ1	S	2	206.367	2.896					
1/12/2008	6:00:00 PM	CQ1	B	1	235.24	3.387					
1/12/2008	6:00:00 PM	CQ1	B	2	241.28	0.372					
1/12/2008	10:45:00 AM	CQ2	S	1	516.4	3.562					
1/12/2008	10:45:00 AM	CQ2	S	2	487.867	3.096					
1/12/2008	10:45:00 AM	CQ2	B	1	712.2						
1/12/2008	10:45:00 AM	CQ2	B	2	698.5	4.069					
2/12/2008	12:20:00 PM	CQ3	S	1	381.133						
2/12/2008	12:20:00 PM	CQ3	S	2	408.6						
2/12/2008	12:20:00 PM	CQ3	B	1	461.667	1.873					
2/12/2008	12:20:00 PM	CQ3	B	2	470.067	1.913					
2/12/2008	9:20:00 AM	RQ1	S	1	283.36	1.726					
2/12/2008	9:20:00 AM	RQ1	S	2	261.44	1.666					
2/12/2008	9:20:00 AM	RQ1	B	1	382.3	2.036					
2/12/2008	9:20:00 AM	RQ1	B	2	326.45	1.961					
3/12/2008	9:15:00 AM	WQ1	S	1	349.7						
3/12/2008	9:15:00 AM	WQ1	S	2	331.7	2.13					
3/12/2008	9:15:00 AM	WQ1	B	1	358.9	1.994					

3/12/2008	9:15:00 AM	WQ1	B	2	336.8	1.835					
14/12/2008	6:00:00 PM	CQ1	S	1	228.833	2.35224	0.055	0.69	0.009	0.002	0.04
14/12/2008	6:00:00 PM	CQ1	S	2	213.4	2.35224	0.041	0.3	0.007	0.006	0.034
14/12/2008	6:00:00 PM	CQ1	B	1	259.4	3.763584	0.042	0.32	0.008	0.001	0.009
14/12/2008	6:00:00 PM	CQ1	B	2	236.08	5.645376	0.04	0.26	0.028	0.003	0.026
14/12/2008	9:50:00 AM	CQ2	S	1	532.733	3.13632	0.047	0.59	0.009	0.003	0.031
14/12/2008	9:50:00 AM	CQ2	S	2	629.467	3.13632	0.099	0.69	0.012	0.006	0.048
14/12/2008	9:50:00 AM	CQ2	B	1	779.2	4.70448	0.16	0.78	0.019	0.004	0.041
14/12/2008	9:50:00 AM	CQ2	B	2	803.9	6.27264	0.2	0.9	0.012	0.005	0.041
15/12/2008	11:30:00 AM	CQ3	S	1	569.333	3.13632	0.12	0.71	0.012	0.007	0.11
15/12/2008	11:30:00 AM	CQ3	S	2	418.4	1.56816	0.12	0.71	0.007	0.006	0.091
15/12/2008	11:30:00 AM	CQ3	B	1	421.533	1.56816	0.14	0.73	0.007	0.009	0.11
15/12/2008	11:30:00 AM	CQ3	B	2	463.933	1.56816	0.13	0.72	0.009	0.008	0.1
15/12/2008	6:55:00 AM	RQ1	S	1	364.35	2.35224	0.1	0.53	0.013	0.003	0.049
15/12/2008	6:55:00 AM	RQ1	S	2	337.55	3.52836	0.076	0.45	0.021	0.007	0.048
15/12/2008	6:55:00 AM	RQ1	B	1	422.4	3.13632	0.087	0.49	0.025	0.006	0.067
15/12/2008	6:55:00 AM	RQ1	B	2	483.8	1.56816	0.1	0.58	0.026	0.005	0.043
16/12/2008	12:10:00 PM	WQ1	S	1	366.4		0.095	0.61	0.033	0.025	0.25
16/12/2008	12:10:00 PM	WQ1	S	2	297	2.35224	0.076	0.6	0.036	0.026	0.27
16/12/2008	12:10:00 PM	WQ1	B	1	416.267	1.56816	0.1	0.67	0.015	0.025	0.21
16/12/2008	12:10:00 PM	WQ1	B	2	428.4	1.56816	0.1	0.64	0.016	0.027	0.21
30/12/2008	6:25:00 PM	CQ1	S	1	517.733	3.904					
30/12/2008	6:25:00 PM	CQ1	S	2	553.333	3.339					
30/12/2008	6:25:00 PM	CQ1	B	1	585.76	3.663					
30/12/2008	6:25:00 PM	CQ1	B	2	611.6	3.672					
30/12/2008	11:10:00 AM	CQ2	S	1	342.5	2.17					
30/12/2008	11:10:00 AM	CQ2	S	2	311.5	2.186					
30/12/2008	11:10:00 AM	CQ2	B	1	522.8	2.351					
30/12/2008	11:10:00 AM	CQ2	B	2	540.067	2.45					

31/12/2008	1:00:00 PM	CQ3	S	1	335.65	1.837					
31/12/2008	1:00:00 PM	CQ3	S	2	326.55	1.675					
31/12/2008	1:00:00 PM	CQ3	B	1	364.7	1.898					
31/12/2008	1:00:00 PM	CQ3	B	2	329.9	1.434					
31/12/2008	8:15:00 AM	RQ1	S	1	278.24	1.444					
31/12/2008	8:15:00 AM	RQ1	S	2	244.04	1.629					
31/12/2008	8:15:00 AM	RQ1	B	1	356.25	1.744					
31/12/2008	8:15:00 AM	RQ1	B	2	312.15	2.113					
1/01/2009	12:30:00 PM	WQ1	S	1	258.16	1.355					
1/01/2009	12:30:00 PM	WQ1	S	2	223.6	1.368					
1/01/2009	12:30:00 PM	WQ1	B	1	295.3	1.303					
1/01/2009	12:30:00 PM	WQ1	B	2	319.85	1.241					
13/01/2009	5:55:00 PM	CQ1	S	1	439.867		0.13	0.42	0.031	0.014	0.057
13/01/2009	5:55:00 PM	CQ1	S	2	390.8		0.12	0.46	0.025	0.016	0.032
13/01/2009	5:55:00 PM	CQ1	B	1	392.667		0.13	0.51	0.057	0.016	0.096
13/01/2009	5:55:00 PM	CQ1	B	2	379.067		0.13	0.5	0.024	0.016	0.029
13/01/2009	10:15:00 AM	CQ2	S	1	564		0.16	0.64	0.107	0.012	0.152
13/01/2009	10:15:00 AM	CQ2	S	2	457.067		0.14	0.51	0.043	0.01	0.073
13/01/2009	10:15:00 AM	CQ2	B	1	646		0.16	0.63	0.06	0.012	0.026
13/01/2009	10:15:00 AM	CQ2	B	2	618.8		0.16	0.66	0.038	0.01	0.022
14/01/2009	11:45:00 AM	CQ3	S	1	238.3		0.093	0.44	0.008	0.009	0.031
14/01/2009	11:45:00 AM	CQ3	S	2	199.5		0.078	0.37	0.01	0.009	0.045
14/01/2009	11:45:00 AM	CQ3	B	1	191.5	0.55	0.075	0.37	0.015	0.007	0.028
14/01/2009	11:45:00 AM	CQ3	B	2	227.8	0	0.096	0.45	0.009	0.01	0.039
14/01/2009	10:30:00 AM	RQ1	S	1	652.25	0	0.32	0.5	0.032	0.074	0.104
14/01/2009	10:30:00 AM	RQ1	S	2	696	0	0.3	0.52	0.013	0.078	0.064
14/01/2009	10:30:00 AM	RQ1	B	1		0.024	0.32	0.56	0.012	0.078	0.037
14/01/2009	10:30:00 AM	RQ1	B	2	696.75	0.233	0.31	0.51	0.012	0.078	0.048
14/01/2009	12:30:00 PM	WQ1	S	1	188.8		0.092	0.46	0.014	0.009	0.04

14/01/2009	12:30:00 PM	WQ1	S	2	210.7	0.471	0.089	0.4	0.01	0.007	0.032
14/01/2009	12:30:00 PM	WQ1	B	1	199.3		0.073	0.42	0.023	0.008	0.035
14/01/2009	12:30:00 PM	WQ1	B	2	199	0.491	0.094	0.36	0.011	0.007	0.024
27/01/2009	5:45:00 PM	CQ1	S	1	121.733						
27/01/2009	5:45:00 PM	CQ1	S	2	117.733	0.737					
27/01/2009	5:45:00 PM	CQ1	B	1	120.08	2.678					
27/01/2009	5:45:00 PM	CQ1	B	2	110.16	2.285					
27/01/2009	10:10:00 AM	CQ2	S	1	96.45	1.546					
27/01/2009	10:10:00 AM	CQ2	S	2	112.3	0.727					
27/01/2009	10:10:00 AM	CQ2	B	1	113.371	0					
27/01/2009	10:10:00 AM	CQ2	B	2	99.2	0					
30/01/2009	9:15:00 AM	CQ3	S	1	62.356	1.485					
30/01/2009	9:15:00 AM	CQ3	S	2	56.622	0.002					
30/01/2009	9:15:00 AM	CQ3	B	1	60						
30/01/2009	9:15:00 AM	CQ3	B	2	60	1.413					
28/01/2009	9:15:00 AM	RQ1	S	1	468.8	2.257					
28/01/2009	9:15:00 AM	RQ1	S	2	499	1.856					
28/01/2009	9:15:00 AM	RQ1	B	1	473.4	1.991					
28/01/2009	9:15:00 AM	RQ1	B	2	461.4	1.601					
30/01/2009	10:10:00 AM	WQ1	S	1	105.55	0.935					
30/01/2009	10:10:00 AM	WQ1	S	2	91.886	0.003					
30/01/2009	10:10:00 AM	WQ1	B	1	98.667	0.976					
30/01/2009	10:10:00 AM	WQ1	B	2	102.267	0.962					
10/02/2009	6:00:00 PM	CQ1	S	1	75.067	2.208	0.055	0.59	0.014	0.01	0.077
10/02/2009	6:00:00 PM	CQ1	S	2	74.667	2.29	0.061	0.49	0.016	0.007	0.031
10/02/2009	6:00:00 PM	CQ1	B	1	70.6	0	0.053	0.47	0.015	0.01	0.035
10/02/2009	6:00:00 PM	CQ1	B	2	71.05	0	0.057	0.46	0.016	0.018	0.028
10/02/2009	9:20:00 AM	CQ2	S	1	117.75	2.092	0.08	0.62	0.017	0.013	0.096
10/02/2009	9:20:00 AM	CQ2	S	2	119.8	2.271	0.077	0.57	0.018	0.014	0.043

10/02/2009	9:20:00 AM	CQ2	B	1	149.267	2.487	0.076	0.52	0.018	0.012	0.035
10/02/2009	9:20:00 AM	CQ2	B	2	137.067	2.616	0.079	0.55	0.017	0.012	0.029
11/02/2009	8:20:00 AM	CQ3	S	1	51.4	1.801	0.064		0.02	0.016	0.062
11/02/2009	8:20:00 AM	CQ3	S	2	51.033	0.936	0.063	0.49	0.024	0.013	0.046
11/02/2009	8:20:00 AM	CQ3	B	1	42.436	1.842	0.06	0.49	0.02	0.013	0.046
11/02/2009	8:20:00 AM	CQ3	B	2	34.509		0.053	0.46	0.02	0.012	0.04
11/02/2009	2:10:00 PM	RQ1	S	1	87.05	2.453	0.088	0.45	0.016	0.024	0.051
11/02/2009	2:10:00 PM	RQ1	S	2	90.8	3.311	0.09	0.48	0.015	0.024	0.048
11/02/2009	2:10:00 PM	RQ1	B	1	101.829	2.047	0.094	0.47	0.016	0.026	0.056
11/02/2009	2:10:00 PM	RQ1	B	2	104.914	2.718	0.097	0.49	0.018	0.026	0.046
11/02/2009	9:20:00 AM	WQ1	S	1	21.3	0.247	0.034	0.51	0.018	0.003	0.032
11/02/2009	9:20:00 AM	WQ1	S	2	21.275	1.831	0.035	0.52	0.02	0.003	0.025
11/02/2009	9:20:00 AM	WQ1	B	1	21.15	1.76	0.032	0.5	0.019	0.002	0.02
11/02/2009	9:20:00 AM	WQ1	B	2	25.325	1.841	0.031	0.49	0.024	0.005	0.023
23/02/2009	5:30:00 PM	CQ1	S	1	60.55	3.8					
23/02/2009	5:30:00 PM	CQ1	S	2	59.15	2.788					
23/02/2009	5:30:00 PM	CQ1	B	1	127.086	4.373					
23/02/2009	5:30:00 PM	CQ1	B	2	60.65	3.99					
23/02/2009	7:40:00 AM	CQ2	S	1	82	3.474					
23/02/2009	7:40:00 AM	CQ2	S	2	86.45	3.685					
23/02/2009	7:40:00 AM	CQ2	B	1	95.371	3.772					
23/02/2009	7:40:00 AM	CQ2	B	2	106	3.766					
24/02/2009	9:35:00 AM	CQ3	S	1	56	4.771					
24/02/2009	9:35:00 AM	CQ3	S	2	52.72	4.343					
24/02/2009	9:35:00 AM	CQ3	B	1	61.556	4.74					
24/02/2009	9:35:00 AM	CQ3	B	2	63.467	4.834					
24/02/2009	7:30:00 AM	RQ1	S	1	352.533	2.312					
24/02/2009	7:30:00 AM	RQ1	S	2	321.067	1.499					
24/02/2009	7:30:00 AM	RQ1	B	1	365.2	4.875					

24/02/2009	7:30:00 AM	RQ1	B	2	333.8	0.007					
25/02/2009	8:25:00 AM	WQ1	S	1	48.364	2.862					
25/02/2009	8:25:00 AM	WQ1	S	2	42.982	2.898					
25/02/2009	8:25:00 AM	WQ1	B	1	48.76	2.664					
25/02/2009	8:25:00 AM	WQ1	B	2	49.6	2.797					
11/03/2009	6:00:00 PM	CQ1	S	1	43.086	3.932	0.054	0.67	0.019	0.008	0.052
11/03/2009	6:00:00 PM	CQ1	S	2	42	4.045	0.049	0.65	0.014	0.007	0.033
11/03/2009	6:00:00 PM	CQ1	B	1	46.154	1.093	0.047	0.56	0.02	0.008	0.033
11/03/2009	6:00:00 PM	CQ1	B	2	45.692	3.96	0.036	0.42	0.012	0.005	0.01
11/03/2009	8:50:00 AM	CQ2	S	1	61.782		0.058	0.86	0.017	0.009	0.089
11/03/2009	8:50:00 AM	CQ2	S	2	59.491	2.331	0.057	0.7	0.018	0.008	0.045
11/03/2009	8:50:00 AM	CQ2	B	1	60.68	5.078	0.054	0.53	0.015	0.007	0.021
11/03/2009	8:50:00 AM	CQ2	B	2	62.56	3.816	0.056	0.54	0.017	0.009	0.034
9/03/2009	11:40:00 AM	CQ3	S	1	77.6	3.328	0.058	0.64	0.012	0.006	0.02
9/03/2009	11:40:00 AM	CQ3	S	2	68.48	3.383	0.066		0.013	0.004	0.009
9/03/2009	11:40:00 AM	CQ3	B	1	78.9	3.664	0.067	0.63	0.013	0.005	0.008
9/03/2009	11:40:00 AM	CQ3	B	2	87.25	-0.089	0.067	0.64	0.012	0.004	0.008
9/03/2009	8:45:00 AM	RQ1	S	1	162.933		0.1	0.75	0.018	0.005	0.018
9/03/2009	8:45:00 AM	RQ1	S	2	163.2	4.406	0.11	0.62			
9/03/2009	8:45:00 AM	RQ1	B	1	230.48	6.394	0.11	0.62	0.021	0.006	0.012
9/03/2009	8:45:00 AM	RQ1	B	2	181.36	6.383	0.13	0.94			
10/03/2009	11:05:00 AM	WQ1	S	1	90.15	3.084	0.066	0.61	0.016	0.007	0.018
10/03/2009	11:05:00 AM	WQ1	S	2	94.25	2.877	0.069	0.5	0.016	0.006	0.011
10/03/2009	11:05:00 AM	WQ1	B	1	129.6	1.517	0.056	0.5	0.018	0.007	0.015
10/03/2009	11:05:00 AM	WQ1	B	2	120.514	3.517	0.061	0.5	0.017	0.006	0.011
23/03/2009	5:10:00 PM	CQ1	S	1	70.111	2.672					
23/03/2009	5:10:00 PM	CQ1	S	2	74.622	3.269					
23/03/2009	5:10:00 PM	CQ1	B	1	97.825	3.82					
23/03/2009	5:10:00 PM	CQ1	B	2	97.6	3.9					

24/03/2009	7:20:00 AM	CQ2	S	1	46.56	3.437					
24/03/2009	7:20:00 AM	CQ2	S	2	43.4	3.807					
24/03/2009	7:20:00 AM	CQ2	B	1	46.12	3.66					
24/03/2009	7:20:00 AM	CQ2	B	2	51.74	3.942					
23/03/2009	9:15:00 AM	CQ3	S	1	63.529	3.603					
23/03/2009	9:15:00 AM	CQ3	S	2	64.25	3.542					
23/03/2009	9:15:00 AM	CQ3	B	1	116.1	3.12					
23/03/2009	9:15:00 AM	CQ3	B	2	110.174	2.815					
23/03/2009	7:45:00 AM	RQ1	S	1	26.311	2.856					
23/03/2009	7:45:00 AM	RQ1	S	2	25.354	3.21					
23/03/2009	7:45:00 AM	RQ1	B	1	63.16	4.476					
23/03/2009	7:45:00 AM	RQ1	B	2	86.55	7.091					
23/03/2009	9:35:00 AM	WQ1	S	1	72.37	5.12					
23/03/2009	9:35:00 AM	WQ1	S	2	74.938	3.955					
23/03/2009	9:35:00 AM	WQ1	B	1	90.867	3.95					
23/03/2009	9:35:00 AM	WQ1	B	2	91.769	4.547					
3/06/2009	1:50:00 PM	CQ1	S	1	269.6	1.671	0.018	0.24	0.006	0.005	0.008
3/06/2009	1:50:00 PM	CQ1	S	2	57.78	1.601	0.019	0.3	0.011	0.002	0.015
3/06/2009	1:50:00 PM	CQ1	B	1	55.84	1.281	0.013	0.25	0.006	0.004	0.009
3/06/2009	1:50:00 PM	CQ1	B	2	62.44	1.469	0.012	0.25	0.007	0.003	0.01
3/06/2009	7:20:00 AM	CQ2	S	1	57.9	1.782	0.019	0.28	0.021	0.006	0.016
3/06/2009	7:20:00 AM	CQ2	S	2	54.02	2.251	0.023	0.33	0.02	0.006	0.034
3/06/2009	7:20:00 AM	CQ2	B	1	54.74	2.14	0.015	0.26	0.012	0.007	0.041
3/06/2009	7:20:00 AM	CQ2	B	2	57.36	2.682	0.014	0.23	0.013	0.005	0.026
2/06/2009	9:30:00 AM	CQ3	S	1	83.3	1.089	0.048	0.54	0.006	0.021	0.22
2/06/2009	9:30:00 AM	CQ3	S	2	63.733	1.469	0.024	0.3	0.009	0.022	0.23
2/06/2009	9:30:00 AM	CQ3	B	1	150.35	1.735	0.071	0.6	0.007	0.029	0.3
2/06/2009	9:30:00 AM	CQ3	B	2	146	1.542	0.053	0.47	0.006	0.029	0.3
2/06/2009	7:40:00 AM	RQ1	S	1	75.067	1.121	0.03	0.37	0.026	0.014	0.097

2/06/2009	7:40:00 AM	RQ1	S	2	70.933	0.654	0.026	0.33	0.035	0.069	0.13
2/06/2009	7:40:00 AM	RQ1	B	1	89.5	0.921	0.025	0.29	0.031	0.017	0.096
2/06/2009	7:40:00 AM	RQ1	B	2	90	0.382	0.013	0.15	0.032	0.015	0.085
2/06/2009	10:20:00 AM	WQ1	S	1	45.8	2.976	0.043	0.54	0.005	0.027	0.28
2/06/2009	10:20:00 AM	WQ1	S	2	45.025	2.281	0.042	0.54	0.004	0.028	0.28
2/06/2009	10:20:00 AM	WQ1	B	1	355.9	1.996	0.1	0.63	0.006	0.025	0.26
2/06/2009	10:20:00 AM	WQ1	B	2	283.2	1.856	0.081	0.59	0.007	0.029	0.27
11/10/2009	2:05:00 PM	CQ3	S	1	365.7	3.5717	0.063	0.4	0.008	0.008	0.052
11/10/2009	2:05:00 PM	CQ3	S	2	393.9	4.424	0.091	0.53	0.004	0.008	0.053
11/10/2009	10:50:00 AM	RQ1	S	1	290.6	1.5062666667	0.054	0.4	0.014	0.008	0.084
11/10/2009	2:05:00 PM	CQ3	B	1	436.6	3.5541	0.092	0.52	0.008	0.008	0.047
11/10/2009	2:05:00 PM	CQ3	B	2	445	5.027	0.086	0.5	0.01	0.008	0.047
11/10/2009	10:50:00 AM	RQ1	S	2	294.7333333	2.3694	0.051	0.42	0.034	0.009	0.11
11/10/2009	10:50:00 AM	RQ1	B	1	483.6	3.3847	0.087	0.54	0.015	0.008	0.062
11/10/2009	10:50:00 AM	RQ1	B	2	503.9	3.5629	0.065	0.4	0.011	0.009	0.073
11/10/2009	2:35:00 PM	WQ1	S	1	296.8333333	5.2754166667	0.054	0.37	0.024	0.01	0.087
11/10/2009	2:35:00 PM	WQ1	S	2	447.8333333	2.9544166667	0.053	0.44	0.005	0.009	0.054
11/10/2009	2:35:00 PM	WQ1	B	1	513.5	3.7411	0.074	0.54	0.005	0.013	0.063
11/10/2009	2:35:00 PM	WQ1	B	2	498.2	3.7323	0.074	0.44	0.011	0.007	0.045
11/10/2009	11:00:00 AM	Glenore	S	1	23.48571428	24.5025					
11/10/2009	11:00:00 AM	Glenore	S	2	17.43333333	17.6418					
11/10/2009	11:00:00 AM	Glenore	S	3	18.46666666	24.470966667					
11/10/2009	11:00:00 AM	NW	S	1	30.26	3.675375					
11/10/2009	11:00:00 AM	NW	S	2	33.6	3.6018675					
11/10/2009	11:00:00 AM	NW	S	3	34.8	3.7345					
13/10/2009	3:30:00 PM	CQ2	S	1	913.1333333	3.95736	0.13	0.88	0.011	0.004	0.022

13/10/2009	3:30:00 PM	CQ2	S	2	626.2727272	4.0946190905	0.058	0.38	0.006	0.003	0.016
13/10/2009	3:30:00 PM	CQ2	B	1	1318.5	3.3572	0.046	0.33	0.007	0.003	0.019
13/10/2009	3:30:00 PM	CQ2	B	2	630.4666666	2.4288	0.066	0.38	0.015	0.003	0.02
14/10/2009	6:30:00 AM	CQ1	S	1	197.2	1.87055	0.038	0.26	0.005	0.004	0.005
14/10/2009	6:30:00 AM	CQ1	S	2	255.6	3.2384	0.041	0.26	0.009	0.005	0.005
14/10/2009	6:30:00 AM	CQ1	B	1	219.65	2.99585	0.046	0.28	0.004	0.005	0.004
14/10/2009	6:30:00 AM	CQ1	B	2		2.4882	0.045	0.32	0.006	0.004	0.003
16/10/2009	1:30:00 PM	NW	S	1	296.6285714	5.3827714143	0.039	0.5	0.004	0.006	0.007
16/10/2009	1:30:00 PM	NW	S	2	101.2	3.3603428286	0.031	0.34	0.014	0.003	0.004
16/10/2009	1:30:00 PM	NW	B	1	359.95	5.0405142429	0.031	0.31	0.012	0.007	0.022
16/10/2009	1:30:00 PM	NW	B	2	534.85	3.9204	0.035	0.45	0.012	0.005	0.004
25/10/2009	6:34:00 AM	CQ1	S	1	344.55	2.99585	0.053	0.31	0.005	0.002	0.003
25/10/2009	6:34:00 AM	CQ1	S	2	745.5	3.00025	0.042	0.22	0.013	0.003	0.003
25/10/2009	6:34:00 AM	CQ1	B	1	1054.133333	3.08495					
25/10/2009	6:34:00 AM	CQ1	B	2	993	2.5223					
25/10/2009	10:30:00 AM	NW	S	1	252.15	1.47015	0.019	0.21	0.006	0.007	0.003
25/10/2009	10:30:00 AM	NW	S	2	248.95	2.9403	0.021	0.27	0.007	0.007	0.006
25/10/2009	10:30:00 AM	NW	B	1	286.95	3.52836	0.025	0.28	0.005	0.009	0.004
25/10/2009	10:30:00 AM	NW	B	2	626.1	2.35224	0.034	0.4	0.003	0.005	0.001
25/10/2009	1:40:00 PM	CQ2	S	1	265.4375	3.08495	0.056	0.38	0.007	0.006	0.041
25/10/2009	1:40:00 PM	CQ2	S	2	310.6666666	3.652	0.074	0.44	0.006	0.008	0.059
25/10/2009	1:40:00 PM	CQ2	B	1	278	4.8576					
25/10/2009	1:40:00 PM	CQ2	B	2	471.8	2.2623333333					
27/10/2009	4:00:00 PM	RQ1	S	1	219.1333333	3.036					
27/10/2009	4:00:00 PM	RQ1	S	2	182	2.4288					

27/10/2009	4:00:00 PM	RQ1	B	1	204.15	4.2038333333					
27/10/2009	4:00:00 PM	RQ1	B	2	208.2	5.742					
27/10/2009	3:45:00 PM	WQ1	S	1	473.5454545	2.5449285857					
27/10/2009	3:45:00 PM	WQ1	S	2	207.85	3.88608					
27/10/2009	3:45:00 PM	WQ1	B	2	205.25	3.2384					
27/10/2009	3:45:00 PM	WQ1	B	1	433.1	3.393					
27/10/2009	9:30:00 AM	CQ3	S	1	523.4814814	6.072					
27/10/2009	9:30:00 AM	CQ3	S	2	565.2857142	2.6986666667					
27/10/2009	9:30:00 AM	CQ3	B	1	464.2	5.3973333333					
27/10/2009	9:30:00 AM	CQ3	B	2	480.4	5.027					
4/11/2009	6:35:00 AM	N0E	S	1		0.72416666667	0.037	0.27	0.007	0.003	0.026
4/11/2009	6:35:00 AM	N0E	S	2					0.004	0.003	0.031
4/11/2009	7:15:00 AM	N0W	S	1		3.17405	0.041	0.3	0.003	0.003	0.025
4/11/2009	7:15:00 AM	N0W	S	2					0.004	0.004	0.029
4/11/2009	8:00:00 AM	N10E	S	1		2.4440625	0.059	0.62	0.004	0.008	0.1
4/11/2009	8:00:00 AM	N10E	S	2					0.003	0.009	0.1
4/11/2009	8:15:00 AM	N10W	S	1		0.81007141429	0.051	0.41	0.003	0.007	0.092
4/11/2009	8:15:00 AM	N10W	S	2					0.006	0.008	0.097
4/11/2009	9:00:00 AM	N20E	S	1		2.2617692923	0.045	0.43	0.012	0.024	0.2
4/11/2009	9:00:00 AM	N20E	S	2					0.021	0.01	0.14
4/11/2009	9:17:00 AM	N20W	S	1		3.563	0.034	0.34	0.004	0.008	0.085
4/11/2009	9:17:00 AM	N20W	S	2					0.003	0.007	0.081
4/11/2009	9:40:00 AM	N30E	S	1		4.5280714143	0.056	0.44	0.006	0.008	0.085

4/11/2009	9:40:00 AM	N30E	S	2					0.005	0.008	0.077
4/11/2009	9:53:00 AM	N30W	S	1		3.0148461615	0.049	0.44	0.004	0.006	0.062
4/11/2009	9:53:00 AM	N30W	S	2					0.005	0.01	0.095
4/11/2009	10:25:00 AM	N40E	S	1		3.0148461615	0.063	0.45	0.003	0.01	0.08
4/11/2009	10:25:00 AM	N40E	S	2					0.001	0.011	0.083
4/11/2009	10:40:00 AM	N40W	S	1		2.6722142429	0.062	0.47	0.005	0.025	0.17
4/11/2009	10:40:00 AM	N40W	S	2					0.005	0.011	0.084
4/11/2009	11:15:00 AM	N50E	S	1		4.2004285857	0.053	0.38	0.012	0.024	0.17
4/11/2009	11:15:00 AM	N50E	S	2					0.005	0.025	0.17
4/11/2009	11:30:00 AM	N50W	S	1		5.2830344862	0.062	0.49	0.008	0.024	0.18
4/11/2009	11:30:00 AM	N50W	S	2					0.005	0.024	0.17
4/11/2009	12:10:00 PM	N60E	S	1		5.5423703037	0.037	0.41	0.007	0.008	0.02
4/11/2009	12:10:00 PM	N60E	S	2					0.005	0.009	0.015
4/11/2009	12:25:00 PM	N60W	S	1		7.2065714143	0.034	0.39	0.008	0.008	0.02
4/11/2009	12:25:00 PM	N60W	S	2					0.005	0.008	0.015
8/11/2009	2:40:00 PM	CQ2	S	1	214.6	3.7367	0.044	0.39	0.007	0.005	0.05
8/11/2009	2:40:00 PM	CQ2	S	2	213.45	4.47315	0.046	0.44	0.008	0.004	0.045
8/11/2009	2:40:00 PM	CQ2	B	1	356.07142857	5.50935	0.063	0.43	0.007	0.012	0.09
8/11/2009	2:40:00 PM	CQ2	B	2	283	4.665375	0.065	0.47	0.007	0.005	0.05
9/11/2009	6:20:00 AM	CQ1	S	1	243.65	3.3630666667	0.039	0.27	0.005	0.003	0.005
9/11/2009	6:20:00 AM	CQ1	S	2	273.73333333	2.4882	0.044	0.3	0.005	0.003	0.004
9/11/2009	6:20:00 AM	CQ1	B	1	320.35714285	2.6722142429	0.042	0.29	0.007	0.003	0.005
9/11/2009	6:20:00 AM	CQ1	B	2	337.62962962	3.1175833	0.043	0.35	0.007	0.002	0.004

						333					
9/11/2009	11:30:00 AM	RQ1	S	1	344.4444444	4.0553333 333	0.061	0.5	0.008	0.017	0.14
9/11/2009	11:30:00 AM	RQ1	S	2	331.2307692	3.938	0.054	0.46	0.007	0.01	0.095
9/11/2009	11:30:00 AM	RQ1	B	1	911.7647058	10.409142 429	0.2	1	0.009	0.013	0.12
9/11/2009	11:30:00 AM	RQ1	B	2	737.7333333	5.7555384 846	0.15	0.81	0.008	0.011	0.11
9/11/2009	3:10:00 PM	CQ3	S	1	466.875	4.3547777 778	0.08	0.52	0.006	0.014	0.12
9/11/2009	3:10:00 PM	CQ3	S	2	439.4444444	4.416	0.081	0.53	0.007	0.011	0.097
9/11/2009	3:10:00 PM	CQ3	B	1	537.25	4.676375	0.083	0.44	0.005	0.021	0.15
9/11/2009	3:10:00 PM	CQ3	B	2	484.1111111	2.8781176 882	0.11	0.67	0.004	0.015	0.13
10/11/2009	3:40:00 PM	WQ1	S	1	383.6363636	5.7487692 923	0.06	0.48	0.01	0.003	0.006
10/11/2009	3:40:00 PM	WQ1	S	2	315.7777777	4.93592	0.067	0.54	0.007	0.003	0.006
10/11/2009	3:40:00 PM	WQ1	B	2	360	5.6116923 231	0.054	0.44	0.007	0.004	0.004
10/11/2009	3:40:00 PM	WQ1	B	1	335.52	4.3866086 217	0.058	0.48	0.01	0.003	0.005
10/11/2009	3:40:00 PM	WQ1	S	1					0.006	0.014	0.12
10/11/2009	3:40:00 PM	WQ1	S	2					0.013	0.012	0.1
10/11/2009	3:40:00 PM	WQ1	B	1					0.006	0.012	0.11
10/11/2009	3:40:00 PM	WQ1	B	2					0.004	0.011	0.1
18/11/2009	11:00:00 AM	NW	S	1	78.8	1.47015	0.031	0.52	0.008	0.007	0.006
18/11/2009	11:00:00 AM	NW	S	2	54.6	2.9403	0.029	0.49	0.006	0.007	0.005
18/11/2009	11:00:00 AM	NW	B	1	82.4666666	2.9403	0.038	0.51	0.014	0.008	0.011
18/11/2009	11:00:00 AM	NW	B	2	101.5217391	4.5235384 846	0.048	0.6	0.018	0.009	0.011
21/11/2009	1:50:00 PM	CQ2	S	1	462.8461538	6.802					
21/11/2009	1:50:00 PM	CQ2	S	2	565	8.7681					

21/11/2009	1:50:00 PM	CQ2	B	1	573.4	7.4734					
21/11/2009	1:50:00 PM	CQ2	B	2	545.6	7.4734					
22/11/2009	6:00:00 AM	CQ1	S	1	724.25	6.9183529 647					
22/11/2009	6:00:00 AM	CQ1	S	2	754.7142857	8.4008571 714					
22/11/2009	6:00:00 AM	CQ1	B	1	888.5714285	7.8408					
22/11/2009	6:00:00 AM	CQ1	B	2	904.1538461	8.4008571 714					
22/11/2009	11:05:00 AM	RQ1	S	1	364	9.0207096 936					
22/11/2009	11:05:00 AM	RQ1	S	2	347.8	7.8408					
22/11/2009	11:05:00 AM	RQ1	B	1	899.8387096	7.8408					
22/11/2009	11:05:00 AM	RQ1	B	2	603.7777777	11.026125					
22/11/2009	2:40:00 PM	CQ3	S	1	319.6153846	8.3589523 238					
22/11/2009	2:40:00 PM	CQ3	S	2	335.68	8.96456					
22/11/2009	2:40:00 PM	CQ3	B	1	434.2608695	8.4008571 714					
22/11/2009	2:40:00 PM	CQ3	B	2	523.9	12.441					
23/11/2009	2:30:00 PM	WQ1	S	1	138.1333333	6.8607					
23/11/2009	2:30:00 PM	WQ1	S	2	135.92	9.2084666 667					
23/11/2009	2:30:00 PM	WQ1	B	1	221.65	10.29105					
23/11/2009	2:30:00 PM	WQ1	B	2	201.4	10.0804					
28/11/2009	6:15:00 AM	N0E	S	1		6.1655	0.037	0.28	0.005	0.005	0.008
28/11/2009	6:15:00 AM	N0E	S	2					0.005	0.005	0.007
28/11/2009	6:20:00 AM	N0W	S	1		6.1263888	0.04	0.29	0.005	0.004	0.007
28/11/2009	6:20:00 AM	N0W	S	2					0.005	0.005	0.005
28/11/2009	6:45:00 AM	N10E	S	1		15.724210	0.043	0.32	0.011	0.003	0.009
28/11/2009	6:45:00 AM	N10E	S	2					0.005	0.002	0.008

28/11/2009	6:49:00 AM	N10W	S	1		11.88	0.035	0.28	0.004	0.001	0.007
28/11/2009	6:49:00 AM	N10W	S	2					0.004	0.001	0.007
28/11/2009	7:12:00 AM	N20E	S	1		7.524	0.02	0.26	0.004	0.001	0.005
28/11/2009	7:12:00 AM	N20E	S	2					0.005	0.001	0.005
28/11/2009	7:23:00 AM	N20W	S	1		7.9020333	0.035	0.31	0.005	0.001	0.006
28/11/2009	7:23:00 AM	N20W	S	2					0.005	0.001	0.006
28/11/2009	7:45:00 AM	N30E	S	1		11.429	0.051	0.38	0.006	0.003	0.007
28/11/2009	7:45:00 AM	N30E	S	2					0.006	0.004	0.008
28/11/2009	7:50:00 AM	N30W	S	1		5.9752	0.029	0.28	0.005	0.004	0.008
28/11/2009	7:50:00 AM	N30W	S	2					0.005	0.004	0.006
28/11/2009	8:12:00 AM	N40E	S	1		6.3919565	0.035	0.31	0.005	0.005	0.009
28/11/2009	8:12:00 AM	N40E	S	2					0.004	0.005	0.008
28/11/2009	8:16:00 AM	N40W	S	1		4.8720434	0.052	0.36	0.005	0.006	0.011
28/11/2009	8:16:00 AM	N40W	S	2					0.004	0.006	0.009
28/11/2009	8:37:00 AM	N50E	S	1		3.9204	0.072	0.47	0.005	0.015	0.078
28/11/2009	8:37:00 AM	N50E	S	2					0.005	0.016	0.08
28/11/2009	8:43:00 AM	N50W	S	1		1.9602	0.062	0.44	0.005	0.016	0.083
28/11/2009	8:43:00 AM	N50W	S	2					0.005	0.017	0.083
28/11/2009	9:06:00 AM	N60E	S	1		2.2617692	0.065	0.6	0.005	0.028	0.22
28/11/2009	9:06:00 AM	N60E	S	2					0.005	0.027	0.22
28/11/2009	9:10:00 AM	N60W	S	1		1.9602	0.071	0.62	0.01	0.021	0.17
28/11/2009	9:10:00 AM	N60W	S	2					0.004	0.028	0.22
30/11/2009	5:05:00 PM	NW	S	1			0.023	0.54			
30/11/2009	5:05:00 PM	NW	S	2			0.029	0.59			
30/11/2009	11:00:00 AM	NW	S	1	41.17777777	4.1093555					
30/11/2009	11:00:00 AM	NW	S	2	40.4	4.1489555					
30/11/2009	11:00:00 AM	NW	S	3	32.09090909	3.9204					
6/12/2009	1:30:00 PM	CQ2	S	1	346.7586206	4.8634666 667	0.069	0.41	0.005	0.003	0.004

6/12/2009	1:30:00 PM	CQ2	S	2	444.7333333	5.7383333333	0.041	0.26	0.005	0.002	0.003
6/12/2009	1:30:00 PM	CQ2	B	1	466.8666666	9.2026	0.11	0.54	0.005	0.006	0.007
6/12/2009	1:30:00 PM	CQ2	B	2	485.0666666	9.0838	0.088	0.51	0.007	0.002	0.005
6/12/2009	7:10:00 PM	CQ1	S	1	548.0909090	3.393238081	0.087	0.4	0.006	0.003	0.007
6/12/2009	7:10:00 PM	CQ1	S	2	556.5	3.7411	0.11	0.55	0.005	0.004	0.006
6/12/2009	7:10:00 PM	CQ1	B	1	614.125	1.406625	0.094	0.47	0.004	0.003	0.005
6/12/2009	7:10:00 PM	CQ1	B	2	578.5882352	4.4012941706	0.087	0.42	0.007	0.004	0.003
7/12/2009	12:30:00 PM	CQ3	S	1	452.3703703	9.1884375	0.09	0.49	0.003	0.003	0.006
7/12/2009	12:30:00 PM	CQ3	S	2	564	8.8209	0.095	0.53	0.015	0.003	0.008
7/12/2009	12:30:00 PM	CQ3	B	1	697.625	10.737375	0.1	0.53	0.008	0.005	0.009
7/12/2009	12:30:00 PM	CQ3	B	2	618.8888888	12.450777778	0.11	0.55	0.004	0.003	0.006
7/12/2009	10:20:00 AM	RQ1	S	1	478	7.2952	0.073	0.42	0.01	0.004	0.003
7/12/2009	10:20:00 AM	RQ1	S	2	448.5	6.1787	0.066	0.43	0.006	0.004	0.005
7/12/2009	10:20:00 AM	RQ1	B	1	620.4	9.31975	0.1	0.53	0.005	0.004	0.005
7/12/2009	10:20:00 AM	RQ1	B	2	655.875	7.701375	0.1	0.56	0.008	0.005	0.006
8/12/2009	2:00:00 PM	WQ1	S	1	297.7333333	7.963	0.053	0.35			
8/12/2009	2:00:00 PM	WQ1	S	2	293.4615384	7.6103076769	0.049	0.38			
8/12/2009	2:00:00 PM	WQ1	B	1	449.5833333	7.35075	0.1	0.57			
8/12/2009	2:00:00 PM	WQ1	B	2	524.1052631	6.1901052789	0.097	0.51			
20/12/2009	10:20:00 AM	CQ2	S	1	1038.285714	12.283857571					
20/12/2009	10:20:00 AM	CQ2	S	2	1051.076923	14.628166667					
20/12/2009	10:20:00 AM	CQ2	B	1	2190.363636	14.9292					
20/12/2009	10:20:00 AM	CQ2	B	2	2253.636363	15.942					

21/12/2009	11:35:00 AM	CQ3	S	1	522.09523809	4.8004					
21/12/2009	11:35:00 AM	CQ3	S	2	563.625	4.665375					
21/12/2009	11:35:00 AM	CQ3	B	1	572	9.31975					
21/12/2009	11:35:00 AM	CQ3	B	2	624	5.3973333333					
21/12/2009	9:30:00 AM	RQ1	S	1	492.6	6.786					
21/12/2009	9:30:00 AM	RQ1	S	2	499.9	6.3393					
21/12/2009	9:30:00 AM	RQ1	B	1	568.1	10.0628					
21/12/2009	9:30:00 AM	RQ1	B	2	632	10.305058294					
21/12/2009	7:00:00 PM	CQ1	S	1	479	6.632					
21/12/2009	7:00:00 PM	CQ1	S	2	502.2	7.4646					
21/12/2009	7:00:00 PM	CQ1	B	1	554.5	9.31975					
21/12/2009	7:00:00 PM	CQ1	B	2	538.58823529	6.8358888889					
22/12/2009	3:10:00 PM	WQ1	S	1	505.35	4.37965					
22/12/2009	3:10:00 PM	WQ1	S	2	532.85	4.38405					
22/12/2009	3:10:00 PM	WQ1	B	1	1197.1	5.0358					
22/12/2009	3:10:00 PM	WQ1	B	2	576	6.1523					
23/12/2009	12:00:00 PM	NW	S	1	57.6	7.35075	0.024	0.58	0.005	0.003	0.024
23/12/2009	12:00:00 PM	NW	S	2	55.525	6.615675	0.019	0.4	0.008	0.002	0.021
23/12/2009	12:00:00 PM	NW	B	1	84.96666666(	7.4671142429	0.032	0.62	0.011	0.003	0.027
23/12/2009	12:00:00 PM	NW	B	2	93.83333333	4.9005	0.032	0.58	0.01	0.002	0.021
2/01/2010	11:00:00 AM	CQ2	S	1	1921.411764	3.4863529647	0.17	0.73	0.007	0.014	0.16
2/01/2010	11:00:00 AM	CQ2	S	2	1554.285714	2.1167142429	0.19	0.73	0.007	0.014	0.16
2/01/2010	11:00:00 AM	CQ2	B	1	2525.666666(	0	0.19	0.9	0.009	0.012	0.14
2/01/2010	11:00:00 AM	CQ2	B	2	3100.33	2.1725			0.009	0.011	0.11
2/01/2010	7:15:00 PM	CQ1	S	1	592.25	3.26975	0.092	0.45	0.017	0.011	0.041

2/01/2010	7:15:00 PM	CQ1	S	2	643.75	3.036	0.12	0.55	0.011	0.009	0.032
2/01/2010	7:15:00 PM	CQ1	B	1	762	4.642	0.13	0.54	0.008	0.011	0.035
2/01/2010	7:15:00 PM	CQ1	B	2	844.6666666(	2.4695	0.17	0.69	0.004	0.011	0.035
3/01/2010	10:15:00 AM	RQ1	S	1	596.375	1.4483333 333	0.11	0.35	0.012	0.007	0.017
3/01/2010	10:15:00 AM	RQ1	S	2	641.833333	1.4666666 667E-02	0.11	0.36	0.01	0.008	0.019
3/01/2010	10:15:00 AM	RQ1	B	1	993	0.869	0.21	0.83	0.011	0.009	0.019
3/01/2010	10:15:00 AM	RQ1	B	2	797.75	0	0.18	0.7	0.016	0.009	0.046
3/01/2010	2:35:00 PM	CQ3	S	1	132.6666666(	1.9745	0.16	0.71	0.005	0.006	0.15
3/01/2010	2:35:00 PM	CQ3	S	2	152.65	2.4288	0.036	0.48	0.004	0.006	0.14
3/01/2010	2:35:00 PM	CQ3	B	2	458	5.3318571 714	0.1	0.79	0.012	0.01	0.24
3/01/2010	2:35:00 PM	CQ3	B	1	422.4285714	5.4678461 615	0.069	0.44	0.007	0.006	0.15
4/01/2010	2:00:00 PM	WQ1	S	1	549.875	0.162	0.082	0.57	0.045	0.003	0.02
4/01/2010	2:00:00 PM	WQ1	S	2	497.375	5.7148235 176	0.085	0.39	0.074	0.005	0.039
4/01/2010	2:00:00 PM	WQ1	B	1	1331.428571	4.7388	0.068	0.37	0.051	0.003	0.023
4/01/2010	2:00:00 PM	WQ1	B	2	853.8571428	5.3318571 714	0.085	0.57	0.071	0.005	0.042
9/01/2010	4:20:00 PM	NW	S	1	225.8	1.16468	0.096	0.85	0.065	0.007	0.053
9/01/2010	4:20:00 PM	NW	S	2	241	0.92114	0.096	0.84	0.069	0.008	0.066
9/01/2010	4:20:00 PM	NW	B	1	225.4	0.86724	0.098	0.8	0.074	0.008	0.064
9/01/2010	4:20:00 PM	NW	B	2	193.8	0.86482	0.098	0.8	0.083	0.008	0.063
16/01/2010	11:40:00 AM	CQ2	S	1	25.8	12.832875					
16/01/2010	11:40:00 AM	CQ2	S	2	41.5714285	13.441371 714					
16/01/2010	11:40:00 AM	CQ2	B	1	39.4333333	13.7214					
16/01/2010	11:40:00 AM	CQ2	B	2	41.2666666(	15.053866 667					

16/01/2010	7:00:00 PM	CQ1	S	1	86.24	4.107884					
16/01/2010	7:00:00 PM	CQ1	S	2	108.08	3.419284					
16/01/2010	7:00:00 PM	CQ1	B	1	166.3	4.41045					
16/01/2010	7:00:00 PM	CQ1	B	2	226.7333333	3.2799066667					
17/01/2010	11:00:00 AM	RQ1	S	1	156.9	1.8153666667					
17/01/2010	11:00:00 AM	RQ1	S	2	138.9	1.86615					
17/01/2010	11:00:00 AM	RQ1	B	1	340.125	2.57301					
17/01/2010	11:00:00 AM	RQ1	B	2	331.4285714	2.6005571714					
17/01/2010	2:15:00 PM	CQ3	S	1	59.44999999	0.96379137826					
17/01/2010	2:15:00 PM	CQ3	S	2	77.73333333	0.34899333333					
17/01/2010	2:15:00 PM	CQ3	B	1	425.2	0.8338					
17/01/2010	2:15:00 PM	CQ3	B	2	416.6	0.81224					
18/01/2010	1:50:00 PM	WQ1	S	1	92.75	2.2771629296					
18/01/2010	1:50:00 PM	WQ1	S	2	107.1	2.48					
18/01/2010	1:50:00 PM	WQ1	B	1	97.625	3.1247857571					
18/01/2010	1:50:00 PM	WQ1	B	2	127.875	3.182575					
27/01/2010	6:15:00 PM	CQ1	S	2	1433.333333	0.62333333333	0.19	0.74	0.01	0.015	0.04
27/01/2010	6:15:00 PM	CQ1	B	1	1478.333333	1.188	0.22	0.93	0.01	0.014	0.041
27/01/2010	7:15:00 AM	CQ2	S	1	93.44999999	3.5779615154	0.044	0.32	0.005	0.012	0.11
27/01/2010	6:15:00 PM	CQ1	B	2	1474.333333	1.188	0.21	0.83	0.01	0.013	0.04
27/01/2010	7:15:00 AM	CQ2	S	2	95.35	3.34785	0.038	0.27	0.006	0.008	0.077
27/01/2010	7:15:00 AM	CQ2	B	1	126.0666666	3.7279	0.043	0.33	0.006	0.014	0.13
27/01/2010	7:15:00 AM	CQ2	B	2	125.8	1.9814666	0.032	0.21	0.01	0.01	0.086

						667					
27/01/2010	6:15:00 PM	CQ1	S	1	1395.666666(	1.188	0.24	0.87	0.009	0.014	0.045
2/02/2010	8:25:00 AM	RQ1	S	1	600.3333333:	0	0.14	0.52	0.033	0.016	0.021
2/02/2010	8:25:00 AM	RQ1	S	2	563.6	0	0.13	0.5	0.03	0.014	0.019
2/02/2010	8:25:00 AM	RQ1	B	1	539.6	0	0.17	0.53	0.037	0.016	0.025
2/02/2010	8:25:00 AM	RQ1	B	2	606.0000000(	0	0.15	0.52	0.035	0.017	0.025
2/02/2010	9:45:00 AM	CQ3	S	1	158.8333333:	0	0.086	0.4	0.012	0.012	0.015
2/02/2010	9:45:00 AM	CQ3	S	2	206.666666(	0	0.1	0.48	0.012	0.01	0.019
2/02/2010	9:45:00 AM	CQ3	B	1	244	0	0.097	0.44	0.012	0.01	0.02
2/02/2010	9:45:00 AM	CQ3	B	2	249.8	0	0.093	0.43	0.011	0.011	0.02
2/02/2010	10:35:00 AM	WQ1	S	1	205.8	0	0.082	0.44	0.014	0.009	0.013
2/02/2010	10:35:00 AM	WQ1	S	2	249.8	0			0.015	0.009	0.012
2/02/2010	10:35:00 AM	WQ1	B	1	264.4	0	0.1	0.5	0.015	0.009	0.011
2/02/2010	10:35:00 AM	WQ1	B	2	233.4	0	0.082	0.43	0.014	0.009	0.011
5/02/2010	3:40:00 PM	NW	S	1	92.3333333:						
5/02/2010	3:40:00 PM	NW	S	2	98.266666(						
7/02/2010	8:00:00 AM	WQ1	S	1	549.5						
7/02/2010	8:00:00 AM	WQ1	S	2	563.7						
9/02/2010	8:30:00 AM	CQ3	S	2	146.928571						
9/02/2010	8:30:00 AM	CQ3	S	1	196.428571						
9/02/2010	4:40:00 PM	WC1	S	1	58.05						
9/02/2010	4:40:00 PM	WC1	S	2	59.1						
9/02/2010	5:30:00 PM	WC2	S	2	89.1500000(						
9/02/2010	5:30:00 PM	WC2	S	1	88.95						
10/02/2010	8:30:00 AM	CQ2	B	2	178.25	3.036	0.072	0.55	0.014	0.009	0.016
10/02/2010	8:30:00 AM	CQ2	B	1	180.125	4.453625	0.079	0.56	0.015	0.01	0.012
10/02/2010	8:30:00 AM	CQ2	S	2	150.3	3.5629	0.094	0.64	0.016	0.009	0.018
10/02/2010	8:30:00 AM	CQ2	S	1	167	2.2682	0.076	0.52	0.015	0.01	0.017
10/02/2010	6:00:00 PM	CQ1	S	2	111.266666(	3.3689333	0.058	0.43	0.017	0.008	0.016

						333					
10/02/2010	6:00:00 PM	CQ1	S	1	103.86666666	2.7199333 333	0.065	0.51	0.014	0.006	0.011
10/02/2010	6:00:00 PM	CQ1	B	2	110.86666666	2.6187333 333	0.056	0.49	0.02	0.006	0.013
10/02/2010	6:00:00 PM	CQ1	B	1	103.66666666	2.4882	0.051	0.44	0.022	0.007	0.014
11/02/2010	12:00:00 PM	CQ3	S	1	77.999999999	2.3283333 333	0.064	0.57	0.011	0.008	0.013
11/02/2010	12:00:00 PM	CQ3	S	2	89.4	3.7499	0.061	0.52	0.01	0.008	0.014
11/02/2010	12:00:00 PM	CQ3	B	1	95.2	3.9105	0.068	0.55	0.024	0.009	0.014
11/02/2010	12:00:00 PM	CQ3	B	2	129	4.0975	0.075	0.59			
11/02/2010	8:00:00 AM	RQ1	B	2	410.2	0	0.097	0.47	0.012	0.005	0.005
11/02/2010	8:00:00 AM	RQ1	B	1	328.6	0	0.099	0.53	0.014	0.007	0.011
11/02/2010	8:00:00 AM	RQ1	S	2	336	0	0.12	0.54	0.012	0.004	0.006
11/02/2010	8:00:00 AM	RQ1	S	1	302	4.6566666 667	0.11	0.48	0.012	0.005	0.006
12/02/2010	12:00:00 PM	WQ1	S	1	281.6	1.7497333 333	0.088	0.55	0.015	0.008	0.013
12/02/2010	12:00:00 PM	WQ1	S	2	221.4	0	0.093	0.5	0.015	0.008	0.013
12/02/2010	12:00:00 PM	WQ1	B	1	238.6	0	0.087	0.47	0.015	0.008	0.012
12/02/2010	12:00:00 PM	WQ1	B	2	228.6	1.8942	0.082	0.5	0.015	0.009	0.01
27/02/2010	7:10:00 AM	CQ2	S	1	411.5	0	0.14	0.79	0.026	0.012	0.033
27/02/2010	6:30:00 PM	CQ1	S	1	329	20.4996	0.21	0.87	0.005	0.003	0.006
27/02/2010	6:30:00 PM	CQ1	S	2	298.88888888	15.6596	0.22	0.96	0.005	0.003	0.008
27/02/2010	6:30:00 PM	CQ1	B	1	994.8	26.07	0.1	0.65	0.009	0.006	0.016
27/02/2010	6:30:00 PM	CQ1	B	2	1068.6	16.016	0.087	0.46	0.017	0.006	0.016
27/02/2010	7:10:00 AM	CQ2	S	2	406.75	0	0.12	0.66	0.027	0.011	0.033
27/02/2010	7:10:00 AM	CQ2	B	1	566.66666666	0.6233333 3333	0.17	0.85	0.028	0.013	0.037
27/02/2010	7:10:00 AM	CQ2	B	2	550.66666666	1.1586666 667	0.16	0.83	0.028	0.012	0.04

28/02/2010	11:30:00 AM	RQ1	S	1	443.75	0	0.15	0.47	0.013	0.014	0.01
28/02/2010	11:30:00 AM	RQ1	S	2	514	0	0.15	0.53	0.018	0.014	0.013
28/02/2010	11:30:00 AM	RQ1	B	1	523	0	0.18	0.62	0.014	0.014	0.012
28/02/2010	11:30:00 AM	RQ1	B	2	542.6666666(	0	0.027	0.27	0.013	0.013	0.011
1/03/2010	2:40:00 PM	WQ1	S	1	112.6	0	0.059	0.39	0.011	0.007	0.007
1/03/2010	2:40:00 PM	WQ1	S	2	101.3	0	0.055	0.31	0.01	0.007	0.009
1/03/2010	2:40:00 PM	WQ1	B	1	108.8	0	0.062	0.31	0.01	0.006	0.009
1/03/2010	2:40:00 PM	WQ1	B	2	111.9	0	0.062	0.31	0.009	0.005	0.006
1/03/2010	9:50:00 AM	CQ3	S	1	79.73333333	1.4817	0.07	0.48	0.011	0.006	0.012
1/03/2010	9:50:00 AM	CQ3	S	2	81.49999999	1.6599	0.076	0.44	0.009	0.005	0.008
1/03/2010	9:50:00 AM	CQ3	B	1	102.5	1.0429375	0.066	0.42	0.007	0.004	0.006
1/03/2010	9:50:00 AM	CQ3	B	2	100.4	0.187	0.05	0.47			
11/03/2010	5:30:00 AM	CQ2	S	1	99.7	1.9998					
11/03/2010	5:30:00 AM	CQ2	S	2	105	1.95371					
11/03/2010	5:30:00 AM	CQ2	B	1	102.3	1.85955					
11/03/2010	4:00:00 PM	CQ1	S	1	67.5	2.0538736053					
11/03/2010	5:30:00 AM	CQ2	B	2	93.8	2.02741					
11/03/2010	4:00:00 PM	CQ1	S	2	66.33333333	2.0201133333					
11/03/2010	4:00:00 PM	CQ1	B	1	102.35	2.864345					
11/03/2010	4:00:00 PM	CQ1	B	2	128.2	3.882395					
12/03/2010	7:20:00 AM	WQ1	S	1	84.6666666(	2.0803062					
12/03/2010	7:20:00 AM	WQ1	S	2	79	2.2544866667					
12/03/2010	7:20:00 AM	WQ1	B	1	91.08333333	2.6404583333					
12/03/2010	7:20:00 AM	WQ1	B	2	95.6666666(	1.7482666667					
12/03/2010	8:15:00 AM	CQ3	S	1	43.87096774	1.9008709194					

12/03/2010	8:15:00 AM	CQ3	S	2	52.92857142{	2.2693					
12/03/2010	8:15:00 AM	CQ3	B	1	57.25	2.1230916667					
12/03/2010	8:15:00 AM	CQ3	B	2	57.74999999	1.926925					
13/03/2010	8:15:00 AM	RQ1	S	1	61	1.27699					
13/03/2010	8:15:00 AM	RQ1	S	2	64.40000000(	1.3552					
13/03/2010	8:15:00 AM	RQ1	B	1	89.83333333	1.4607083333					
13/03/2010	8:15:00 AM	RQ1	B	2	126.9166666(	1.629375					
23/03/2010	8:00:00 AM	NW	S	1	42.85714285	5.4591428286	0.056	0.68	0.038	0.007	0.059
23/03/2010	8:00:00 AM	NW	B	1	50.21428571	2.1002142429	0.058	0.78	0.034	0.008	0.059
23/03/2010	8:00:00 AM	NW	S	2	49.14285714	3.7305714143	0.059	0.68	0.031	0.008	0.03
23/03/2010	8:00:00 AM	NW	B	2	42.92857142{	3.7305714143	0.042	0.63	0.041	0.009	0.062
26/03/2010	4:00:00 PM	CQ1	B	1	89.3	3.52836	0.023	0.35	0.005	0.001	0.008
26/03/2010	4:00:00 PM	CQ1	B	2	70.08333333	2.9403	0.027	0.3	0.005	0.001	0.003
26/03/2010	4:00:00 PM	CQ1	S	1	81.2	2.9403	0.023	0.28	0.009	0.001	0.003
26/03/2010	4:00:00 PM	CQ1	S	2	67.36	2.9403	0.027	0.29	0.007	0.001	0.003
26/03/2010	5:15:00 AM	CQ2	S	1	47.20454545	1.9602	0.027	0.44			
26/03/2010	5:15:00 AM	CQ2	S	2	41.6	3.1090888889	0.028	0.48	0.081	0.007	0.03
26/03/2010	5:15:00 AM	CQ2	B	1	47.66666666(	3.1090888889	0.026	0.45	0.059	0.005	0.022
26/03/2010	5:15:00 AM	CQ2	B	2	40.82222222	2.6136	0.029	0.57	0.1	0.009	0.035
27/03/2010	11:00:00 AM	CQ3	S	1	108.6	4.2320666667	0.069	0.62	0.029	0.013	0.064
27/03/2010	11:00:00 AM	CQ3	S	2	72.73333333	3.476			0.029	0.013	0.046
27/03/2010	11:00:00 AM	CQ3	B	1	106	5.0952	0.069	0.74	0.03	0.013	0.063
27/03/2010	11:00:00 AM	CQ3	B	2	82.70000000(	3.7411	0.055	0.4	0.03	0.013	0.06

27/03/2010	9:20:00 AM	RQ1	S	1	51.43333333	2.4911333333	0.034	0.56	0.088	0.01	0.044
27/03/2010	9:20:00 AM	RQ1	S	2	50	2.607	0.025	0.37	0.093	0.011	0.047
27/03/2010	9:20:00 AM	RQ1	B	1	60.53333333	2.1131	0.031	0.49	0.099	0.011	0.046
27/03/2010	9:20:00 AM	RQ1	B	2	66.43333333	2.1725	0.023	0.26	0.098	0.011	0.044
28/03/2010	10:50:00 AM	WQ1	S	1	37.4	3.2001269698	0.028	0.26	0.026	0.01	0.047
28/03/2010	10:50:00 AM	WQ1	S	2	38.92	4.03216	0.03	0.3	0.029	0.009	0.078
28/03/2010	10:50:00 AM	WQ1	B	1	89.06666666	4.0734375	0.057	0.65	0.033	0.013	0.088
28/03/2010	10:50:00 AM	WQ1	B	2	108.4666666	4.2262	0.053	0.42	0.027	0.01	0.052
1/06/2010	10:30:00 PM	CQ2	S	1	77.74	5.8806	0.024	0.25	0.004	0.001	0.003
1/06/2010	10:30:00 PM	CQ2	S	2	71.92	6.49308	0.027	0.29	0.004	0.001	0.005
1/06/2010	10:30:00 PM	CQ2	B	1	79.6	6.00908	0.026	0.25	0.01	0.001	0.004
1/06/2010	10:30:00 PM	CQ2	B	2	79.51111111	5.8806	0.024	0.24	0.003	0.001	0.003
2/06/2010	1:00:00 PM	CQ1	S	1	66.22	2.27502	0.019	0.21	0.004	0.001	0.003
2/06/2010	1:00:00 PM	CQ1	S	2	62.88	1.76418	0.016	0.19	0.002	0.001	0.002
2/06/2010	1:00:00 PM	CQ1	B	1	72.42	2.35224	0.022	0.21	0.001	0.001	0.002
2/06/2010	1:00:00 PM	CQ1	B	2	68.26	2.35224	0.022	0.22	0.002	0.001	0.003
2/06/2010	10:00:00 PM	RQ1	S	1	201.4117647	3.9204	0.04	0.3	0.014	0.005	0.01
2/06/2010	10:00:00 PM	RQ1	S	2	202.2941176	5.1887647235	0.047	0.39	0.014	0.005	0.007
2/06/2010	10:00:00 PM	RQ1	B	1	351.8	8.8209	0.059	0.38	0.014	0.005	0.007
2/06/2010	10:00:00 PM	RQ1	B	2	384.1	8.8209	0.065	0.37	0.015	0.005	0.007
2/06/2010	11:50:00 PM	CQ3	S	1	187.2666666	7.3516666667	0.012	0.18	0.023	0.015	0.009
2/06/2010	11:50:00 PM	CQ3	S	2	182.5333333	3.9204	0.045	0.3	0.006	0.005	0.009
2/06/2010	11:50:00 PM	CQ3	B	1	262.8	2.9403	0.048	0.36	0.005	0.005	0.012
2/06/2010	11:50:00 PM	CQ3	B	2	265.4	2.9403	0.062	0.43	0.005	0.004	0.009
3/06/2010	12:45:00 AM	WQ1	S	1	193.6666666	6.5956	0.042	0.32	0.017	0.004	0.012
3/06/2010	12:45:00 AM	WQ1	S	2	196.9333333	7.4646	0.043	0.34	0.014	0.005	0.013

3/06/2010	12:45:00 AM	WQ1	B	1	256.1	6.3481	0.056	0.38	0.007	0.005	0.014
3/06/2010	12:45:00 AM	WQ1	B	2	269.6	8.9463	0.051	0.36	0.008	0.005	0.012
3/06/2010	8:00:00 AM	NW	S	1	108.38461538	6.3006428286	0.064	0.72	0.01	0.012	0.18
3/06/2010	8:00:00 AM	NW	S	2	95.25000000	6.3006428286	0.06	0.7	0.01	0.013	0.2
3/06/2010	8:00:00 AM	NW	B	1	101.33333333	7.35075	0.067	0.64	0.008	0.013	0.19
3/06/2010	8:00:00 AM	NW	B	2	96.33333333	4.9005	0.062	0.71	0.01	0.012	0.19

Appendix 4: Secchi depth data

Table 2.1: Secchi depth (m) at all sites and sampling occasions.

Site	Date	Time	Secchi Depth (m)
CQ1	25/10/2009	6:34:00 AM	0.2
CQ2	25/10/2009	1:40:00 PM	0.2
WQ1	10/11/2009	3:40:00 PM	0.3
RQ1	9/11/2009	11:30:00 AM	0.2
CQ3	9/11/2009	3:10:00 PM	0.25
CQ2	8/11/2009	2:40:00 PM	0.3
CQ1	9/11/2009	6:20:00 AM	0.3
WQ1	23/11/2009	2:30:00 PM	0.3
CQ3	22/11/2009	2:40:00 PM	0.2
RQ1	22/11/2009	11:05:00 AM	0.25
CQ2	21/11/2009	1:50:00 PM	0.2
CQ1	21/11/2009	6:00:00 AM	0.1
NW	18/11/2009	11:00:00 AM	0.6
WQ1	8/12/2009	2:00:00 PM	0.25
RQ1	13/03/2010	8:15:00 AM	0.25
WQ1	12/03/2010	7:20:00 AM	0.15
CQ3	12/03/2010	12/03/2010	0.15
CQ2	11/03/2010	5:30:00 AM	0.15
CQ1	11/03/2010	4:00:00 PM	0.2
CQ3	28/02/2010	9:50:00 AM	0.15
RQ1	28/02/2010	11:30:00 AM	0.075
CQ1	27/02/2010	6:30:00 PM	0.15
CQ2	27/02/2010	7:10:00 AM	0.075
WQ1	1/03/2010	2:40:00 PM	0.15
CQ2	10/02/2010	8:30:00 AM	0.1
CQ1	10/02/2010	6:00:00 PM	0.2
CQ3	11/02/2010	12:00:00 AM	0.15
RQ1	11/02/2010	8:00:00 AM	0.05
WQ1	12/02/2010	12:00:00 AM	0.1
CQ2	27/01/2010	7:15:00 AM	0.3
CQ1	27/01/2010	6:15:00 PM	0.08
WQ1	2/02/2010	10:35:00 AM	0.05
RQ1	2/02/2010	8:25:00 AM	0.05
CQ3	2/02/2010	9:45:00 AM	0.05
CQ1	16/01/2010	7:00:00 PM	0.4
CQ2	16/01/2010	11:40:00 AM	0.4
RQ1	17/01/2010	11:00:00 AM	0.15
CQ3	17/01/2010	2:15:00 PM	0.15
WQ1	18/01/2010	1:50:00 PM	0.1
NW	9/01/2010	4:20:00 PM	0.1
CQ1	2/01/2010	7:15:00 PM	0.15

CQ2	2/01/2010	11:00:00 AM	0.075
RQ1	3/01/2010	10:15:00 AM	0.1
CQ3	3/01/2010	2:35:00 PM	0.15
WQ1	4/01/2010	2:00:00 PM	0.15
NW	23/12/2009	12:00:00 AM	0.7
CQ1	21/12/2009	7:00:00 PM	0.15
CQ2	20/12/2009	10:20:00 AM	0.1
RQ1	21/12/2009	9:30:00 AM	0.2
CQ3	21/12/2009	11:35:00 AM	0.15
WQ1	22/12/2009	3:10:00 PM	0.3
WQ1	6/12/2009	7:10:00 PM	0.1
CQ2	6/12/2009	1:30:00 PM	0.2
RQ1	7/12/2009	10:20:00 AM	0.15
CQ3	7/12/2009	12:30:00 PM	0.15
NW	23/03/2010	8:00:00 AM	0.2
CQ1	26/03/2010	4:00:00 PM	0.7
CQ2	26/03/2010	5:15:00 AM	0.5
RQ1	27/03/2010	9:20:00 AM	0.5
WQ1	28/03/2010	10:50:00 AM	0.3
CQ3	27/03/2010	11:00:00 AM	0.2
NW	25/10/2009	10:30:00 AM	0.6
RQ1	7/10/2008	12:15:00 PM	0.3
WQ1	7/10/2008	2:15:00 PM	0.4
CQ3	7/10/2008	3:00:00 PM	0.2
CQ2	8/10/2008	4:20:00 PM	0.2
CQ1	20/10/2008	6:30:00 PM	0.24
CQ2	21/10/2008	1:30:00 PM	0.14
CQ3	20/10/2008	9:00:00 AM	0.18
RQ1	21/10/2008	10:05:00 AM	0.1
WQ1	20/10/2008	10:15:00 AM	0.2
CQ1	3/11/2008	6:30:00 PM	0.18
CQ2	3/11/2008	11:15:00 AM	0.12
CQ3	4/11/2008	10:55:00 AM	0.16
RQ1	4/11/2008	9:00:00 AM	0.18
WQ1	5/11/2008	9:45:00 AM	0.18
CQ1	17/11/2008	6:15:00 PM	0.16
CQ2	17/11/2008	11:00:00 AM	0.14
CQ3	18/11/2008	1:10:00 PM	0.16
RQ1	18/11/2008	9:30:00 AM	0.16
WQ1	19/11/2008	9:20:00 AM	0.14
CQ1	1/12/2008	6:00:00 PM	0.18
CQ2	1/12/2008	10:45:00 AM	0.08
CQ3	2/12/2008	12:20:00 PM	0.14
RQ1	2/12/2008	9:20:00 AM	0.16
WQ1	3/12/2008	9:15:00 AM	0.16
CQ1	14/12/2008	6:00:00 PM	0.22
CQ2	14/12/2008	9:50:00 AM	0.06
CQ3	15/12/2008	11:30:00 AM	0.12

RQ1	15/12/2008	6:55:00 AM	0.14
WQ1	16/12/2008	12:10:00 PM	0.16
CQ1	30/12/2008	6:25:00 PM	0.12
CQ2	30/12/2008	11:10:00 AM	0.16
CQ3	31/12/2008	1:00:00 PM	0.16
RQ1	31/12/2008	8:15:00 AM	0.2
WQ1	1/01/2009	12:30:00 PM	0.24
CQ1	13/01/2009	5:55:00 PM	0.08
CQ2	13/01/2009	10:15:00 AM	0.06
CQ3	14/01/2009	11:45:00 AM	0.08
RQ1	14/01/2009	10:30:00 AM	0.06
WQ1	14/01/2009	12:30:00 PM	0.1
CQ1	27/01/2009	5:45:00 PM	
CQ2	27/01/2009	10:10:00 AM	0.18
CQ3	30/01/2009	9:15:00 AM	0.22
RQ1	28/01/2009	9:15:00 AM	0.08
WQ1	30/01/2009	10:10:00 AM	0.18
CQ1	10/02/2009	6:00:00 PM	0.2
CQ2	10/02/2009	9:20:00 AM	0.16
CQ3	11/02/2009	8:20:00 AM	0.2
RQ1	11/02/2009	2:10:00 PM	0.1
WQ1	11/02/2009	9:20:00 AM	0.4
CQ1	23/02/2009	5:30:00 PM	0.26
CQ2	23/02/2009	7:40:00 AM	0.2
CQ3	24/02/2009	9:35:00 AM	0.2
RQ1	24/02/2009	7:30:00 AM	0.08
WQ1	25/02/2009	8:25:00 AM	0.3
CQ1	23/03/2009	5:10:00 PM	0.5
CQ2	24/03/2009	7:20:00 AM	0.5
CQ3	23/03/2009	9:15:00 AM	0.18
RQ1	23/03/2009	7:45:00 AM	
WQ1	23/03/2009	9:35:00 AM	0.18
RQ1	2/06/2009	7:40:00 AM	0.75
CQ3	2/06/2009	9:30:00 AM	0.4
WQ1	2/06/2009	10:20:00 AM	0.65
CQ2	3/06/2009	7:20:00 AM	1.1
CQ1	3/06/2009	1:50:00 PM	2.3
R1	18/01/2009	12:00:00 PM	0.1
R2	18/01/2009	12:30:00 PM	0.1
C1	18/01/2009	1:00:00 PM	0.12
W1	18/01/2009	1:50:00 PM	0.14
C4	19/01/2009	9:30:00 AM	0.18
Raptis	19/01/2009	10:50:00 AM	0.11
W6	20/01/2009	9:20:00 AM	0.6
W1	20/01/2009	10:30:00 AM	0.2
Mouth	20/01/2009	12:10:00 PM	0.16
Mouth	21/01/2009	8:00:00 AM	0.12
C1	21/01/2009	8:30:00 AM	0.16

R2	21/01/2009	9:45:00 AM	0.08
RQ1	21/01/2009	10:30:00 AM	0.06
C4	21/01/2009	11:35:00 AM	0.2
W1	21/01/2009	12:15:00 PM	0.3
W4	21/01/2009	1:10:00 PM	0.32
W6	21/01/2009	2:00:00 PM	0.38
WQ1	11/10/2009	2:35:00 PM	0.2
CQ3	11/10/2009	2:05:00 PM	0.19
RQ1	11/10/2009	10:50:00 AM	0.19
CQ2	13/10/2009	3:30:00 PM	0.2
CQ1	14/10/2009	6:30:00 AM	0.3
NW	16/10/2009	1:30:00 PM	0.4
WQ1	27/10/2009	3:45:00 PM	0.3
CQ3	27/10/2009	9:30:00 AM	0.15
RQ1	27/10/2009	4:00:00 PM	0.4
CQ2	1/06/2010	10:30:00 PM	0.7
CQ1	2/06/2010	1:00:00 PM	1.8
CQ3	2/06/2010	11:50:00 PM	0.2
RQ1	2/06/2010	10:00:00 PM	0.25
WQ1	3/06/2010	12:45:00 AM	0.2
NW	3/06/2010	8:00:00 AM	0.2

Appendix 5: Physico-chemical data

Table 3.1: Physico-chemical parameters measured through the water column using a Sonde probe. Temperature (temp, ℃), DO (mg L^{-1}).

Site	Date	Time	Depth (m)	Temp.	Salinity	pH	DO
C1	21/01/2009	8:30:00 AM	1	31.38	0.07	6.91	4.4
C1	18/01/2009	1:00:00 PM	0	31.65	0.0766090038449	7.13	
C1	21/01/2009	8:30:00 AM	7	31.39	0.07	6.63	4.34
C1	18/01/2009	1:00:00 PM	1	31.62	8.54204385740037 02	7.1	
C1	21/01/2009	8:30:00 AM	0	31.37	0.07	7.15	4.9
C1	21/01/2009	8:30:00 AM	2	31.38	0.07	6.8	4.36
C1	21/01/2009	8:30:00 AM	3	31.38	0.07	6.72	4.35
C1	21/01/2009	8:30:00 AM	4	31.39	0.07	6.69	4.35
C1	21/01/2009	8:30:00 AM	6	31.39	0.07	6.62	4.34
C1	21/01/2009	8:30:00 AM	5	31.39	0.07	6.65	4.35
C4	21/01/2009	11:35:00 AM	2	31.72	0.05	6.54	4.44
C4	18/01/2009	9:30:00 AM	4	30.71	2.98973665422284 02	6.55	
C4	18/01/2009	9:30:00 AM	3	30.71	2.98973665422284 02	6.59	
C4	18/01/2009	9:30:00 AM	2	30.76	2.98973665422284 02	6.59	
C4	18/01/2009	9:30:00 AM	5	30.7	2.98973665422284 02	6.55	
C4	18/01/2009	9:30:00 AM	8	30.69	2.98973665422284 02	6.55	
C4	18/01/2009	9:30:00 AM	1	30.79	2.98973665422284 02	6.63	
C4	21/01/2009	11:35:00 AM	0	31.75	0.05	7.04	4.74
C4	21/01/2009	11:35:00 AM	6	31.72	0.05	6.41	4.31
C4	18/01/2009	9:30:00 AM	0	30.8		6.71	
C4	21/01/2009	11:35:00 AM	7	31.72	0.05	6.39	4.3
C4	21/01/2009	11:35:00 AM	3	31.74	0.05	6.45	4.32
C4	21/01/2009	11:35:00 AM	8	31.72	0.05	6.38	4.3
C4	21/01/2009	11:35:00 AM	4	31.73	0.05	6.4	4.32
C4	21/01/2009	11:35:00 AM	5	31.71	0.05	6.4	4.32
C4	21/01/2009	11:35:00 AM	1	31.74	0.05	6.68	4.36
CQ1	10/02/2010	6:00:00 PM	4	32.48	1.38540165430411	7.36	5.12
CQ1	10/02/2010	6:00:00 PM	3	32.47	1.06727356030788	7.43	5.07
CQ1	10/02/2010	6:00:00 PM	2	32.44	0.59466223697226	7.61	5.06
CQ1	10/02/2010	6:00:00 PM	1	32.55	0.52770476185558	7.77	5.14
CQ1	10/02/2010	6:00:00 PM	0	32.48	0.43966830105554	7.98	5.29
CQ1	27/02/2010	6:30:00 PM	5	29.25	23.87	8.36	2.77
CQ1	27/02/2010	6:30:00 PM	4	29.15	22.83	8.36	2.74
CQ1	27/02/2010	6:30:00 PM	1	29.01	20.36	8.28	3.1
CQ1	27/02/2010	6:30:00 PM	3	29.15	21.22	8.35	2.8

CQ1	21/12/2009	7:00:00 PM	0	32.8	37.73	8.03	5.14
CQ1	27/01/2010	6:15:00 PM	0	28.67	28.09	8.23	5.29
CQ1	16/01/2010	7:00:00 PM	5	33.01	29.73	8.17	5.18
CQ1	2/01/2010	7:15:00 AM	0	29.8	32.41	8.06	5.07
CQ1	2/01/2010	7:15:00 AM	1	29.8	32.38	8.06	4.92
CQ1	2/01/2010	7:15:00 AM	2	29.8	32.48	8.06	4.98
CQ1	2/01/2010	7:15:00 AM	3	29.8	32.48	8.06	4.9
CQ1	16/01/2010	7:00:00 PM	3	33.23	23.4	8.26	6
CQ1	2/01/2010	7:15:00 AM	5	29.8	32.46	8.06	4.87
CQ1	16/01/2010	7:00:00 PM	2	33.24	23.52	8.25	5.97
CQ1	21/12/2009	7:00:00 PM	1	32.8	37.73	8.04	5.05
CQ1	21/12/2009	7:00:00 PM	2	32.81	37.73	8.05	5.08
CQ1	26/03/2010	4:00:00 PM	0	29.02	28.63	7.92	3.38
CQ1	26/03/2010	4:00:00 PM	1	28.95	28.39	7.98	3.2
CQ1	26/03/2010	4:00:00 PM	2	28.95	28.37	8	3.05
CQ1	26/03/2010	4:00:00 PM	3	28.95	28.45	8.01	3.08
CQ1	2/01/2010	7:15:00 AM	4	29.8	32.45	8.06	4.89
CQ1	10/02/2009	6:00:00 PM	6	29.33	0.05	7.28	6.63
CQ1	11/03/2010	4:00:00 PM	1	29.88	2.48	7.37	3.39
CQ1	23/02/2009	5:30:00 PM	0	30.56	0.07	6.17	7.61
CQ1	10/02/2009	6:00:00 PM	0	29.34	0.05	7.84	6.72
CQ1	10/02/2009	6:00:00 PM	1	29.33	0.05	7.62	6.63
CQ1	10/02/2009	6:00:00 PM	2	29.33	0.05	7.52	6.63
CQ1	10/02/2009	6:00:00 PM	3	29.33	0.05	7.42	6.63
CQ1	16/01/2010	7:00:00 PM	4	33.07	27.68	8.19	5.46
CQ1	10/02/2009	6:00:00 PM	5	29.33	0.05	7.32	6.63
CQ1	27/01/2010	6:15:00 PM	1	28.62	28.32	8.23	5.17
CQ1	27/01/2010	6:15:00 PM	2	28.63	28.41	8.23	5.07
CQ1	27/01/2010	6:15:00 PM	3	28.63	28.43	8.22	4.98
CQ1	27/01/2010	6:15:00 PM	4	28.61	28.4	8.22	4.91
CQ1	27/01/2010	6:15:00 PM	5	28.61	28.53	8.22	4.85
CQ1	16/01/2010	7:00:00 PM	0	33.24	23.01	8.29	6.32
CQ1	16/01/2010	7:00:00 PM	1	33.25	22.96	8.29	6.19
CQ1	10/02/2009	6:00:00 PM	4	29.33	0.05	7.36	6.63
CQ1	14/12/2008	6:00:00 PM	1	32.4	35.756053631618		
CQ1	23/02/2009	5:30:00 PM	6	30.63	0.07	5.99	7.55
CQ1	9/11/2009	6:20:00 AM	3	29.62	35.79	7.79	5.04
CQ1	9/11/2009	6:20:00 AM	2	29.58	35.74	7.97	5.14
CQ1	9/11/2009	6:20:00 AM	1	29.6	35.77	7.98	5.21
CQ1	9/11/2009	6:20:00 AM	0	29.58	35.69	8.04	5.17
CQ1	25/10/2009	6:34:00 AM	3	27.43	35.06	7.9	7.53
CQ1	25/10/2009	6:34:00 AM	2	27.42	35.05	7.86	
CQ1	25/10/2009	6:34:00 AM	1	27.43	35.04	7.85	7.21
CQ1	25/10/2009	6:34:00 AM	0	27.4	35.01	7.82	6.17
CQ1	1/12/2008	6:00:00 PM	3	33.7	35.756053631618		
CQ1	1/12/2008	6:00:00 PM	2	33.7	35.756053631618		
CQ1	1/12/2008	6:00:00 PM	1	33.7	35.684030906982		
CQ1	1/12/2008	6:00:00 PM	0	33.8	35.540020671014		

CQ1	11/03/2010	4:00:00 PM	3	29.71	10.88	7.59	2.41
CQ1	21/11/2009	6:00:00 AM	0	30.45	37.12	7.99	5.19
CQ1	23/03/2009	5:10:00 PM	4	31.46	24.8	8.08	6.04
CQ1	14/10/2009	6:30:00 AM	0	27.06	35.01	8.05	5.6
CQ1	14/10/2009	6:30:00 AM	1	27.06	35.08	8.05	5.97
CQ1	14/10/2009	6:30:00 AM	2	27.09	35.1	8.05	6.58
CQ1	14/10/2009	6:30:00 AM	3	27.11	35.13	8.06	6.53
CQ1	14/12/2008	6:00:00 PM	3	32.3	35.90013419510		
CQ1	23/03/2009	5:10:00 PM	3	31.51	24.27	8.08	6.21
CQ1	14/12/2008	6:00:00 PM	2	32.3	35.82808806757		
CQ1	30/12/2008	6:25:00 PM	0	31.45	37.38685313902	8.09	
CQ1	23/03/2009	5:10:00 PM	2	31.57	23.6	8.12	6.5
CQ1	23/03/2009	5:10:00 PM	1	31.7	23.74	8.13	6.74
CQ1	23/03/2009	5:10:00 PM	0	31.73	23.46	8.13	6.65
CQ1	14/12/2008	6:00:00 PM	0	32.5	35.61201991348		
CQ1	17/11/2008	6:15:00 PM	1	32.8	37.05444644028		
CQ1	14/10/2009	6:30:00 AM	4	27.11	35.13	8.07	6.43
CQ1	3/06/2009	1:50:00 PM	1	23.3	34.24606683755		
CQ1	23/02/2009	5:30:00 PM	5	30.63	0.07	5.99	7.55
CQ1	6/10/2008	6:45:00 PM	2	29.02			5.49
CQ1	13/01/2009	5:55:00 PM	3	23.41	1.291475156760	8.22	
CQ1	13/01/2009	5:55:00 PM	2	23.41	1.285966825273	8.22	
CQ1	21/12/2009	7:00:00 PM	3	32.8	37.73	8.05	5.02
CQ1	6/10/2008	6:45:00 PM	0	29.04			5.63
CQ1	13/01/2009	5:55:00 PM	0	23.46	1.269453280736	8.3	
CQ1	13/01/2009	5:55:00 PM	4	23.41	1.285966825273	8.22	
CQ1	3/06/2009	1:50:00 PM	0	23.6	34.03078705917		
CQ1	11/03/2010	4:00:00 PM	0	30.54	0.57	7.73	4.93
CQ1	27/02/2010	6:30:00 PM	2	29.04	21.29	8	2.9
CQ1	11/03/2010	4:00:00 PM	2	29.73	8.67	7.39	2.62
CQ1	26/03/2010	4:00:00 PM	4	28.95	28.41	8.03	3.13
CQ1	11/03/2010	4:00:00 PM	4	29.69	18.45	7.58	1.92
CQ1	13/01/2009	5:55:00 PM	1	23.43	1.269453280736	8.24	
CQ1	21/11/2009	6:00:00 AM	3	30.6	37.22	8	4.97
CQ1	11/03/2010	4:00:00 PM	5	29.69	19.61	7.7	1.83
CQ1	23/02/2009	5:30:00 PM	4	30.63	0.07	6	7.54
CQ1	23/02/2009	5:30:00 PM	3	30.62	0.07	6.02	7.52
CQ1	23/02/2009	5:30:00 PM	2	30.62	0.07	6.07	7.51
CQ1	23/02/2009	5:30:00 PM	1	30.61	0.07	6.11	7.52
CQ1	6/10/2008	6:45:00 PM	1	29.01			5.52
CQ1	21/11/2009	6:00:00 AM	2	30.59	37.17	8.01	5.02
CQ1	17/11/2008	6:15:00 PM	0	32.7	36.90999669988		
CQ1	3/11/2008	6:30:00 PM	0	31.4	35.68403090698		
CQ1	3/11/2008	6:30:00 PM	1	31.3	35.90013419510		
CQ1	3/11/2008	6:30:00 PM	2	31.3	36.04426144622		
CQ1	3/11/2008	6:30:00 PM	3	31.3	36.04426144622		
CQ1	3/11/2008	6:30:00 PM	4	31.2	36.11634253067		
CQ1	20/10/2008	6:30:00 PM	0	31	33.02761029805		

CQ1	21/11/2009	6:00:00 AM	1	30.58	37.18	8.02	5.07
CQ1	27/01/2009	5:45:00 PM	5	29.03	0.13	7.32	5.85
CQ1	27/02/2010	6:30:00 PM	0	28.87	19.53	8.11	3.14
CQ1	26/03/2010	4:00:00 PM	5	28.94	28.37	8.06	3.12
CQ1	27/01/2009	5:45:00 PM	1	29.03	0.13	7.38	5.8
CQ1	27/01/2009	5:45:00 PM	2	29.03	0.13	7.35	5.82
CQ1	27/01/2009	5:45:00 PM	3	29.03	0.13	7.34	5.84
CQ1	27/01/2009	5:45:00 PM	0	28.98	0.13	7.48	5.79
CQ1	27/01/2009	5:45:00 PM	6	29.03	0.13	7.32	5.86
CQ1	21/12/2009	7:00:00 PM	4	32.8	37.72	8.05	4.93
CQ1	27/01/2009	5:45:00 PM	4	29.03	0.13	7.33	5.84
CQ2	27/01/2009	10:10:00 AM	4	30.24	0.14	7.31	5.23
CQ2	21/11/2009	1:50:00 PM	0	31.37	36.75	7.96	5.75
CQ2	10/02/2009	9:20:00 AM	4	29.14	0.07	7.28	6.46
CQ2	10/02/2009	9:20:00 AM	5	29.14	0.07	7.26	6.46
CQ2	21/11/2009	1:50:00 PM	1	31.39	36.78	7.96	5.23
CQ2	1/12/2008	10:45:00 AM	2	32.4	36.33265538608		
CQ2	20/12/2009	10:20:00 AM	0	30.22	37.76	7.92	4.51
CQ2	27/01/2009	10:10:00 AM	3	30.24	0.14	7.34	5.21
CQ2	20/12/2009	10:20:00 AM	1	30.84	37.9	7.94	4.41
CQ2	27/01/2009	10:10:00 AM	2	30.24	0.14	7.38	5.2
CQ2	20/12/2009	10:20:00 AM	2	30.76	37.9	7.94	4.2
CQ2	27/01/2009	10:10:00 AM	0	30.25	0.15	7.73	5.2
CQ2	13/10/2009	3:30:00 PM	1	27.04	33.87	8.04	
CQ2	13/10/2009	3:30:00 PM	0	27.01	33.88	8.01	
CQ2	11/03/2010	5:30:00 AM	0	29.68	0.12	8.34	4.67
CQ2	11/03/2010	5:30:00 AM	1	29.68	0.12	8.19	4.61
CQ2	11/03/2010	5:30:00 AM	2	29.66	0.12	8.11	4.54
CQ2	2/01/2010	11:00:00 AM	1	29.5	24.95	7.69	4.68
CQ2	3/11/2008	11:15:00 AM	0	30.4	35.32409364972		
CQ2	30/12/2008	11:10:00 AM	0	31.48	38.58838014598	8.07	
CQ2	30/12/2008	11:10:00 AM	1	31.45	38.66085877137	8.08	
CQ2	27/01/2009	10:10:00 AM	1	30.24	0.14	7.45	5.19
CQ2	1/12/2008	10:45:00 AM	0	33.4	35.39605751906		
CQ2	13/01/2009	10:15:00 AM	2	23.49	2.31464851191	8.19	
CQ2	13/01/2009	10:15:00 AM	3	23.52	2.33197855978	8.18	
CQ2	10/02/2009	9:20:00 AM	3	29.15	0.07	7.29	6.45
CQ2	10/02/2009	9:20:00 AM	2	29.15	0.07	7.36	6.44
CQ2	8/10/2008	4:20:00 PM	2	29.47			3.73
CQ2	8/10/2008	4:20:00 PM	1	29.48			3.74
CQ2	8/10/2008	4:20:00 PM	0	29.47			3.72
CQ2	21/10/2008	1:30:00 PM	3	29.6	35.68403090698		
CQ2	21/10/2008	1:30:00 PM	2	29.6	35.82808806757		
CQ2	21/10/2008	1:30:00 PM	1	29.2	36.18843522838		
CQ2	21/10/2008	1:30:00 PM	0	31.6	33.31398457370		
CQ2	10/02/2010	10:00:00 AM	2	31.95	0.16	7.16	4.3
CQ2	10/02/2009	9:20:00 AM	0	29.15	0.07	7.48	6.47
CQ2	3/06/2009	7:20:00 AM	0	21.8	32.95604796594		

CQ2	1/12/2008	10:45:00 AM	1	32.8	36.116342530672		
CQ2	16/01/2010	11:40:00 AM	0	31.97	4.34	7.88	5.54
CQ2	16/01/2010	11:40:00 AM	1	31.99	4.35	7.89	5.55
CQ2	16/01/2010	11:40:00 AM	2	31.87	4.91	7.87	5.4
CQ2	3/11/2008	11:15:00 AM	2	30.3	35.900134195102		
CQ2	13/01/2009	10:15:00 AM	0	23.49	2.3146485119103	8.3	
CQ2	13/10/2009	3:30:00 PM	2	27.01	33.86	8.05	
CQ2	2/01/2010	11:00:00 AM	2	29.5	24.92	7.69	4.64
CQ2	3/11/2008	11:15:00 AM	1	30.3	35.756053631618		
CQ2	30/12/2008	11:10:00 AM	2	31.45	38.740597927617	8.08	
CQ2	3/06/2009	7:20:00 AM	1	22.9	32.526938120689		
CQ2	10/02/2009	9:20:00 AM	1	29.16	0.07	7.42	6.42
CQ2	2/01/2010	11:00:00 AM	0	29.52	24.98	7.7	4.78
CQ2	27/01/2009	10:10:00 AM	5	30.24	0.15	7.28	5.27
CQ2	24/03/2009	7:20:00 AM	2	30.27	12.9	7.55	4.13
CQ2	8/11/2009	2:40:00 PM	1	30.27	29.62	7.56	5.87
CQ2	8/11/2009	2:40:00 PM	0	30.69	29.28	7.49	5.99
CQ2	25/10/2009	1:40:00 PM	0	27.83	34.71	7.94	
CQ2	14/12/2008	9:50:00 AM	2	32.3	36.260539519971		
CQ2	14/12/2008	9:50:00 AM	1	32.3	36.260539519971		
CQ2	14/12/2008	9:50:00 AM	0	32.3	34.964452178474		
CQ2	13/01/2009	10:15:00 AM	1	23.49	2.3319785597893	8.21	
CQ2	17/11/2008	11:00:00 AM	2		36.404782807461		
CQ2	23/02/2009	7:40:00 AM	2	30.78	0.09	7.14	6.95
CQ2	23/02/2009	7:40:00 AM	6	30.79	0.09	6.99	7.08
CQ2	23/02/2009	7:40:00 AM	5	30.79	0.09	7.02	7.06
CQ2	23/02/2009	7:40:00 AM	3	30.79	0.09	7.09	7.05
CQ2	23/02/2009	7:40:00 AM	4	30.79	0.09	7.06	7.08
CQ2	6/12/2009	1:30:00 PM	0	31.37	37.79	7.96	4.78
CQ2	6/12/2009	1:30:00 PM	1	31.23	37.8	7.98	4.71
CQ2	6/12/2009	1:30:00 PM	2	31.06	37.8	7.99	4.59
CQ2	24/03/2009	7:20:00 AM	0	30.25	12.9	7.48	4.33
CQ2	24/03/2009	7:20:00 AM	1	30.28	12.9	7.55	4.18
CQ2	25/10/2009	1:40:00 PM	1	27.82	34.98	7.82	
CQ2	24/03/2009	7:20:00 AM	3	30.28	12.96	7.56	4.02
CQ2	26/03/2010	5:15:00 AM	1	29.29	14.18	7.86	3.33
CQ2	10/02/2010	10:00:00 AM	1	31.98	0.16	7.19	4.37
CQ2	27/01/2010	7:15:00 AM	2	29.46	8.61	7.9	6.42
CQ2	8/11/2009	2:40:00 PM	2	30.2	29.56	7.57	5.77
CQ2	26/03/2010	5:15:00 AM	0	29.95	14.15	7.81	3.35
CQ2	23/02/2009	7:40:00 AM	1	30.79	0.09	7.21	6.71
CQ2	27/01/2010	7:15:00 AM	0	29.46	8.6	7.97	6.58
CQ2	27/01/2010	7:15:00 AM	1	29.48	8.59	7.93	6.48
CQ2	10/02/2010	10:00:00 AM	0	32.02	0.16	7.28	4.47
CQ2	27/02/2010	7:10:00 AM	2	29.16	1.12	8.4	4.84
CQ2	27/02/2010	7:10:00 AM	1	29.16	1.12	8.44	4.89
CQ2	27/02/2010	7:10:00 AM	0	29.15	1.15	8.42	4.92
CQ2	17/11/2008	11:00:00 AM	0		36.188435228388		

CQ2	17/11/2008	11:00:00 AM	1		36.332655386085		
CQ2	23/02/2009	7:40:00 AM	0	30.78	0.09	7.16	6.81
CQ3	2/06/2009	9:30:00 AM	1	24.1	16.890233078196		
CQ3	2/12/2008	12:20:00 PM	0	31.5	35.828088067574		
CQ3	2/06/2009	9:30:00 AM	0	23.5	16.822446303749		
CQ3	9/03/2009	11:40:00 AM	0	30.42	0.24		
CQ3	9/03/2009	11:40:00 AM	1	30.42	0.24		
CQ3	23/03/2009	9:15:00 AM	3	31.05	0.54	7.08	3.55
CQ3	23/03/2009	9:15:00 AM	0	31.4	0.53	7.04	3.95
CQ3	23/03/2009	9:15:00 AM	2	31.05	0.54	7.07	3.56
CQ3	23/03/2009	9:15:00 AM	4	31.05	0.54	7.09	3.54
CQ3	12/03/2010	8:15:00 AM	2	31.11	0.06	7.58	4.14
CQ3	28/02/2010	9:50:00 AM	2	27.99	0.12	7.6	4.85
CQ3	28/02/2010	9:50:00 AM	3	27.98	0.12	7.57	4.93
CQ3	28/02/2010	9:50:00 AM	4	27.97	0.12	7.6	4.93
CQ3	2/12/2008	12:20:00 PM	1	31.5	35.756053631618		
CQ3	28/02/2010	9:50:00 AM	1	28	0.11	7.56	4.93
CQ3	28/02/2010	9:50:00 AM	0	28.04	0.11	7.52	4.87
CQ3	28/02/2010	9:50:00 AM	5	27.97	0.12	7.6	4.92
CQ3	12/03/2010	8:15:00 AM	6	31.09	0.06	7.46	4
CQ3	12/03/2010	8:15:00 AM	5	31.09	0.06	7.49	4.09
CQ3	27/10/2009	9:30:00 AM	3	27.21	30.36	7.82	7.32
CQ3	12/03/2010	8:15:00 AM	3	31.09	0.06	7.54	4.11
CQ3	9/03/2009	11:40:00 AM	2	30.42	0.24		
CQ3	12/03/2010	8:15:00 AM	1	31.11	0.06	7.58	4.13
CQ3	28/02/2010	9:50:00 AM	6	27.96	0.12	7.66	4.8
CQ3	28/02/2010	9:50:00 AM	7	27.96	0.12	7.65	4.94
CQ3	12/03/2010	8:15:00 AM	0	31.11	0.125	7.67	4.18
CQ3	15/12/2008	11:30:00 AM	6	30.9	37.343482167657		
CQ3	15/12/2008	11:30:00 AM	5	30.9	37.343482167657		
CQ3	15/12/2008	11:30:00 AM	4	30.9	37.343482167657		
CQ3	15/12/2008	11:30:00 AM	2	30.8	37.343482167657		
CQ3	15/12/2008	11:30:00 AM	0	30.7	37.488067859357		
CQ3	12/03/2010	8:15:00 AM	4	31.09	0.06	7.53	4.08
CQ3	9/11/2009	3:10:00 PM	0	30.1	29.01	7.83	5.43
CQ3	18/11/2008	1:10:00 PM	5	30.8	34.676953678954		
CQ3	18/11/2008	1:10:00 PM	4	30.8	34.676953678954		
CQ3	18/11/2008	1:10:00 PM	3	30.9	34.605109042497		
CQ3	18/11/2008	1:10:00 PM	2	31	34.533276443128		
CQ3	18/11/2008	1:10:00 PM	1	31.1	34.461455901841		
CQ3	18/11/2008	1:10:00 PM	0	31.2	34.317851077866		
CQ3	23/02/2009	9:35:00 AM	8	30.16	0.06	6.45	7.59
CQ3	23/02/2009	9:35:00 AM	7	30.14	0.06	6.45	7.56
CQ3	9/11/2009	3:10:00 PM	6	29.77	29.03	7.82	5.1
CQ3	9/11/2009	3:10:00 PM	5	29.76	29.03	7.82	5.08
CQ3	9/11/2009	3:10:00 PM	4	29.76	29.03	7.82	5.26
CQ3	9/11/2009	3:10:00 PM	3	29.76	29.02	7.82	5.33
CQ3	4/11/2008	10:55:00 AM	5	29.6	32.669924268455		

CQ3	9/11/2009	3:10:00 PM	1	29.95	29	7.83	5.54
CQ3	31/12/2008	1:00:00 PM	5	30.69	41.525076278162	7.85	
CQ3	23/02/2009	9:35:00 AM	6	30.15	0.06	6.46	7.53
CQ3	23/02/2009	9:35:00 AM	5	30.14	0.06	6.46	7.49
CQ3	23/02/2009	9:35:00 AM	4	30.15	0.06	6.48	7.44
CQ3	23/02/2009	9:35:00 AM	3	30.14	0.06	6.5	7.36
CQ3	23/02/2009	9:35:00 AM	0	30.1	0.06	6.76	7.28
CQ3	23/02/2009	9:35:00 AM	1	30.24	0.06	6.62	7.19
CQ3	27/10/2009	9:30:00 AM	0	27.29	30.44	7.78	7.15
CQ3	27/10/2009	9:30:00 AM	1	27.21	30.37	7.81	6.97
CQ3	27/10/2009	9:30:00 AM	2	27.21	30.27	7.82	7.15
CQ3	23/02/2009	9:35:00 AM	2	30.14	0.06	6.54	7.32
CQ3	27/10/2009	9:30:00 AM	6	27.24	30.35	7.83	7.37
CQ3	27/10/2009	9:30:00 AM	5	27.23	30.34	7.82	7.4
CQ3	27/10/2009	9:30:00 AM	4	27.21	30.35	7.82	7.34
CQ3	9/11/2009	3:10:00 PM	2	29.76	29.02	7.82	5.34
CQ3	15/12/2008	11:30:00 AM	1	30.8	37.343482167657		
CQ3	2/12/2008	12:20:00 PM	3	31.5	35.828088067574		
CQ3	31/12/2008	1:00:00 PM	0	30.69	41.532366674870	7.83	
CQ3	31/12/2008	1:00:00 PM	1	30.69	41.525076278162	7.84	
CQ3	7/10/2008	3:00:00 PM	6	29			3.83
CQ3	7/10/2008	3:00:00 PM	3	29.03			3.88
CQ3	7/10/2008	3:00:00 PM	2	29.06			3.87
CQ3	7/10/2008	3:00:00 PM	1	29.14			3.82
CQ3	7/10/2008	3:00:00 PM	0	29.26			3.78
CQ3	20/10/2008	9:00:00 AM	6	28.9	31.598772800469		
CQ3	20/10/2008	9:00:00 AM	0	29.1	31.242367799417		
CQ3	2/12/2008	12:20:00 PM	4	31.5	35.828088067574		
CQ3	2/12/2008	12:20:00 PM	5	31.5	35.828088067574		
CQ3	31/12/2008	1:00:00 PM	2	30.69	41.525076278162	7.85	
CQ3	31/12/2008	1:00:00 PM	7	30.69	41.525076278162	7.86	
CQ3	22/11/2009	2:40:00 PM	5	30.69	31.89	8.04	6.22
CQ3	2/12/2008	12:20:00 PM	2	31.5	35.828088067574		
CQ3	31/12/2008	1:00:00 PM	4	30.69	41.525076278162	7.85	
CQ3	22/11/2009	2:40:00 PM	0	30.95	31.86	8.04	5.81
CQ3	22/11/2009	2:40:00 PM	1	30.7	31.89	8.04	5.91
CQ3	22/11/2009	2:40:00 PM	2	30.69	31.9	8.03	5.98
CQ3	31/12/2008	1:00:00 PM	3	30.69	41.525076278162	7.85	
CQ3	22/11/2009	2:40:00 PM	4	30.7	31.9	8.04	6.11
CQ3	4/11/2008	10:55:00 AM	4	29.7	32.669924268455		
CQ3	22/11/2009	2:40:00 PM	6	30.68	31.88	8.04	6.26
CQ3	4/11/2008	10:55:00 AM	0	29.9	32.598424866854		
CQ3	4/11/2008	10:55:00 AM	1	29.8	32.598424866854		
CQ3	4/11/2008	10:55:00 AM	2	29.7	32.598424866854		
CQ3	4/11/2008	10:55:00 AM	3	29.7	32.669924268455		
CQ3	31/12/2008	1:00:00 PM	6	30.69	41.525076278162	7.86	
CQ3	22/11/2009	2:40:00 PM	3	30.69	31.9	8.03	6.03
CQ3	14/01/2009	11:45:00 AM	1	24.53	0.130941224905	7.53	

CQ3	27/03/2010	11:00:00 AM	9	29.72	0.38	7.92	5.27
CQ3	27/03/2010	11:00:00 AM	10	29.72	0.38	7.97	5.37
CQ3	14/01/2009	11:45:00 AM	5	24.51	0.1104683563974	7.32	
CQ3	14/01/2009	11:45:00 AM	6	24.49	0.1118242974306	7.27	
CQ3	17/01/2010	2:15:00 AM	0	32.03	2.53	7.32	5
CQ3	17/01/2010	2:15:00 AM	1	32.4	2.35	7.32	4.5
CQ3	17/01/2010	2:15:00 AM	2	32.7	2.21	7.42	4.31
CQ3	17/01/2010	2:15:00 AM	3	32.35	2.37	7.32	4.53
CQ3	17/01/2010	2:15:00 AM	4	32.09	2.29	7.35	4.4
CQ3	17/01/2010	2:15:00 AM	5	31.99	2.28	7.35	4.3
CQ3	17/01/2010	2:15:00 AM	6	31.9	2.26	7.35	4.21
CQ3	3/01/2010	2:35:00 PM	2	29.65	12.14	7.41	5.41
CQ3	14/01/2009	11:45:00 AM	2	24.52	0.1323158037502	7.45	
CQ3	27/03/2010	11:00:00 AM	1	29.72	0.37	7.73	5.07
CQ3	17/01/2010	2:15:00 AM	8	31.07	2.26	7.5	4.12
CQ3	2/02/2010	9:45:00 AM	0	29.01	0.08	7.43	4.96
CQ3	21/12/2009	11:35:00 AM	0	30.83	35.42	7.77	4.09
CQ3	11/02/2009	8:20:00 AM	7	29.05	0.04	7.06	6.04
CQ3	21/12/2009	11:35:00 AM	2	30.76	35.4	7.76	4.11
CQ3	21/12/2009	11:35:00 AM	3	30.76	35.43	7.76	4.11
CQ3	21/12/2009	11:35:00 AM	4	30.76	35.43	7.76	4.1
CQ3	11/10/2009	2:05:00 PM	4	25.23		8.1	8.68
CQ3	11/10/2009	2:05:00 PM	3	25.24	26.16	8.09	8.87
CQ3	14/01/2009	11:45:00 AM	0	24.55		7.64	
CQ3	3/01/2010	2:35:00 PM	0	30.75	12.15	7.37	5.11
CQ3	3/01/2010	2:35:00 PM	1	29.65	12.13	7.39	5.35
CQ3	17/01/2010	2:15:00 AM	7	31.82	2.26	7.4	4.18
CQ3	2/02/2010	9:45:00 AM	6	28.94	0.07	7.11	4.94
CQ3	14/01/2009	11:45:00 AM	4	24.51	0.1364464220356	7.31	
CQ3	14/01/2009	11:45:00 AM	3	24.5	0.1327742535432	7.37	
CQ3	11/02/2009	8:20:00 AM	1	29.1	0.04	7.66	6.01
CQ3	11/02/2009	8:20:00 AM	2	29.1	0.04	7.49	6
CQ3	11/02/2009	8:20:00 AM	3	29.1	0.04	7.42	6.01
CQ3	11/02/2009	8:20:00 AM	4	29.09	0.04	7.24	6.02
CQ3	11/02/2009	8:20:00 AM	5	29.1	0.04	7.16	6.02
CQ3	11/02/2009	8:20:00 AM	6	29.07	0.04	7.15	6.03
CQ3	15/12/2008	11:30:00 AM	3	30.9	37.343482167657		
CQ3	2/02/2010	9:45:00 AM	1	29.05	0.08	7.34	4.92
CQ3	2/02/2010	9:45:00 AM	2	29.03	0.08	7.27	4.89
CQ3	2/02/2010	9:45:00 AM	3	28.98	0.08	7.22	4.91
CQ3	27/03/2010	11:00:00 AM	8	29.72	0.38	7.89	5.22
CQ3	2/02/2010	9:45:00 AM	5	28.95	0.07	7.14	4.91
CQ3	27/03/2010	11:00:00 AM	0	29.73	0.76	7.72	5.08
CQ3	2/02/2010	9:45:00 AM	7	28.97	0.08	7.07	4.91
CQ3	2/02/2010	9:45:00 AM	8	28.95	0.08	7.07	4.97
CQ3	11/02/2009	8:20:00 AM	8	29.02	0.04	6.95	6.04
CQ3	27/03/2010	11:00:00 AM	5	29.72	0.38	7.8	5.13
CQ3	2/02/2010	9:45:00 AM	9	28.92	0.08	7.05	4.98

CQ3	2/02/2010	9:45:00 AM	10	28.92	0.08	7.06	4.98
CQ3	27/03/2010	11:00:00 AM	4	29.72	0.38	7.78	5.12
CQ3	27/03/2010	11:00:00 AM	3	29.72	0.37	7.77	5.09
CQ3	27/03/2010	11:00:00 AM	6	29.71	0.37	7.82	5.15
CQ3	27/03/2010	11:00:00 AM	7	29.72	0.38	7.86	5.19
CQ3	27/03/2010	11:00:00 AM	2	29.71	0.37	7.74	5.12
CQ3	21/12/2009	11:35:00 AM	1	30.75	35.4	7.76	4.11
CQ3	2/02/2010	9:45:00 AM	4	28.95	0.08	7.16	4.93
CQ3	11/02/2010	12:00:00 AM	5	31.88	0.08	6.63	4.4
CQ3	11/10/2009	2:05:00 PM	0	25.78	26.18	8.04	7.7
CQ3	30/01/2009	9:15:00 AM	2	26.75	0.03	7.1	6.34
CQ3	7/12/2009	12:30:00 PM	6	30.4	34.31	7.9	3.84
CQ3	7/12/2009	12:30:00 PM	4	30.41	34.45	7.91	4.01
CQ3	11/02/2010	12:00:00 AM	8	31.86	0.08	6.67	4.35
CQ3	7/12/2009	12:30:00 PM	3	30.4	34.34	7.9	4.04
CQ3	11/02/2010	12:00:00 AM	7	31.86	0.08	6.65	4.22
CQ3	11/02/2010	12:00:00 AM	6	31.88	0.08	6.63	4.37
CQ3	9/03/2009	11:40:00 AM	3	30.42	0.24		
CQ3	21/12/2009	11:35:00 AM	5	30.76	35.42	7.76	4.11
CQ3	30/01/2009	9:15:00 AM	1	26.76	0.03	7.15	6.31
CQ3	7/12/2009	12:30:00 PM	0	30.4	34.32	7.91	4.16
CQ3	3/01/2010	2:35:00 PM	3	29.63	12.14	7.43	5.51
CQ3	7/12/2009	12:30:00 PM	2	30.4	34.33	7.9	4.07
CQ3	11/02/2009	8:20:00 AM	0	29.08	0.04	7.86	6.2
CQ3	7/12/2009	12:30:00 PM	1	30.38	34.32	7.9	4.11
CQ3	11/02/2010	12:00:00 AM	2	31.88	0.08	6.7	4.37
CQ3	11/02/2010	12:00:00 AM	3	31.87	0.08	6.66	4.42
CQ3	11/02/2010	12:00:00 AM	4	31.88	0.08	6.64	4.35
CQ3	21/12/2009	11:35:00 AM	6	30.75	35.41	7.76	4.08
CQ3	30/01/2009	9:15:00 AM	6	26.75	0.03	6.87	6.45
CQ3	3/01/2010	2:35:00 PM	4	29.63	12.2	7.46	5.55
CQ3	3/01/2010	2:35:00 PM	5	29.81	12.43	7.53	5.9
CQ3	3/01/2010	2:35:00 PM	6	30.18	13.34	7.59	6.57
CQ3	11/10/2009	2:05:00 PM	2	25.24	26.16	8.08	8.65
CQ3	30/01/2009	9:15:00 AM	8	26.76	0.03	6.84	6.51
CQ3	9/03/2009	11:40:00 AM	8	30.42	0.24		
CQ3	23/03/2009	9:15:00 AM	1	31.06	0.53	7.06	3.63
CQ3	11/02/2010	12:00:00 AM	0	31.99	0.08	6.72	4.32
CQ3	11/02/2010	12:00:00 AM	1	31.89	0.08	6.7	4.39
CQ3	7/12/2009	12:30:00 PM	5	30.4	34.35	7.9	3.97
CQ3	30/01/2009	9:15:00 AM	7	26.75	0.03	6.86	6.47
CQ3	9/03/2009	11:40:00 AM	4	30.42	0.24		
CQ3	11/10/2009	2:05:00 PM	1	25.36	26.23	8.05	8.85
CQ3	30/01/2009	9:15:00 AM	3	26.75	0.03	7.01	6.38
CQ3	30/01/2009	9:15:00 AM	4	26.75	0.03	6.96	6.41
CQ3	30/01/2009	9:15:00 AM	5	26.75	0.03	6.9	6.43
Mouth	21/01/2009	8:00:00 AM	4	31.48	0.09	7.07	4.52
Mouth	20/01/2009	12:10:00 PM	4	30.72	0.08	6.93	4.73

Mouth	21/01/2009	8:00:00 AM	5	31.48	0.09	7.04	4.53
Mouth	20/01/2009	12:10:00 PM	3	30.72	0.08	6.92	4.76
Mouth	20/01/2009	12:10:00 PM	1	30.71	0.08	6.95	4.79
Mouth	21/01/2009	8:00:00 AM	3	31.48	0.09	7.1	4.52
Mouth	20/01/2009	12:10:00 PM	2	30.71	0.08	6.93	4.77
Mouth	20/01/2009	12:10:00 PM	5	30.73	0.08	6.93	4.71
Mouth	20/01/2009	12:10:00 PM	6	30.73	0.08	6.93	4.7
Mouth	21/01/2009	8:00:00 AM	0	31.47	0.09	7.38	4.92
Mouth	21/01/2009	8:00:00 AM	1	31.48	0.09	7.22	4.62
Mouth	21/01/2009	8:00:00 AM	2	31.48	0.09	7.13	4.56
Mouth	20/01/2009	12:10:00 PM	0	30.72	0.08	7	4.82
N10E	4/11/2009	8:00:00 AM	4	28.42	33.28	7.96	6.7
N10E	4/11/2009	8:00:00 AM	1	28.43	33.34	7.96	6.37
N10E	4/11/2009	8:00:00 AM	3	28.42	33.39	7.97	6.79
N10E	4/11/2009	8:00:00 AM	0	28.43	33.27	7.96	5.91
N10E	4/11/2009	8:00:00 AM	5	28.42	33.4	7.96	6.64
N10E	4/11/2009	8:00:00 AM	6	28.42	33.4	7.96	6.73
N10E	4/11/2009	8:00:00 AM	2	28.42	33.39	7.96	6.88
N10W	4/11/2009	8:15:00 AM	5	28.42	33.21	7.96	0.83
N10W	4/11/2009	8:15:00 AM	6	28.42	33.22	7.95	5.86
N10W	4/11/2009	8:15:00 AM	4	28.42	33.26	7.96	5.4
N10W	4/11/2009	8:15:00 AM	3	28.42	33.24	7.96	5.5
N10W	4/11/2009	8:15:00 AM	2	28.42	33.23	7.98	5.25
N10W	4/11/2009	8:15:00 AM	1	28.42	33.22	7.96	5.02
N10W	4/11/2009	8:15:00 AM	0	28.42	33.2	7.96	4.84
N15	4/11/2009	8:34:00 AM	0	28.55	31.89	7.96	6.87
N20E	4/11/2009	9:00:00 AM	6	28.28	30.21	7.96	6.62
N20E	4/11/2009	9:00:00 AM	0	28.33	30.11	7.98	6.46
N20E	4/11/2009	9:00:00 AM	1	28.3	30.16	7.96	6.67
N20E	4/11/2009	9:00:00 AM	2	28.28	30.2	7.96	7.06
N20E	4/11/2009	9:00:00 AM	3	28.28	30.2	7.96	6.8
N20E	4/11/2009	9:00:00 AM	4	28.28	30.22	7.96	6.63
N20E	4/11/2009	9:00:00 AM	7	28.28	30.26	7.96	6.56
N20E	4/11/2009	9:00:00 AM	5	28.28	30.27	7.96	6.59
N20W	4/11/2009	9:17:00 AM	2	28.33	29.82	7.96	7.14
N20W	4/11/2009	9:17:00 AM	3	28.28	30.04	7.95	7.11
N20W	4/11/2009	9:17:00 AM	4	28.28	30.13	7.95	6.81
N20W	4/11/2009	9:17:00 AM	5	28.27	30.16	7.95	6.7
N20W	4/11/2009	9:17:00 AM	1	28.34	29.81	7.96	6.7
N20W	4/11/2009	9:17:00 AM	0	28.38	29.8	7.96	6.29
N30E	4/11/2009	9:40:00 AM	0	28.39	28.42	7.99	6.34
N30E	4/11/2009	9:40:00 AM	1	28.34	28.43	7.98	6.87
N30E	4/11/2009	9:40:00 AM	3	28.32	28.45	7.98	7.38
N30E	4/11/2009	9:40:00 AM	2	28.34	28.44	7.98	7.39
N30W	4/11/2009	9:53:00 AM	2	28.35	28.38	7.98	7.6
N30W	4/11/2009	9:53:00 AM	3	28.35	28.39	7.98	7.37
N30W	4/11/2009	9:53:00 AM	4	28.34	28.4	7.98	6.92
N30W	4/11/2009	9:53:00 AM	5	28.34	28.4	7.98	6.82

N30W	4/11/2009	9:53:00 AM	0	28.42	28.38	7.99	6.65
N30W	4/11/2009	9:53:00 AM	1	28.39	28.39	7.98	7.01
N35	4/11/2009	10:10:00 AM	0	28.87	27.04	7.91	6.76
N40E	4/11/2009	10:25:00 AM	0	29.08	26.2	7.9	6.56
N40E	4/11/2009	10:25:00 AM	2	28.98	26.2	7.9	7.88
N40E	4/11/2009	10:25:00 AM	1	29	26.2	7.9	7.28
N40W	4/11/2009	10:25:00 AM	0	29.09	26.13	7.94	6.86
N40W	4/11/2009	10:25:00 AM	1	29.04	26.09	7.94	7.28
N40W	4/11/2009	10:25:00 AM	3	29.03	26.07	7.93	7.43
N40W	4/11/2009	10:25:00 AM	2	29.04	26.08	7.94	8.12
N45	4/11/2009	10:55:00 AM	0	29.11	25.16	7.96	6.96
N5	4/11/2009	7:55:00 AM	0	28.66	34.53	8.01	6.05
N50E	4/11/2009	1:05:00 PM	3	28.99	22.93	7.92	7.6
N50E	4/11/2009	1:05:00 PM	2	28.99	22.93	7.92	8.41
N50E	4/11/2009	1:05:00 PM	1	29	22.92	7.96	8.37
N50E	4/11/2009	1:05:00 PM	0	29.03	22.97	7.97	7.47
N50W	4/11/2009	11:30:00 AM	2	29.66	22.95	8.01	8.56
N50W	4/11/2009	11:30:00 AM	1	29.11	22.92	8.02	7.72
N50W	4/11/2009	11:30:00 AM	3	29.07	22.96	8.01	8.22
N50W	4/11/2009	11:30:00 AM	0	29.12	22.91	8.02	7.13
N55	4/11/2009	11:42:00 AM	11.42	29.36	20.9	8.08	7.8
N60E	4/11/2009	12:10:00 PM	1	29.87	18.41	8.12	8.73
N60E	4/11/2009	12:10:00 PM	0	29.99	18.37	8.11	7.53
N60W	4/11/2009	12:25:00 PM	0	30	18.38	8.15	7.94
N60W	4/11/2009	12:25:00 PM	2	29.72	18.45	8.13	
N60W	4/11/2009	12:25:00 PM	1	29.72	18.38	8.14	8.79
NC	17/11/2007	9:35:00 AM	0	30.46	15.27	7.59	
NC	9/01/2009	2:50:00 PM	0	29.79	1.6083961151486	7.56	
NOE	4/11/2009	6:35:00 AM	0	28.75	35.37	7.88	5.93
NOE	4/11/2009	6:35:00 AM	5	28.95	35.43	8.05	6.65
NOE	4/11/2009	6:35:00 AM	6	28.96	35.43	8.05	6.68
NOE	4/11/2009	6:35:00 AM	7	28.96	35.43	8.05	6.68
NOE	4/11/2009	6:35:00 AM	3	28.85	35.4	7.97	6.75
NOE	4/11/2009	6:35:00 AM	2	28.8	35.38	7.94	6.61
NOE	4/11/2009	6:35:00 AM	1	28.8	35.37	7.92	6.55
NOE	4/11/2009	6:35:00 AM	4	28.9	35.41	8.01	7.7
NOW	4/11/2009	7:15:00 AM	7	28.66	35.31	8.03	6.47
NOW	4/11/2009	7:15:00 AM	1	28.67	35.27	8.05	5.47
NOW	4/11/2009	7:15:00 AM	2	28.65	35.27	8.03	5.67
NOW	4/11/2009	7:15:00 AM	3	28.67	35.28	8.03	6.27
NOW	4/11/2009	7:15:00 AM	5	28.67	35.29	8.03	6.41
NOW	4/11/2009	7:15:00 AM	6	28.66	35.03	8.04	6.5
NOW	4/11/2009	7:15:00 AM	4	28.67	35.28	8.03	6.36
NOW	4/11/2009	7:15:00 AM	0	28.63	35.27	8.04	4.96
NW	23/12/2009	12:00:00 AM	6	31.62	16.78	7.53	5.31
NW	18/11/2009	11:00:00 AM	4	30.91	11.96	7.76	6.15
NW	18/11/2009	11:00:00 AM	5	30.84	12.41	7.74	5.99
NW	25/10/2009	10:30:00 AM	2	27.79	10.82	8.05	

NW	25/10/2009	10:30:00 AM	1	27.86	10.24	8.07	
NW	16/10/2009	1:30:00 PM	2	26.45	8.24	7.4	8.91
NW	18/11/2009	11:00:00 AM	0	31.34	11.67	7.83	6.3
NW	16/10/2009	1:30:00 PM	0	26.61	8.3	7.65	9.3
NW	23/12/2009	12:00:00 AM	0	32.41	16.49	7.64	5.71
NW	23/12/2009	12:00:00 AM	1	32.25	16.5	7.63	5.68
NW	23/12/2009	12:00:00 AM	2	31.83	16.54	7.6	5.57
NW	23/12/2009	12:00:00 AM	3	31.7	16.55	7.58	5.41
NW	18/11/2009	11:00:00 AM	3	30.95	11.89	7.75	6.16
NW	23/12/2009	12:00:00 AM	5	31.58	16.61	7.55	5.33
NW	16/10/2009	1:30:00 PM	1	26.53	8.27	7.42	8.99
NW	23/12/2009	12:00:00 AM	7	31.57	17.13	7.5	5.12
NW	23/12/2009	12:00:00 AM	8	31.62	17.29	7.48	5.06
NW	25/10/2009	10:30:00 AM	0	27.92	10.3	8.14	
NW	23/03/2010	8:00:00 AM	0	30.64	0.06	8.56	5.42
NW	23/03/2010	8:00:00 AM	1	30.65	0.05	8.2	5.25
NW	23/03/2010	8:00:00 AM	2	30.65	0.06	8.01	5.17
NW	23/03/2010	8:00:00 AM	3	30.63	0.06	7.91	5.14
NW	23/03/2010	8:00:00 AM	4	30.63	0.06	7.8	5.09
NW	23/03/2010	8:00:00 AM	4	30.63	0.06	7.74	5.04
NW	23/03/2010	8:00:00 AM	6	30.63	0.06	7.67	5.01
NW	23/03/2010	8:00:00 AM	7	30.62	0.06	7.6	4.97
NW	23/03/2010	8:00:00 AM	8	30.62	0.06	7.72	4.94
NW	23/12/2009	12:00:00 AM	4	31.58	16.57	7.56	5.36
NW	9/01/2010	4:20:00 PM	8	31.07	0.21	6.85	4.03
NW	18/11/2009	11:00:00 AM	7	30.76	13.13	7.71	5.79
NW	18/11/2009	11:00:00 AM	1	31.27	11.73	7.78	6.1
NW	9/01/2010	4:20:00 PM	0	31.06	0.21	7.25	4.14
NW	9/01/2010	4:20:00 PM	1	31.06	0.21	7.13	4.13
NW	9/01/2010	4:20:00 PM	2	31.06	0.21	7.08	4.1
NW	9/01/2010	4:20:00 PM	3	31.06	0.21	7.01	4.1
NW	9/01/2010	4:20:00 PM	4	31.06	0.21	6.95	4.1
NW	9/01/2010	4:20:00 PM	5	31.06	0.21	6.89	4.08
NW	9/01/2010	4:20:00 PM	6	31.07	0.21	6.86	4.08
NW	9/01/2010	4:20:00 PM	7	31.07	0.21	6.83	4.06
NW	18/11/2009	11:00:00 AM	6	30.81	12.66	7.74	5.96
NW	18/11/2009	11:00:00 AM	2	30.99	11.87	7.76	6.25
R1	18/01/2009	12:00:00 PM	1	31.02	6.3546753083812 02	7.18	
R1	18/01/2009	12:00:00 PM	3	31.03	6.3546753083812 02	7.09	
R1	18/01/2009	12:00:00 PM	2	31.02	6.3546753083812 02	7.11	
R1	18/01/2009	12:00:00 PM	0	31.03	6.3546753083812 02	7.33	
R2	18/01/2009	12:30:00 PM	2	31.03	6.7878773234029 02	6.91	
R2	21/01/2009	9:45:00 AM	5	30.25	8.5420438574037 02	6.97	5.84
R2	18/01/2009	12:30:00 PM	0	31.09	6.7878773234029 02	7.06	

R2	18/01/2009	12:30:00 PM	1	31.05	6.787877323402902	6.98	
R2	21/01/2009	9:45:00 AM	4	30.25	0.1	7.01	5.85
R2	21/01/2009	9:45:00 AM	3	30.23	0.1	7.3	5.86
R2	21/01/2009	9:45:00 AM	2	30.22	0.1	7.04	5.88
R2	21/01/2009	9:45:00 AM	1	30.22	0.1	7.04	5.9
R2	21/01/2009	9:45:00 AM	0	30.24	0.1	7.15	6.01
Raptis	19/01/2009	10:50:00 AM	4	30.55	6.354675308381202	7.02	
Raptis	19/01/2009	10:50:00 AM	3	30.55	6.354675308381202	7.04	
Raptis	18/01/2009	10:50:00 AM	1	30.57	6.354675308381202	7	6.6
Raptis	19/01/2009	10:50:00 AM	9	30.54	6.354675308381202	7.03	
Raptis	19/01/2009	10:50:00 AM	2	30.55	6.354675308381202	7.04	
Raptis	18/01/2009	10:50:00 AM	0	30.58	6.354675308381202	7.05	
Raptis	19/01/2009	10:50:00 AM	5	30.55	6.354675308381202	7.03	
RQ1	2/12/2008	9:20:00 AM	0	30.6	38.13925855097		
RQ1	21/12/2009	9:30:00 AM	1	29.98	38.84	7.83	3.68
RQ1	9/03/2009	8:45:00 AM	0	28.08	1.08		
RQ1	21/12/2009	9:30:00 AM	2	29.98	38.85	7.83	3.69
RQ1	14/01/2009	10:30:00 AM	1	25.36	0.10325968348	7.74	
RQ1	15/12/2008	6:55:00 AM	3	27.4	40.24358958265		
RQ1	11/10/2009	10:50:00 AM	0	25.8	32.14	8	6.13
RQ1	2/12/2008	9:20:00 AM	1	30.3	38.28409008970		
RQ1	2/12/2008	9:20:00 AM	2	30.2	38.57388573868		
RQ1	9/03/2009	8:45:00 AM	3	28.03	1.1		
RQ1	14/01/2009	10:30:00 AM	0	25.34	9.87746357505302	7.84	
RQ1	15/12/2008	6:55:00 AM	1	27.3	40.09817235494		
RQ1	24/02/2009	7:30:00 AM	0	28.68	0.1	7.44	8.25
RQ1	11/10/2009	10:50:00 AM	2	25	32.11	8.02	7.25
RQ1	15/12/2008	6:55:00 AM	4	27.4	39.73481573757		
RQ1	15/12/2008	6:55:00 AM	0	27.1	40.31631411340		
RQ1	2/12/2008	9:20:00 AM	3	30	38.71884957005		
RQ1	21/12/2009	9:30:00 AM	0	30.03	38.81	7.84	3.66
RQ1	11/10/2009	10:50:00 AM	3	24.97	32.1	8.03	7.29
RQ1	11/10/2009	10:50:00 AM	1	25.02	32.1	8.02	6.87
RQ1	24/02/2009	7:30:00 AM	1	28.67	0.1	7.16	7.97
RQ1	9/03/2009	8:45:00 AM	2	28.03	1.09		
RQ1	9/03/2009	8:45:00 AM	1	28.05	1.09		
RQ1	15/12/2008	6:55:00 AM	2	27.4	40.24358958265		
RQ1	11/02/2010	8:00:00 AM	0	27.63	0.93	7.85	5.67
RQ1	11/02/2009	2:10:00 PM	0	28.36	0.07		7.06
RQ1	11/02/2009	2:10:00 PM	1	28.35	0.07	8.89	7.13
RQ1	11/02/2009	2:10:00 PM	2	28.39	0.07	8.64	7.09
RQ1	11/02/2009	2:10:00 PM	3	28.39	0.07	8.64	7.11

RQ1	11/02/2009	2:10:00 PM	4	28.39	0.07	8.76	7.15
RQ1	11/02/2009	2:10:00 PM	5	28.38	0.07	8.31	7.2
RQ1	11/02/2010	8:00:00 AM	4	27.62	0.95	7.76	5.82
RQ1	11/02/2010	8:00:00 AM	3	27.63	0.95	7.85	5.78
RQ1	28/02/2010	11:30:00 AM	3	25.53	0.77	8.3	6.22
RQ1	11/02/2010	8:00:00 AM	1	27.63	0.93	7.86	5.81
RQ1	21/12/2009	9:30:00 AM	3	29.97	38.89	7.83	3.7
RQ1	21/01/2009	10:30:00 AM	5	30.28	0.12	7.11	5.84
RQ1	21/01/2009	10:30:00 AM	4	30.28	0.12	7.12	5.84
RQ1	21/01/2009	10:30:00 AM	3	30.29	0.11	7.12	5.84
RQ1	21/01/2009	10:30:00 AM	2	30.29	0.11	7.12	5.84
RQ1	21/01/2009	10:30:00 AM	1	30.29	0.11	7.14	5.87
RQ1	13/03/2010	8:15:00 AM	3	28.89	1.73	7.76	3.15
RQ1	28/02/2010	11:30:00 AM	5	25.53	0.77	8.21	6.48
RQ1	27/10/2009	4:00:00 PM	0	27.8	33.33	7.87	6.54
RQ1	11/02/2010	8:00:00 AM	2	27.62	0.94	7.86	5.85
RQ1	3/01/2010	10:15:00 AM	3	27.9	18.63	8.1	5.36
RQ1	27/03/2010	9:20:00 AM	0	29.43	9.05	7.91	3.8
RQ1	27/03/2010	9:20:00 AM	1	29.44	9.1	7.92	3.82
RQ1	7/12/2009	10:20:00 AM	2	29.71	39.18	7.95	4.02
RQ1	7/12/2009	10:20:00 AM	1	29.8	39.16	7.95	4.06
RQ1	7/12/2009	10:20:00 AM	0	29.87	39.13	7.96	4.11
RQ1	27/03/2010	9:20:00 AM	2	29.43	10.05	7.94	3.8
RQ1	27/03/2010	9:20:00 AM	3	29.43	11.23	7.91	3.72
RQ1	27/03/2010	9:20:00 AM	4	29.42	11.4	7.9	3.78
RQ1	2/02/2010	8:25:00 AM	0	28.81	0.44	7.82	5.97
RQ1	3/01/2010	10:15:00 AM	4	27.9	18.66	8.05	5.4
RQ1	2/02/2010	8:25:00 AM	5	28.77	0.45	7.72	5.7
RQ1	3/01/2010	10:15:00 AM	2	27.9	18.55	8.11	5.35
RQ1	3/01/2010	10:15:00 AM	1	27.9	18.46	8.1	5.28
RQ1	3/01/2010	10:15:00 AM	0	27.9	18.42	8.1	5.46
RQ1	21/12/2009	9:30:00 AM	4	29.96	38.92	7.83	3.74
RQ1	17/01/2010	11:00:00 AM	3	29.88	9.62	7.9	5.98
RQ1	17/01/2010	11:00:00 AM	2	29.89	9.57	7.9	5.9
RQ1	17/01/2010	11:00:00 AM	1	29.91	9.23	7.92	5.92
RQ1	17/01/2010	11:00:00 AM	0	30.08	8.99	7.94	6.22
RQ1	28/02/2010	11:30:00 AM	4	25.53	0.77	8.27	6.1
RQ1	28/01/2009	9:15:00 AM	0	25.85	0.11	7.75	7.44
RQ1	18/11/2008	9:30:00 AM	4	29.7	37.488067859357		
RQ1	21/10/2008	10:05:00 AM	3	28.6	34.820678979543		
RQ1	21/10/2008	10:05:00 AM	2	28.6	34.892559602070		
RQ1	21/10/2008	10:05:00 AM	1	28.5	35.252141611676		
RQ1	21/10/2008	10:05:00 AM	0	28.9	34.605109042497		
RQ1	4/11/2008	9:00:00 AM	3	29.4	36.044261446226		
RQ1	4/11/2008	9:00:00 AM	2	29.5	36.044261446226		
RQ1	4/11/2008	9:00:00 AM	1	29.5	35.972191994522		
RQ1	22/11/2009	11:05:00 AM	2	29.98	38.68	7.79	4.48
RQ1	22/11/2009	11:05:00 AM	1	30.1	38.66	7.86	4.6

RQ1	21/01/2009	10:30:00 AM	0	30.29	0.12	7.26	6.16
RQ1	4/11/2008	9:00:00 AM	0	29.6	35.900134195102		
RQ1	31/12/2008	8:15:00 AM	1	28.9	43.233813464549	8.11	
RQ1	18/11/2008	9:30:00 AM	3	29.8	37.488067859357		
RQ1	18/11/2008	9:30:00 AM	2	29.8	37.415769376460		
RQ1	18/11/2008	9:30:00 AM	1	29.9	37.271206251246		
RQ1	18/11/2008	9:30:00 AM	0	30.1	36.982215877672		
RQ1	9/11/2009	11:30:00 AM	3	29.05	35.63	7.75	4.48
RQ1	9/11/2009	11:30:00 AM	2	29.16	35.54	7.74	4.61
RQ1	9/11/2009	11:30:00 AM	1	29.28	35.56	7.75	4.66
RQ1	9/11/2009	11:30:00 AM	0	29.58	35.5	7.76	4.84
RQ1	27/10/2009	4:00:00 PM	2	27.32	33.34	7.84	6.92
RQ1	27/10/2009	4:00:00 PM	1	27.34	33.42	7.85	7.02
RQ1	22/11/2009	11:05:00 AM	0	30.43	38.53	7.82	4.97
RQ1	2/06/2009	7:40:00 AM	0	23.6	25.727048427448		
RQ1	28/02/2010	11:30:00 AM	1	25.53	0.77	8.35	6.28
RQ1	28/02/2010	11:30:00 AM	0	25.53	0.77	8.36	6.1
RQ1	23/03/2009	7:45:00 AM	0	30.79	4.52	7.26	3.53
RQ1	23/03/2009	7:45:00 AM	1	30.6	4.97	7.31	3.42
RQ1	23/03/2009	7:45:00 AM	2	30.1	5.61	7.38	3.56
RQ1	23/03/2009	7:45:00 AM	3	30.08	5.69	7.39	3.51
RQ1	13/03/2010	8:15:00 AM	4	28.86	1.73	7.75	3.65
RQ1	13/03/2010	8:15:00 AM	2	28.88	1.69	7.75	3.08
RQ1	13/03/2010	8:15:00 AM	1	28.86	1.671	7.73	2.99
RQ1	31/12/2008	8:15:00 AM	3	28.98	43.431330854556	8.11	
RQ1	13/03/2010	8:15:00 AM	0	28.86	1.671	7.72	2.95
RQ1	31/12/2008	8:15:00 AM	2	28.96	43.409380891131	8.11	
RQ1	2/06/2009	7:40:00 AM	1	23.6	25.586799226578		
RQ1	7/10/2008	12:15:00 PM	3	29.03			4.3
RQ1	7/10/2008	12:15:00 PM	2	29.02			4.45
RQ1	7/10/2008	12:15:00 PM	1	29.1			4.6
RQ1	7/10/2008	12:15:00 PM	0	29.39			4.69
RQ1	31/12/2008	8:15:00 AM	0	28.9	43.277699935725	8.1	
RQ1	28/02/2010	11:30:00 AM	2	25.53	0.77	8.33	6.3
W1	20/01/2009	10:30:00 AM	0	30.85	0.05	6.66	4.68
W1	18/01/2009	1:50:00 PM	2	31.64	4.2274512780683 02	6.6	
W1	18/01/2009	1:50:00 PM	1	31.64	4.2274512780683 02	6.69	
W1	18/01/2009	1:50:00 PM	0	31.63	4.2274512780683 02	6.84	
W1	20/01/2009	10:30:00 AM	5	30.79	0.05	6.35	4.76
W1	21/01/2009	12:15:00 PM	0	32.11	0.05	6.85	5.09
W1	21/01/2009	12:15:00 PM	8	32.24	0.06	6.32	4.44
W1	21/01/2009	12:15:00 PM	7	32.08	0.05	6.38	4.66
W1	21/01/2009	12:15:00 PM	6	32.06	0.05	6.39	4.7
W1	21/01/2009	12:15:00 PM	5	32.07	0.05	6.39	4.7
W1	21/01/2009	12:15:00 PM	4	32.06	0.05	6.41	4.72
W1	21/01/2009	12:15:00 PM	3	32.08	0.05	6.46	4.77

W1	20/01/2009	10:30:00 AM	3	30.8	0.05	6.39	4.78
W1	21/01/2009	12:15:00 PM	1	32.1	0.05	6.66	4.85
W1	20/01/2009	10:30:00 AM	7	30.79	0.05	6.35	4.74
W1	20/01/2009	10:30:00 AM	6	30.79	0.05	6.34	4.75
W1	20/01/2009	10:30:00 AM	4	30.8	0.05	6.38	4.77
W1	20/01/2009	10:30:00 AM	2	30.82	0.05	6.43	4.77
W1	20/01/2009	10:30:00 AM	1	30.83	0.05	6.51	4.67
W1	21/01/2009	12:15:00 PM	2	32.09	0.05	6.54	4.8
W4	21/01/2009	1:10:00 PM	5	32.58	0.06	6.67	5.36
W4	21/01/2009	1:10:00 PM	4	32.58	0.06	6.72	5.39
W4	21/01/2009	1:10:00 PM	3	32.59	0.06	6.73	5.45
W4	21/01/2009	1:10:00 PM	2	32.58	0.06	6.79	5.75
W4	21/01/2009	1:10:00 PM	1	32.6	0.06	6.9	5.54
W4	21/01/2009	1:10:00 PM	0	32.63	0.06	7.08	5.79
W4	21/01/2009	1:10:00 PM	6	32.57	0.06	6.69	5.36
W6	21/01/2009	2:00:00 PM	3	33.15	0.04	6.52	4.72
W6	21/01/2009	2:00:00 PM	0	33.23	0.04	6.88	5.18
W6	21/01/2009	2:00:00 PM	2	33.15	0.04	6.59	4.79
W6	20/01/2009	9:20:00 AM	0	31.68	0.04	6.76	4.29
W6	21/01/2009	2:00:00 PM	1	33.17	0.04	6.69	4.88
W6	21/01/2009	2:00:00 PM	4	33.15	0.04	6.48	4.7
WQ1	2/02/2010	10:35:00 AM	4	29.54	0.08	7.22	5.14
WQ1	11/02/2009	9:20:00 AM	2	28.95	0.04	6.93	6.19
WQ1	11/02/2009	9:20:00 AM	1	28.95	0.04	7.07	6.18
WQ1	11/02/2009	9:20:00 AM	0	28.95	0.04	7.28	6.16
WQ1	2/02/2010	10:35:00 AM	7	29.54	0.08	7.25	5.14
WQ1	2/02/2010	10:35:00 AM	5	29.54	0.08	7.22	5.13
WQ1	2/02/2010	10:35:00 AM	3	29.56	0.08	7.2	5.15
WQ1	2/02/2010	10:35:00 AM	2	29.64	0.08	7.21	5.16
WQ1	2/02/2010	10:35:00 AM	1	29.57	0.08	7.21	5.13
WQ1	11/02/2009	9:20:00 AM	3	28.94	0.04	6.87	6.19
WQ1	2/02/2010	10:35:00 AM	0	29.55	0.08	7.21	5.41
WQ1	11/02/2009	9:20:00 AM	8	28.93	0.04	6.49	6.23
WQ1	2/02/2010	10:35:00 AM	6	29.54	0.08	7.24	5.11
WQ1	12/02/2010	12:00:00 AM	6	29.71	0.24	7.21	4.67
WQ1	1/03/2010	2:40:00 PM	4	27.41	0.17	7.77	5.08
WQ1	1/03/2010	2:40:00 PM	5	27.41	0.17	7.77	4.78
WQ1	1/03/2010	2:40:00 PM	6	27.41	0.17	7.77	4.76
WQ1	1/03/2010	2:40:00 PM	7	27.4	0.17	7.75	4.65
WQ1	12/02/2010	12:00:00 AM	1	29.69	0.24	7.25	4.9
WQ1	12/02/2010	12:00:00 AM	0	29.73	0.24	7.23	4.74
WQ1	12/02/2010	12:00:00 AM	2	29.69	0.24	7.26	4.75
WQ1	12/02/2010	12:00:00 AM	3	29.69	0.24	7.25	4.75
WQ1	11/02/2009	9:20:00 AM	6	28.96	0.04	6.58	6.22
WQ1	12/02/2010	12:00:00 AM	5	29.7	0.24	7.23	4.72
WQ1	11/02/2009	9:20:00 AM	4	28.96	0.04	6.72	6.22
WQ1	11/10/2009	2:35:00 PM	0	25.72	26.23	8.02	7.25
WQ1	11/10/2009	2:35:00 PM	1	25.52	26.27	8.03	8.28

WQ1	11/10/2009	2:35:00 PM	2	25.55	26.3	8.04	8.08
WQ1	11/10/2009	2:35:00 PM	3	25.44	26.28	8.08	8.37
WQ1	18/01/2010	1:50:00 PM	2	31.44	1.04	7.33	4.64
WQ1	11/02/2009	9:20:00 AM	7	28.96	0.04	6.57	6.23
WQ1	18/01/2010	1:50:00 PM	1	31.78	1.04	7.28	4.61
WQ1	11/02/2009	9:20:00 AM	5	28.96	0.04	6.66	6.23
WQ1	12/02/2010	12:00:00 AM	4	29.69	0.24	7.25	4.78
WQ1	28/03/2010	10:50:00 AM	3	29.56	1.67	7.57	4.68
WQ1	18/01/2010	1:50:00 PM	0	32.39	1.04	7.28	4.72
WQ1	22/12/2009	3:10:00 PM	4	30.78	35.74	7.56	3.11
WQ1	22/12/2009	3:10:00 PM	3	30.78	35.72	7.55	3.17
WQ1	22/12/2009	3:10:00 PM	2	30.79	35.71	7.54	3.24
WQ1	22/12/2009	3:10:00 PM	1	30.82	35.67	7.54	3.28
WQ1	22/12/2009	3:10:00 PM	0	31.79	35.12	7.55	3.55
WQ1	6/12/2009	7:10:00 PM	5	32.33	37.55	8.15	4.46
WQ1	6/12/2009	7:10:00 PM	6	32.33	37.56	8.15	4.43
WQ1	28/03/2010	10:50:00 AM	0	29.63	1.52	7.56	4.75
WQ1	22/12/2009	3:10:00 PM	6	30.78	35.76	7.61	2.98
WQ1	28/03/2010	10:50:00 AM	2	29.58	1.59	7.57	4.7
WQ1	6/12/2009	7:10:00 PM	0	32.34	37.57	8.16	4.75
WQ1	28/03/2010	10:50:00 AM	4	29.55	1.85	7.55	4.64
WQ1	28/03/2010	10:50:00 AM	5	29.55	1.94	7.53	4.72
WQ1	28/03/2010	10:50:00 AM	6	29.55	2.01	7.52	4.8
WQ1	14/01/2009	12:30:00 PM	0	25.22	4.06049863019600 02	7.65	
WQ1	14/01/2009	12:30:00 PM	1	25.13	4.10218574807360 02	7.46	
WQ1	14/01/2009	12:30:00 PM	2	25.09	4.18566235864140 02	7.35	
WQ1	14/01/2009	12:30:00 PM	3	25.11	4.18566235864140 02	7.28	
WQ1	14/01/2009	12:30:00 PM	4	25.13	4.22745127806830 02	7.23	
WQ1	14/01/2009	12:30:00 PM	5	25.08	4.01884602802970 02	7.18	
WQ1	14/01/2009	12:30:00 PM	6	25.09	3.89409834092990 02	7.14	
WQ1	28/03/2010	10:50:00 AM	1	29.6	1.53	7.57	4.73
WQ1	30/01/2009	10:10:00 AM	0	26.05	0.03	7.3	6.66
WQ1	18/01/2010	1:50:00 PM	3	31.64	1.04	7.21	4.65
WQ1	18/01/2010	1:50:00 PM	4	31.37	1.03	7.27	4.65
WQ1	18/01/2010	1:50:00 PM	5	31.33	1.03	7.27	4.63
WQ1	18/01/2010	1:50:00 PM	6	31.33	1.05	7.34	4.65
WQ1	18/01/2010	1:50:00 PM	7	31.33	1.05	7.36	4.68
WQ1	4/01/2010	2:00:00 PM	0	30.02	8.22	7.37	5.67
WQ1	30/01/2009	10:10:00 AM	5	26.01	0.03	6.59	6.82
WQ1	30/01/2009	10:10:00 AM	4	26.01	0.03	6.6	6.8
WQ1	30/01/2009	10:10:00 AM	3	26.05	0.03	6.65	6.79
WQ1	22/12/2009	3:10:00 PM	5	30.78	35.74	7.59	3.67
WQ1	30/01/2009	10:10:00 AM	1	26.06	0.03	6.71	6.74
WQ1	1/03/2010	2:40:00 PM	1	27.39	0.17	7.82	4.78

WQ1	4/01/2010	2:00:00 PM	1	30.01	8.22	7.37	5.57
WQ1	4/01/2010	2:00:00 PM	2	30.01	8.26	7.36	5.58
WQ1	4/01/2010	2:00:00 PM	3	30.01	8.27	7.39	5.59
WQ1	4/01/2010	2:00:00 PM	4	30.02	8.3	7.36	5.57
WQ1	4/01/2010	2:00:00 PM	5	30.01	8.29	7.42	5.61
WQ1	4/01/2010	2:00:00 PM	6	30.01	8.32	7.46	5.76
WQ1	6/12/2009	7:10:00 PM	2	32.32	37.56	8.15	4.51
WQ1	6/12/2009	7:10:00 PM	3	32.34	37.56	8.15	4.51
WQ1	6/12/2009	7:10:00 PM	4	32.35	37.56	8.15	4.48
WQ1	6/12/2009	7:10:00 PM	1	32.35	37.57	8.16	4.78
WQ1	30/01/2009	10:10:00 AM	2	26.06	0.03	6.69	6.77
WQ1	5/11/2008	9:45:00 AM	2	30.3	33.385609266552		
WQ1	7/10/2008	2:15:00 PM	0	29.21			3.97
WQ1	10/11/2009	3:40:00 PM	3	29.88	29.99	7.8	5.09
WQ1	10/11/2009	3:40:00 PM	4	29.92	30.02	7.79	5
WQ1	10/11/2009	3:40:00 PM	5	29.86	29.99	7.79	4.98
WQ1	23/11/2009	2:30:00 PM	0	30.25	32.55	7.93	5.76
WQ1	23/11/2009	2:30:00 PM	1	30.36	32.54	7.93	5.65
WQ1	23/11/2009	2:30:00 PM	2	30.36	32.54	7.93	5.57
WQ1	19/11/2008	9:20:00 AM	5	30.8	36.260539519971		
WQ1	19/11/2008	9:20:00 AM	6	30.8	36.332655386085		
WQ1	10/11/2009	3:40:00 PM	1	29.95	29.96	7.81	5.12
WQ1	5/11/2008	9:45:00 AM	1	30.3	33.313984573700		
WQ1	10/11/2009	3:40:00 PM	0	30.06	29.94	7.82	5.09
WQ1	5/11/2008	9:45:00 AM	3	30.3	33.385609266552		
WQ1	5/11/2008	9:45:00 AM	4	30.3	37.922094495813		
WQ1	5/11/2008	9:45:00 AM	5	30.2	33.672231862879		
WQ1	5/11/2008	9:45:00 AM	6	30.2	33.743918357432		
WQ1	23/11/2009	2:30:00 PM	3	30.38	32.56	7.93	5.55
WQ1	23/11/2009	2:30:00 PM	4	30.37	32.54	7.93	5.52
WQ1	23/11/2009	2:30:00 PM	5	30.3	32.56	7.93	5.49
WQ1	23/11/2009	2:30:00 PM	6	30.4	32.56	7.93	5.5
WQ1	20/10/2008	10:15:00 AM	0	29.5	30.957479711722		
WQ1	1/03/2010	2:40:00 PM	3	27.42	0.18	7.77	4.76
WQ1	5/11/2008	9:45:00 AM	0	30.6	33.099185147537		
WQ1	25/02/2009	8:25:00 AM	1	29	0.07	8.73	7.94
WQ1	3/12/2008	9:15:00 AM	3	31.3	37.126688369104		
WQ1	3/12/2008	9:15:00 AM	4	31.4	36.982215877672		
WQ1	3/12/2008	9:15:00 AM	5	31.4	36.982215877672		
WQ1	19/11/2008	9:20:00 AM	0	31	36.116342530672		
WQ1	25/02/2009	8:25:00 AM	8	28.99	0.07	8.54	7.74
WQ1	25/02/2009	8:25:00 AM	7	28.99	0.07	8.54	7.87
WQ1	25/02/2009	8:25:00 AM	6	28.99	0.07	8.55	7.88
WQ1	25/02/2009	8:25:00 AM	5	29	0.07	8.56	7.88
WQ1	25/02/2009	8:25:00 AM	4	29	0.07	8.58	7.96
WQ1	10/11/2009	3:40:00 PM	2	29.9	29.95	7.8	5.15
WQ1	25/02/2009	8:25:00 AM	2	29	0.07	8.64	7.87
WQ1	7/10/2008	2:15:00 PM	1	29.17			3.75

WQ1	25/02/2009	8:25:00 AM	0	28.99	0.07	8.86	8.15
WQ1	19/11/2008	9:20:00 AM	1	31	36.188435228388		
WQ1	19/11/2008	9:20:00 AM	2	30.9	36.188435228388		
WQ1	19/11/2008	9:20:00 AM	3	30.9	36.188435228388		
WQ1	19/11/2008	9:20:00 AM	4	30.9	36.260539519971		
WQ1	27/10/2009	3:45:00 PM	2	27.87	28.4	7.75	7.35
WQ1	27/10/2009	3:45:00 PM	3	27.62	28.36	7.77	7.33
WQ1	27/10/2009	3:45:00 PM	4	27.63	28.35	7.75	7.8
WQ1	27/10/2009	3:45:00 PM	5	27.7	28.39	7.77	7.14
WQ1	27/10/2009	3:45:00 PM	0	27.9	28.34	7.77	7.14
WQ1	25/02/2009	8:25:00 AM	3	29	0.07	8.6	7.95
WQ1	12/03/2010	7:20:00 AM	3	30.54	0.19	7.62	4.14
WQ1	20/10/2008	10:15:00 AM	6	29.4	30.957479711722		
WQ1	12/03/2010	7:20:00 AM	0	30.55	0.19	7.65	4.25
WQ1	12/03/2010	7:20:00 AM	1	30.54	0.19	7.63	4.22
WQ1	12/03/2010	7:20:00 AM	2	30.55	0.19	7.64	4.18
WQ1	23/03/2009	9:35:00 AM	6	30.49	1	7.38	4.11
WQ1	23/03/2009	9:35:00 AM	5	30.54	1	7.37	4.12
WQ1	23/03/2009	9:35:00 AM	4	30.71	0.94	7.35	4.06
WQ1	23/03/2009	9:35:00 AM	3	30.87	0.82	7.3	3.92
WQ1	23/03/2009	9:35:00 AM	2	30.91	0.78	7.29	3.89
WQ1	8/12/2009	2:00:00 PM	5	30.91	35.05	7.79	3.76
WQ1	23/03/2009	9:35:00 AM	0	31.1	0.71	7.22	3.91
WQ1	8/12/2009	2:00:00 PM	4	30.86	35.01	7.79	3.76
WQ1	12/03/2010	7:20:00 AM	4	30.48	0.2	7.59	4.15
WQ1	12/03/2010	7:20:00 AM	5	30.5	0.2	7.59	4.14
WQ1	12/03/2010	7:20:00 AM	6	30.49	0.2	7.58	4.16
WQ1	11/10/2009	2:35:00 PM	4	25.4	26.25	8.06	8.99
WQ1	16/12/2008	12:10:00 PM	2	30.8	37.560377598113		
WQ1	16/12/2008	12:10:00 PM	1	30.8	37.632698574553		
WQ1	16/12/2008	12:10:00 PM	0	31	37.415769376460		
WQ1	27/10/2009	3:45:00 PM	1	27.74	28.33	7.44	
WQ1	1/03/2010	2:40:00 PM	0	27.39	0.17	7.83	4.89
WQ1	3/12/2008	9:15:00 AM	2	31.3	37.198941645587		
WQ1	23/03/2009	9:35:00 AM	1	30.94	0.79	7.26	3.9
WQ1	3/12/2008	9:15:00 AM	1	31.2	37.343482167657		
WQ1	7/10/2008	2:15:00 PM	2	29.09			3.76
WQ1	7/10/2008	2:15:00 PM	3	29.05			3.76
WQ1	7/10/2008	2:15:00 PM	4	29.05			3.76
WQ1	7/10/2008	2:15:00 PM	5	29.07			3.78
WQ1	1/01/2009	12:30:00 PM	5	29.59	39.916460675133	7.78	
WQ1	1/01/2009	12:30:00 PM	4	29.5	39.923727862569	7.78	
WQ1	1/01/2009	12:30:00 PM	3	29.48	39.771139373462	7.78	
WQ1	1/01/2009	12:30:00 PM	2	29.47	39.538714464906	7.77	
WQ1	1/01/2009	12:30:00 PM	1	29.44	39.524191562334	7.76	
WQ1	8/12/2009	2:00:00 PM	6	30.92	35.05	7.79	3.78
WQ1	7/10/2008	2:15:00 PM	6	29.06			3.8
WQ1	1/03/2010	2:40:00 PM	2	27.39	0.17	7.81	4.74

WQ1	3/12/2008	9:15:00 AM	0	31	37.488067859357		
WQ1	16/12/2008	12:10:00 PM	5	30.7	37.705030770564		
WQ1	16/12/2008	12:10:00 PM	4	30.7	37.705030770564		
WQ1	16/12/2008	12:10:00 PM	3	30.7	37.705030770564		
WQ1	8/12/2009	2:00:00 PM	0	31.01	35.03	7.79	3.84
WQ1	8/12/2009	2:00:00 PM	1	30.96	35.05	7.79	3.86
WQ1	2/06/2009	10:20:00 AM	1	24	17.229494967389		
WQ1	2/06/2009	10:20:00 AM	0	23.6	17.433311907934		
WQ1	8/12/2009	2:00:00 PM	2	30.91	35.02	7.79	3.72
WQ1	8/12/2009	2:00:00 PM	3	30.91	35.03	7.79	3.82
WQ1	1/01/2009	12:30:00 PM	0	29.39	39.270110605641	7.74	
CQ2	1/06/2010	10:30:00 PM	0	21.47	24.46	7.61	6.13
CQ2	1/06/2010	10:30:00 PM	1	21.48	24.46	7.76	6.17
CQ2	1/06/2010	10:30:00 PM	2	21.48	24.46	7.79	6.24
CQ1	2/06/2010	1:00:00 PM	0	21.34	27.22	7.43	6.03
CQ1	2/06/2010	1:00:00 PM	1	21.23	27.18	7.39	5.55
CQ1	2/06/2010	1:00:00 PM	2	21.21	27.2	7.37	5.45
CQ1	2/06/2010	1:00:00 PM	3	21.17	27.21	7.36	5.36
CQ1	2/06/2010	1:00:00 PM	4	21.07	27.29	7.36	5.52
CQ1	2/06/2010	1:00:00 PM	5	21.04	27.31	7.36	5.49
CQ3	2/06/2010	11:50:00 PM	0	23.31	13.79	7.55	6.49
CQ3	2/06/2010	11:50:00 PM	1	23.34	13.78	7.54	6.48
CQ3	2/06/2010	11:50:00 PM	2	23.34	13.77	7.54	6.55
CQ3	2/06/2010	11:50:00 PM	3	23.35	13.76	7.53	6.49
CQ3	2/06/2010	11:50:00 PM	4	23.35	13.76	7.53	6.45
CQ3	2/06/2010	11:50:00 PM	5	23.35	13.75	7.52	6.44
CQ3	2/06/2010	11:50:00 PM	6	23.35	13.74	7.52	6.44
CQ3	2/06/2010	11:50:00 PM	7	23.35	13.74	7.52	6.46
RQ1	2/06/2010	10:00:00 PM	0	22.85	21.29	7.64	6.65
RQ1	2/06/2010	10:00:00 PM	1	22.85	21.37	7.64	6.63
RQ1	2/06/2010	10:00:00 PM	2	22.85	21.37	7.64	6.51
RQ1	2/06/2010	10:00:00 PM	3	22.85	21.38	7.64	6.47
WQ1	3/06/2010	12:45:00 AM	0	23.31	13.16	7.52	7.04
WQ1	3/06/2010	12:45:00 AM	1	23.31	13.16	7.52	6.98
WQ1	3/06/2010	12:45:00 AM	2	23.31	13.16	7.51	6.89
WQ1	3/06/2010	12:45:00 AM	3	23.31	13.16	7.51	6.9
WQ1	3/06/2010	12:45:00 AM	4	23.32	13.14	7.51	6.88
WQ1	3/06/2010	12:45:00 AM	5	23.31	13.17	7.5	6.81
NW	3/06/2010	8:00:00 AM	0	21.55	0.31	8.05	12.39
NW	3/06/2010	8:00:00 AM	1	21.54	0.31	7.92	12.24
NW	3/06/2010	8:00:00 AM	2	21.55	0.31	7.85	12.11
NW	3/06/2010	8:00:00 AM	3	21.54	0.31	7.79	12.01
NW	3/06/2010	8:00:00 AM	4	21.55	0.31	7.73	11.83
NW	3/06/2010	8:00:00 AM	5	21.54	0.31	7.68	11.81
NW	3/06/2010	8:00:00 AM	6	21.55	0.31	7.64	11.75
NW	3/06/2010	8:00:00 AM	7	21.56	0.31	7.61	11.67
NW	3/06/2010	8:00:00 AM	8	21.56	0.31	7.56	11.45

Appendix 6: Banana prawn size and abundance data

Table 4.1 Raw Data – Banana prawns in beam trawls at all sites
2008/2009

	N1											
mm CL	08_Oct	20_Oct	04_Nov	18_Nov	02_Dec	15_Dec	31_Dec	14_Jan	28_Jan	Mid_Feb	Late_Feb	Mid_March
1	159	130	12	0	0	0	0	0	0	0	0	0
2	15	5	1	0	0	0	0	0	0	0	0	0
3	1	0	0	0	0	0	0	0	0	0	0	0
4	1	2	1	1	0	0	0	0	0	0	0	0
5	0	1	1	4	0	0	0	0	0	0	0	0
6	3	2	0	4	0	0	0	0	0	0	0	0
7	4	4	0	4	2	1	0	0	0	0	0	0
8	0	3	0	6	2	2	0	0	0	0	0	0
9	0	6	0	8	1	4	1	0	0	0	0	0
10	0	3	0	7	1	1	1	0	0	0	0	0
11	1	6	0	0	1	1	1	0	0	0	0	0
12	0	4	0	2	1	0	0	0	0	0	0	0
13	0	3	1	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0
16	0	2	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0

23	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0

	N2											
mm CL	08_Oct	20_Oct	04_Nov	18_Nov	02_Dec	15_Dec	31_Dec	14_Jan	28_Jan	Mid_Feb	Late_Feb	Mid_March
1	164	47	62	0	0	0	6	0	0	0	0	0
2	9	3	3	0	0	0	0	0	0	0	0	0
3	0	1	1	0	0	0	0	0	0	0	0	0
4	0	0	0	2	0	0	0	0	0	0	0	0
5	0	3	0	3	0	0	0	0	0	0	0	0
6	1	0	0	1	1	0	0	0	0	0	0	0
7	1	0	0	0	0	0	0	0	0	0	0	0
8	1	3	0	3	0	0	0	0	0	0	0	0
9	0	3	0	0	1	0	0	0	0	0	0	0
10	0	1	1	0	0	0	0	0	0	0	0	0
11	0	1	2	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	2	0	0	0	0	0	0
13	0	0	0	1	0	0	2	0	0	0	0	0
14	0	0	1	0	1	0	1	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	1	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	1	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0

25	0	0	0	0	0	0	0	0	0	0	0	0

mm CL	N3 08_Oct	20_Oct	04_Nov	18_Nov	02_Dec	15_Dec	31_Dec	14_Jan	28_Jan	Mid_Feb	Late_Feb	Mid_March
1	184	154	38	0	1	0	0	0	0	0	0	0
2	20	15	10	0	0	0	0	0	0	0	0	0
3	1	0	1	0	0	0	0	0	0	0	0	0
4	1	0	0	0	0	0	0	0	0	0	0	0
5	1	0	0	0	0	0	0	0	0	0	0	0
6	3	0	0	1	0	0	0	0	0	0	0	0
7	4	0	0	0	0	0	0	0	0	0	0	0
8	2	1	0	0	0	0	0	0	0	0	0	0
9	1	0	1	0	0	2	0	0	0	0	0	0
10	0	2	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	1	0	0	0	0	0
12	0	3	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0
14	0	1	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0
17	1	0	0	0	0	0	0	0	0	0	0	0
18	1	0	1	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0
22	1	0	0	0	0	0	0	0	0	0	0	0
23	0	0	1	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0

mm CL	N4 08_Oct	20_Oct	04_Nov	18_Nov	02_Dec	15_Dec	31_Dec	14_Jan	28_Jan	Mid_Feb	Late_Feb	Mid_March
1	7	10	13	0	0	0	4	0	0	0	0	0
2	6	0	5	0	0	0	0	0	0	0	0	0
3	0	0	2	0	0	0	0	0	0	0	0	0
4	0	1	0	0	0	0	0	0	0	0	0	0
5	0	2	0	0	0	0	0	0	0	0	0	0
6	0	1	0	0	0	0	0	0	0	0	0	0
7	0	1	0	0	1	0	0	0	0	0	0	0
8	0	1	1	1	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	1	0	0	0	0	0
11	0	1	0	0	0	0	1	0	0	0	0	0
12	0	0	1	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0
14	0	1	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0

W1

mm CL	08_Oct	20_Oct	04_Nov	18_Nov	02_Dec	15_Dec	31_Dec	14_Jan	28_Jan	Mid_Feb	Late_Feb	Mid_March
1	2	14	1	0	0	0	0	0	0	0	0	0
2	0	3	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	1	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	0
10	0	1	0	0	0	1	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0
13	0	0	1	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0

W2

mm CL	08_Oct	20_Oct	04_Nov	18_Nov	02_Dec	15_Dec	31_Dec	14_Jan	28_Jan	Mid_Feb	Late_Feb	Mid_March

1	2	0	0	0	0	0	0	0	0	0	0	0
2	2	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	1	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0	0
6	1	0	1	1	2	0	0	0	0	0	0	0
7	0	0	0	1	2	2	0	0	0	0	0	0
8	1	0	4	0	6	4	1	0	0	0	0	0
9	0	0	1	0	2	7	0	0	0	0	0	0
10	0	0	2	1	1	4	0	0	0	0	0	0
11	0	0	0	1	2	4	0	0	0	0	0	0
12	0	0	0	0	4	1	0	0	0	0	0	0
13	0	0	0	0	3	4	1	0	0	0	0	0
14	0	0	0	2	2	4	0	0	0	0	0	0
15	0	0	0	0	0		0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0

	W3											
mm CL	08_Oct	20_Oct	04_Nov	18_Nov	02_Dec	15_Dec	31_Dec	14_Jan	28_Jan	Mid_Feb	Late_Feb	Mid_March
1	31	15	0	0	0	0	0	0	0	0	0	0
2	12	7	1	0	0	0	0	0	0	0	0	0
3	0	9	0	0	0	0	0	0	0	0	0	0

4	1	5	0	0	0	0	0	0	0	0	0	0
5	3	17	0	0	0	1	0	0	0	0	0	0
6	6	21	0	0	11	0	0	0	0	0	0	0
7	3	11	0	0	13	0	0	0	0	0	0	0
8	2	3	0	0	8	0	0	0	0	0	0	0
9	0	2	0	0	2	3	0	0	0	0	0	0
10	0	1	0	0	1	2	0	0	0	0	0	0
11	0	3	1	0	0	0	0	0	0	0	0	0
12	0	7	0	0	1	1	0	0	0	0	0	0
13	0	5	0	0	1	0	0	0	0	0	0	0
14	0	3	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0

	W4											
mm CL	08_Oct	20_Oct	04_Nov	18_Nov	02_Dec	15_Dec	31_Dec	14_Jan	28_Jan	Mid_Feb	Late_Feb	Mid_March
1	6	2	0	1	0	0	0	0	0	0	0	0
2	4	9	0	0	0	0	0	0	0	0	0	0
3	0	6	1	2	0	0	0	0	0	0	0	0
4	0	7	0	4	0	0	0	0	0	0	0	0
5	0	9	1	9	0	0	0	0	0	0	0	0
6	0	7	1	5	0	0	0	0	0	0	0	0

7	0	1	0	4	2	0	0	0	0	0	0	0
8	0	0	0	0	1	0	0	0	0	0	0	0
9	1	0	0	2	1	1	1	0	0	0	0	0
10	0	1	0	2	0	0	0	0	0	0	0	0
11	0	0	1	2	0	0	1	0	0	0	0	0
12	0	0	0	1	1	0	1	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0
15	1	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0
18	1	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0

	W5											
mm CL	08_Oct	20_Oct	04_Nov	18_Nov	02_Dec	15_Dec	31_Dec	14_Jan	28_Jan	Mid_Feb	Late_Feb	Mid_March
1	4	0	0	0	1	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	1	0	0	0	0	0	0	0	0
5	1	0	0	2	0	0	0	0	0	0	0	0
6	2	0	0	0	0	0	0	0	0	0	0	0
7	2	0	0	3	1	0	0	0	0	0	0	0
8	4	0	0	3	2	2	0	0	0	0	0	0

9	4	0	0	4	2	5	0	0	0	0	0	0
10	0	1	0	2	3	14	0	0	0	0	0	0
11	0	0	0	2	0	5	1	0	0	0	0	0
12	0	0	0	1	0	2	1	0	0	0	0	0
13	0	0	0	0	1	5	2	0	0	0	0	0
14	0	0	0	1	0	4	0	0	0	0	0	0
15	1	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	1	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0

mm CL	W6 08_Oct	20_Oct	04_Nov	18_Nov	02_Dec	15_Dec	31_Dec	14_Jan	28_Jan	Mid_Feb	Late_Feb	Mid_March
1	10	4	9	0	0	0	0	0	0	0	0	0
2	0	7	31	0	0	0	0	0	0	0	0	0
3	0	3	1	0	0	0	0	0	0	0	0	0
4	0	4	0	0	0	0	0	0	0	0	0	0
5	3	5	1	1	0	0	0	0	0	0	0	0
6	4	1	1	1	2	0	0	0	0	0	0	0
7	4	0	3	1	4	1	2	0	0	0	0	0
8	3	3	3	0	3	6	2	0	0	0	0	0
9	2	6	3	3	3	2	9	0	0	0	0	0
10	1	2	1	0	4	3	4	0	0	0	0	0

11	0	2	0	3	2	1	12	0	0	0	0	0
12	0	0	0	0	1	0	7	0	0	0	0	0
13	0	0	0	0	1	1	5	0	0	0	0	0
14	0	0	0	1	0	0	3	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0

mm CL	R1 08_Oct	20_Oct	04_Nov	18_Nov	02_Dec	15_Dec	31_Dec	14_Jan	28_Jan	Mid_Feb	Late_Feb	Mid_March
1	4	4	3	0	0	0	0	0	0	0	0	0
2	4	2	2	0	0	0	0	0	0	0	0	0
3	0	1	0	4	0	0	0	0	0	0	0	0
4	2	0	2	1	0	0	0	0	0	0	0	0
5	12	12	14	2	1	0	0	0	0	0	0	0
6	17	22	31	4	1	0	0	0	0	0	0	0
7	11	22	19	1	2	1	0	0	0	0	0	0
8	0	15	11	0	2	0	0	0	0	0	0	0
9	3	12	4	1	4	2	0	0	0	0	0	0
10	2	5	0	0	0	1	1	0	0	0	0	0
11	0	3	3	0	0	1	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0

13	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0
15	2	2	2	2	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0

	R2											
mm CL	08_Oct	20_Oct	04_Nov	18_Nov	02_Dec	15_Dec	31_Dec	14_Jan	28_Jan	Mid_Feb	Late_Feb	Mid_March
1	0	3	1	0	0	0	0	0	0	0	0	0
2	1	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	2	0	0	0	0	0	0	0	0	0
5	1	1	0	1	0	0	0	0	0	0	0	0
6	0	0	1	1	0	0	0	0	0	0	0	0
7	0	0	0	1	0	0	0	0	0	0	0	0
8	1	0	0	1	1	2	0	0	0	0	0	0
9	0	1	0	2	0	0	0	0	0	0	0	0
10	0	3	0	1	1	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0	0
12	0	4	0	0	0	0	0	0	0	0	0	0
13	0	1	0	1	1	0	0	0	0	0	0	0
14	0	0	1	0	0	1	0	0	0	0	0	0

15	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0

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	N1												
mm CL	11_Oct	26_Oct	09_Nov	22_Nov	07_Dec	22_Dec	3_Jan	17_Jan	2_Feb	11_Feb	28_Feb	13_March	27_March
1	0	0	0	0	0	0	0	0	0	0	0	0	268
2	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0	0
5	2	0	0	1	0	0	2	20	0	0	0	0	0
6	0	4	0	0	1	0	1	12	0	1	0	0	0
7	0	0	0	1	1	2	2	16	0	2	0	0	0
8	2	0	2	1	1	0	3	36	0	0	0	0	0
9	0	0	0	2	4	0	4	104	0	0	0	0	0
10	3	0	0	0	0	0	1	68	0	2	0	0	0
11	2	0	0	0	0	0	2	56	0	0	0	0	0
12	0	0	0	0	0	0	0	52	0	0	0	0	0
13	0	0	0	1	0	0	0	36	0	0	0	0	0
14	0	0	0	0	0	0	0	44	0	0	0	0	0

15	0	0	0	0	0	0	0	24	0	0	0	0	0
16	0	0	0	0	0	0	0	20	0	0	0	0	0
17	0	0	0	0	0	0	0	8	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0	0

	N2												
mm CL	11_Oct	26_Oct	09_Nov	22_Nov	07_Dec	21_Dec	3_Jan	17_Jan	2_Feb	11_Feb	28_Feb	12_March	27_March
1	47	54	0	0	0	0	0	10	10	0	0	0	121
2	4	4	0	0	0	0	0	0	0	0	0	0	4
3	0	2	0	0	0	0	0	1	1	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0	0
5	0	1	0	0	0	0	0	3	0	0	0	0	0
6	1	1	0	0	0	1	0	1	0	0	0	0	0
7	0	1	2	0	12	0	2	4	0	0	0	0	0
8	0	1	0	2	3	1	7	2	0	0	0	0	0
9	3	0	1	2	2	1	9	6	0	0	0	0	0
10	3	0	0	0	6	0	12	6	0	0	0	0	0
11	6	0	1	0	2	0	18	3	1	0	0	0	0
12	3	0	0	0	1	0	24	4	0	0	0	0	0
13	1	0	0	0	0	0	18	0	0	0	0	0	0
14	0	0	0	2	0	0	15	0	0	0	0	0	0
15	4	0	1	0	0	0	17	1	0	0	0	0	0
16	1	0	0	1	0	0	7	0	0	0	0	0	0

17	4	0	1	0	0	0	2	0	0	0	0	0	0
18	1	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	1	0	0	0	0	0	0	0	0	0	0
21	0	0	2	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0	0

	N3												
mm CL	11_Oct	26_Oct	09_Nov	22_Nov	08_Dec	21_Dec	3_Jan	17_Jan	2_Feb	11_Feb	28_Feb	13_March	27_March
1	116	0	0	0	0	0	76	4	0	0	0	0	10
2	4	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	2	0	0	0	0	0	0	0	0
5	0	0	0	0	0	2	0	2	0	0	0	0	0
6	0	0	0	2	1	3	0	8	0	0	0	0	0
7	0	1	0	0	3	6	2	6	0	0	0	0	0
8	2	1	0	1	3	3	2	8	0	0	0	0	0
9	1	2	0	1	7	5	14	2	0	0	0	0	0
10	5	0	2	5	1	2	6	8	0	0	0	0	0
11	9	0	3	1	0	3	0	16	1	0	0	0	0
12	1	0	1	5	1	0	18	14	0	0	0	0	0
13	6	0	2	0	0	1	10	10	0	0	0	0	0
14	1	0	1	1	0	0	2	22	0	0	0	0	0
15	1	0	0	0	0	0	0	10	0	0	0	0	0
16	1	0	0	0	0	0	0	0	0	0	0	0	0
17	2	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	2	0	0	0	0	0	0	0	0	0	0
19	1	0	0	0	0	0	0	0	0	0	0	0	0

20	1	0	0	0	0	0	0	0	0	0	0	0	0
21	1	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0	0

	N4												
mm CL	11_Oct	26_Oct	09_Nov	21_Nov	07_Dec	21_Dec	3_Jan	17_Jan	2_Feb	11_Feb	28_Feb	12_March	27_March
1	100	0	0	0	0	0	54	13	0	0	0	0	2
2	8	0	0	0	0	0	8	2	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	1	0	0	0	0	0
5	0	0	0	0	0	3	0	1	0	0	0	0	0
6	0	0	0	0	0	8	0	1	0	0	0	0	0
7	3	0	0	0	14	7	0	1	7	0	0	0	0
8	3	0	0	9	7	8	4	4	0	0	0	0	0
9	13	0	0	15	4	1	15	2	1	0	0	0	0
10	3	0	0	3	6	2	25	4	1	0	0	0	0
11	6	0	0	3	0	0	26	2	0	0	0	0	0
12	1	0	0	1	0	0	25	2	0	0	0	0	0
13	0	0	0	2	0	0	21	0	0	0	0	0	0
14	0	0	0	1	0	0	8	1	0	0	0	0	0
15	3	0	0	2	0	0	2	0	0	0	0	0	0
16	0	0	1	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0

23	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0	0

	W1												
mm CL	11_Oct	27_Oct	10_Nov	23_Nov	08_Dec	21_Dec	04_Jan	18_Jan	2_Feb	12_Feb	1_March	12_March	28_March
1	5	0	0	0	0	0	0	0	0	0	0	0	32
2	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	1	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	2	1	0	0	0	0	0	0
6	0	1	0	0	2	0	7	1	0	0	0	0	0
7	0	2	0	0	5	2	9	6	0	0	0	0	0
8	0	0	1	1	0	1	8	6	0	0	0	0	0
9	0	0	1	0	4	3	15	7	0	0	0	0	0
10	0	0	1	0	1	2	8	8	0	0	0	0	1
11	0	1	0	0	2	0	10	4	0	0	0	0	0
12	2	0	0	0	0	1	17	21	0	0	0	0	0
13	1	0	0	0	3	0	3	8	0	0	0	0	0
14	2	0	0	0	0	0	3	2	0	0	0	0	0
15	1	0	0	0	1	1	1	1	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	1	0	0	0	0	0	0	0	0
18	0	0	0	0	0	1	0	0	0	0	0	0	0
19	0	0	0	0	1	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0

25	0	0	0	0	0	0	0	0	0	0	0	0	0

W2

mm CL	11_Oct	27_Oct	10_Nov	23_Nov	08_Dec	22_Dec	04_Jan	17_Jan	28_Jan	12_Feb	1_March	12_March	27_March
1	5	0	0	0	0	0	32	0	0	0	0	0	0
2	1	0	0	0	0	0	14	0	0	0	0	0	0
3	0	1	0	0	0	0	22	0	0	0	0	0	0
4	14	6	0	1	0	0	3	0	0	0	0	0	0
5	4	7	2	15	1	201	4	0	0	0	0	0	0
6	1	14	6	19	1	142	6	0	0	0	0	0	0
7	2	9	12	7	1	10	2	0	0	0	0	0	0
8	0	1	4	3	3	6	0	1	0	0	0	0	0
9	0	2	3	0	0	0	0	1	0	0	0	0	0
10	3	0	3	0	4	1	0	2	0	0	0	0	0
11	0	0	0	0	2	2	0	0	0	0	0	0	0
12	0	0	0	1	0	0	0	1	0	0	0	0	0
13	0	1	0	0	0	0	0	0	0	0	0	0	0
14	0	1	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	1	1	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	1	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0	0

W3

mm CL	11_Oct	27_Oct	10_Nov	23_Nov	08_Dec	21_Dec	04_Jan	18_Jan	2_Feb	12_Feb	1_March	12_March	28_March
									no sample				
1	3	3	0	0	2	0	0	0		0	0	0	0
2	3	1	0	0	28	0	0	0		0	0	0	0
3	1	5	0	0	47	1	0	0		0	0	0	0
4	3	14	1	2	27	5	0	0		0	0	0	0
5	0	16	2	2	8	6	0	0		0	0	0	0
6	1	12	0	2	15	3	0	0		0	0	0	0
7	0	5	0	2	11	0	0	0		0	0	0	0
8	0	4	1	0	4	1	0	0		0	0	0	0
9	0	1	0	1	5	0	1	0		0	0	0	0
10	0	0	0	0	2	2	2	1		0	0	0	0
11	0	0	0	0	2	1	3	0		0	0	0	0
12	0	0	0	0	3	0	3	0		0	0	0	0
13	0	1	0	0	0	0	1	0		0	0	0	0
14	0	0	0	0	0	0	2	0		0	0	0	0
15	0	0	0	0	0	0	0	0		0	0	0	0
16	0	0	0	0	0	0	0	0		0	0	0	0
17	0	0	0	0	0	0	0	0		0	0	0	0
18	0	0	0	0	0	0	0	0		0	0	0	0
19	0	0	0	0	0	0	0	0		0	0	0	0
20	0	0	0	0	0	0	0	0		0	0	0	0
21	0	0	0	0	0	0	0	0		0	0	0	0
22	0	0	0	0	0	0	0	0		0	0	0	0
23	0	0	0	0	0	0	0	0		0	0	0	0
24	0	0	0	0	0	0	0	0		0	0	0	0
25	0	0	0	0	0	0	0	0		0	0	0	0

W4

mm CL	11_Oct	27_Oct	10_Nov	23_Nov	08_Dec	21_Dec	04_Jan	18_Jan	2_Feb	12_Feb	1_March	12_March	28_March
1	1	18	0	0	0	0	0	0	0	0	0	0	0

2	1	1	0	0	0	0	0	0	0	0	0	0	0
3	0	3	0	0	1	0	0	0	0	0	0	0	0
4	1	1	0	0	0	5	0	1	0	0	0	0	0
5	0	1	0	3	1	10	0	2	0	0	0	0	0
6	1	0	1	4	0	9	0	2	0	0	0	0	0
7	0	0	0	1	0	0	1	1	0	0	0	0	0
8	0	0	0	1	0	1	1	0	0	0	0	0	0
9	0	0	1	0	1	0	2	1	0	0	0	0	0
10	0	0	0	0	0	2	1	2	0	0	0	0	0
11	0	0	0	0	0	1	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	2	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	1	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	2	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0	0

	W5												
mm CL	12_Oct	27_Oct	10_Nov	23_Nov	08_Dec	22_Dec	04_Jan	18_Jan	2_Feb	12_Feb	1_March	12_March	28_March
1	14	0	0	0	1	0	2	0	0	0	0	0	0
2	22	0	0	0	0	0	2	0	0	0	0	0	0
3	21	5	0	0	3	0	2	0	0	0	0	0	0
4	13	30	0	0	3	0	0	0	0	0	0	0	0

5	10	4	0	0	6	5	1	0	0	0	0	0	0
6	2	4	6	0	2	4	4	0	0	0	0	0	0
7	8	7	6	5	4	1	4	0	0	0	0	0	0
8	1	2	7	11	3	1	1	0	0	0	0	0	0
9	3	2	8	7	3	0	0	0	0	0	0	0	0
10	2	3	6	2	5	7	0	0	0	0	0	0	0
11	3	2	5	6	3	5	0	0	0	0	0	0	0
12	0	0	0	0	1	9	0	0	0	0	0	0	0
13	0	0	1	0	1	1	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	1	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0	0

	W6												
mm CL	12_Oct	27_Oct	04_Nov	23_Nov	08_Dec	22_Dec	04_Jan	18_Jan	2_Feb	12_Feb	1_March	12_March	28_March
1	10	0	0	0	0	0	0	0	0	0	0	0	0
2	3	0	0	0	0	0	0	0	0	0	0	0	0
3	5	0	0	0	1	0	0	0	0	0	0	0	0
4	3	0	0	0	0	1	0	0	0	0	0	0	0
5	7	1	0	0	0	0	0	0	0	0	0	0	0
6	0	1	1	1	0	2	1	0	0	0	0	0	0
7	0	1	1	3	1	1	0	1	0	0	0	0	0
8	0	1	1	2	1	1	1	0	0	0	0	0	0

9	0	0	1	1	0	1	0	0	0	0	0	0	0
10	0	0	0	2	0	1	0	1	0	0	0	0	0
11	0	0	0	1	0	0	0	0	0	0	0	0	0
12	0	0	0	1	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0	0

	R1												
mm CL	12_Oct	27_Oct	04_Nov	23_Nov	08_Dec	22_Dec	04_Jan	18_Jan	2_Feb	12_Feb	1_March	12_March	28_March
1	4	0	0	0	0	0	0	0	ns	0	0	0	0
2	34	0	0	0	0	12	0	0	ns	0	0	0	0
3	33	0	0	0	2	84	0	0	ns	0	0	0	0
4	43	0	11	0	0	182	0	1	ns	1	0	0	0
5	8	5	21	2	7	176	0	4	ns	0	0	0	0
6	2	4	19	2	7	54	0	3	ns	4	0	0	0
7	2	5	5	2	24	64	0	0	ns	2	0	1	0
8	0	5	1	0	25	18	0	1	ns	3	0	1	0
9	0	0	0	0	18	12	0	1	ns	1	0	0	0
10	2	0	0	0	49	12	0	1	ns	0	0	1	0
11	0	0	1	0	14	2	0	0	ns	1	0	0	0
12	0	0	0	1	12	0	0	0	ns	0	0	0	0

13	0	1	0	0	0	0	0	0	ns	0	0	0	0
14	0	0	0	0	0	0	0	0	ns	0	0	0	0
15	0	0	0	0	0	0	0	0	ns	0	0	0	0
16	0	0	0	0	0	0	0	0	ns	0	0	0	0
17	0	0	0	0	0	0	0	0	ns	0	0	0	0
18	0	0	0	0	0	0	0	0	ns	0	0	0	0
19	0	0	0	0	0	0	0	0	ns	0	0	0	0
20	0	0	0	0	0	0	0	0	ns	0	0	0	0
21	0	0	0	0	0	0	0	0	ns	0	0	0	0
22	0	0	0	0	0	0	0	0	ns	0	0	0	0
23	0	0	0	0	0	0	0	0	ns	0	0	0	0
24	0	0	0	0	0	0	0	0	ns	0	0	0	0
25	0	0	0	0	0	0	0	0	ns	0	0	0	0

mm CL	R2 12_Oct	27_Oct	09_Nov	23_Nov	08_Dec	R2 22_Dec	04_Jan	18_Jan	2_Feb	12_Feb	1_March	12_March	28_March
1	0	0	0	0	0	0	0	0	0	0	0	0	80
2	0	0	0	0	0	2	0	0	0	0	0	0	8
3	0	0	0	0	0	6	0	0	0	0	0	0	0
4	0	0	0	0	3	2	0	0	0	0	0	0	0
5	1	0	4	1	2	0	0	0	0	0	0	0	0
6	0	4	0	3	1	2	0	0	0	0	0	0	0
7	1	5	6	0	1	2	0	0	0	0	0	0	0
8	0	2	5	1	1	1	0	0	0	0	0	0	0
9	2	1	2	1	7	0	0	1	0	0	0	0	0
10	4	0	0	0	3	1	0	0	0	0	0	0	0
11	1	0	0	0	5	3	0	0	0	0	0	0	0
12	1	0	0	1	5	2	0	0	0	0	0	0	0
13	0	3	0	0	1	0	0	0	0	0	0	0	0
14	0	0	0	1	0	1	0	0	0	0	0	0	0
15	1	0	0	0	1	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0

17	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 4.2 Banana prawns in set nets at all sites

2008/2009

	N0	2_1										
mm CL	08_Oct	20_Oct	04_Nov	18_Nov	02_Dec	15_Dec	31_Dec	14_Jan	28_Jan	Mid_Feb	Late_Feb	Mid_March
1	0	0	0	0	0	0	0	ns	ns	ns	ns	ns
2	0	0	0	0	0	0	0					
3	0	0	0	0	0	0	0					
4	0	0	0	0	0	0	0					
5	0	2	0	0	0	0	0					
6	0	1	0	4	0	0	0					
7	1	3	0	6	2	0	0					
8	0	3	1	12	5	9	1					
9	0	4	0	22	7	10	0					
10	0	2	0	24	10	12	0					
11	0	1	0	14	10	10	0					
12	0	1	0	10	6	9	0					
13	0	0	0	10	6	10	0					
14	0	0	1	4	8	5	0					
15	0	0	0	4	6	5	0					

16	0	0	0	2	2	3	0
17	0	0	0	0	2	3	1
18	0	0	0	0	0	1	0
19	0	0	0	0	0	2	0
20	0	0	0	0	1	1	0
21	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0

	N0-28-W										
mm CL	08_Oct	20_Oct	04_Nov	18_Nov	02_Dec	15_Dec	31_Dec	14_Jan	28_Jan	Mid_Feb	Late_Feb	Mid_Mar
1	0	0	0	0	0	0	0	0	ns	ns	ns	ns
2	0	0	0	0	0	0	0	0				
3	0	0	0	0	0	0	0	0				
4	0	0	0	0	0	0	0	0				
5	0	0	0	0	0	0	0	1				
6	0	0	0	0	0	0	0	4				
7	1	1	0	3	0	0	0	7				
8	0	3	0	23	2	0	0	15				
9	1	3	1	48	15	8	0	18				
10	0	4	0	47	19	10	3	22				
11	0	3	3	46	50	20	2	34				
12	0	4	2	45	40	36	2	50				
13	0	2	1	19	47	32	3	46				
14	0	1	2	19	33	36	1	23				
15	0	2	1	13	26	48	5	9				
16	0	5	0	17	15	54	9	8				
17	0	1	4	11	11	50	2	5				
18	0	2	1	4	13	28	1	2				

19	0	1	0	9	8	18	0	0
20	0	1	0	2	5	18	0	5
21	0	1	0	2	2	6	0	4
22	0	1	0	0	1	8	0	1
23	0	1	0	0	3	10	0	0
24	0	0	0	0	1	8	0	0
25	0	0	0	0	2	6	0	0

mm CL	N0-28-E 08_Oct	20_Oct	04_Nov	18_Nov	02_Dec	15_Dec	31_Dec	14_Jan	28_Jan	Mid_Feb	Late_Feb	Mid_Mar
1	0	0	0	0	0	0	0	ns	0	ns	ns	ns
2	0	0	0	0	0	0	0		0			
3	0	0	0	0	0	0	0		0			
4	0	0	0	0	0	0	0		0			
5	1	0	0	0	0	0	0		1			
6	2	0	0	0	0	0	0		0			
7	0	3	0	4	0	0	0		0			
8	1	7	2	2	2	0	0		0			
9	0	5	4	6	13	2	1		0			
10	0	7	1	6	12	5	2		0			
11	0	6	1	2	15	3	0		0			
12	1	2	5	8	13	6	0		0			
13	0	3	6	8	13	4	4		0			
14	0	0	5	2	16	2	5		0			
15	0	1	8	18	11	7	9		0			
16	1	1	3	16	7	2	7		0			
17	0	1	1	16	7	5	6		0			
18	0	0	2	22	11	3	2		0			
19	0	1	2	12	8	4	0		0			
20	0	0	0	10	6	6	0		0			
21	0	1	0	4	5	2	0		0			

22	0	0	0	0	3	4	0		0
23	0	1	1	2	7	4	0		0
24	1	0	0	0	6	5	0		0
25	0	0	0	0	3	1	0		0
26					4	2			
27					1				
28					1				
29					3				
30						1			

	W3	2 mm										
mm CL	08_Oct	20_Oct	04_Nov	18_Nov	02_Dec	15_Dec	31_Dec	14_Jan	28_Jan	Mid_Feb	Late_Feb	Mid_March
1	0	0	0	0	0	0	0	ns	ns	ns	ns	ns
2	0	0	0	0	0	0	0					
3	0	0	2	0	0	0	0					
4	0	0	9	7	0	0	1					
5	0	0	42	61	4	0	1					
6	0	0	57	67	14	0	10					
7	0	0	30	24	12	9	19					
8	1	0	11	14	7	8	16					
9	0	1	6	2	2	10	18					
10	0	1	1	1	0	0	5					
11	0	0	0	1	0	0	1					
12	0	0	0	0	0	0	0					
13	0	0	0	0	0	0	0					
14	0	0	0	0	0	0	0					
15	0	0	1	0	0	0	0					
16	0	0	0	0	0	0	0					
17	0	0	0	0	0	0	0					
18	0	0	0	0	0	0	0					
19	0	0	0	0	0	0	0					

20	0	0	1	0	0	0	0
21	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0

mm CL	W3 08_Oct	28 mm 20_Oct	04_Nov	18_Nov	02_Dec	15_Dec	31_Dec	14_Jan	28_Jan	Mid_Feb	Late_Feb	Mid_March
1	0	0	0	0	0	0	0	ns	ns	ns	ns	ns
2	0	0	0	0	0	0	0					
3	0	0	0	0	0	0	0					
4	0	0	0	0	0	0	0					
5	0	0	1	2	0	0	0					
6	0	0	3	13	0	4	0					
7	0	0	1	57	1	13	4					
8	0	0	1	41	6	22	16					
9	0	1	1	13	2	22	7					
10	0	0	0	0	1	12	8					
11	2	0	0	0	0	8	2					
12	0	0	0	0	0	2	0					
13	1	0	0	1	0	3	1					
14	0	0	0	0	0	0	0					
15	0	0	0	1	0	0	0					
16	0	0	0	0	0	0	0					
17	0	0	0	0	0	0	0					
18	0	0	0	0	0	0	0					
19	0	0	0	0	0	0	0					
20	0	0	0	0	0	0	0					
21	0	0	0	0	0	0	0					
22	0	0	0	0	0	0	0					

23	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0

2009/2010

	N0	2_1											
mm CL	11_Oct	27_Oct	09_Nov	22_Nov	08_Dec	22_Dec	3_Jan	17_Jan	01_Feb	11_Feb	28_Feb	13_March	27_March
1	0	0	0	0	0	0	0	0	6	0	0	1	0
2	0	0	0	0	0	0	0	0	5	0	0	0	0
3	0	0	0	0	0	0	0	0	14	0	0	0	0
4	0	0	0	0	0	0	0	0	8	0	1	0	0
5	0	0	2	0	0	0	0	1	25	0	6	0	0
6	0	0	3	0	0	1	0	0	28	0	14	0	0
7	1	2	11	0	4	9	0	1	32	0	24	0	0
8	0	0	3	2	6	3	0	1	18	0	29	0	0
9	4	0	1	2	2	10	0	0	17	0	19	0	0
10	1	0	0	2	2	1	1	0	9	1	10	0	0
11	0	0	3	0	0	2	0	0	5	0	12	0	0
12	0	0	1	4	0	4	1	0	2	0	5	0	0
13	0	0	2	2	2	1	0	0	1	0	3	0	0
14	0	0	2	0	0	0	0	0	0	0	0	0	0
15	0	0	2	0	0	1	0	0	0	0	1	0	0
16	0	0	1	0	0	0	0	0	0	0	0	0	0
17	0	0	1	0	0	0	0	0	0	0	0	0	0
18	0	0	1	0	0	0	0	0	0	0	0	0	0
19	0	0	2	0	0	0	0	0	0	0	0	0	1
20	0	0	1	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0

23	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	1	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0	0

N0-28-W

mm CL	11_Oct	26_Oct	10_Nov	22_Nov	08_Dec	22_Dec	3_Jan	17_Jan	01_Feb	11_Feb	28_Feb	13_March	28_March
1	0	0	1	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	1	0	0	0	0
6	0	0	0	0	1	0	0	0	1	0	20	0	0
7	0	0	2	6	0	0	40	2	6	0	52	0	0
8	1	0	2	6	0	0	24	2	2	1	56	0	0
9	1	0	4	6	0	0	144	0	5	0	30	0	0
10	0	0	3	22	8	2	80	0	11	0	38	0	0
11	1	0	7	4	8	3	112	0	7	0	32	0	0
12	0	0	1	14	3	3	160	0	5	0	26	0	0
13	0	0	0	22	5	9	176	0	1	0	14	0	0
14	0	0	1	24	4	7	120	0	1	0	10	0	0
15	0	0	8	20	4	2	32	0	0	0	6	0	0
16	0	0	4	12	1	6	24	0	0	0	4	0	0
17	0	0	3	8	0	2	0	0	0	0	2	0	0
18	0	0	2	4	1	0	0	0	0	0	0	0	0
19	0	0	1	12	0	0	0	0	0	0	0	0	0
20	0	0	1	2	1	1	0	0	0	0	0	0	0
21	0	0	0	2	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	1	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0	0	0	0	0	0

27	0	0	0	0	0	0	0	0	0	0	0	0	0

mm CL	N0-28-E 08_Oct	26_Oct	09_Nov	22_Nov	08_Dec	22_Dec	3_Jan	17_Jan	01_Feb	11_Feb	28_Feb	13_March	28_March
1	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0	0
5	0	1	0	0	0	0	0	0	4	0	0	0	0
6	0	2	2	0	0	0	0	0	32	0	0	0	0
7	1	2	1	0	0	0	2	0	42	0	0	0	0
8	1	1	2	0	0	0	4	1	52	0	1	0	0
9	5	0	7	0	0	0	0	0	10	0	0	0	0
10	2	1	16	8	20	13	4	0	24	0	1	0	0
11	1	0	21	6	34	3	14	0	6	0	0	0	0
12	0	0	13	16	30	8	8	0	2	0	1	0	0
13	0	2	6	6	34	4	10	0	6	0	0	0	1
14	0	1	3	14	34	11	8	0	2	0	0	0	0
15	0	0	4	16	22	8	22	0	0	0	0	0	1
16	0	0	3	8	26	6	8	0	0	0	0	0	0
17	0	0	5	4	12	3	4	0	0	0	0	0	0
18	0	0	9	6	2	4	0	0	2	0	0	0	0
19	0	0	5	8	0	0	0	0	2	0	0	0	0
20	0	0	6	0	0	0	0	0	0	0	0	0	0
21	0	0	4	2	0	0	0	0	0	0	0	0	0
22	0	1	4	0	2	1	0	0	0	0	0	0	0
23	0	0	4	0	2	0	0	0	0	0	0	0	0
24	0	0	2	0	0	0	0	0	0	0	0	0	0
25	0	0	1	2	0	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0	0	0	0	0	0

29	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0

	W3	2 mm											
mm CL	11_Oct	27_Oct	11_Nov	22_Nov	08_Dec	22_Dec	3_Jan	17_Jan	01_Feb no sample	12_Feb	1_March	13_March	28_March
1	0	0	0	0	0	0	0	0		0	0	0	0
2	0	0	0	0	0	0	0	0		0	0	0	0
3	120	20	1	0	24	0	0	0		0	0	0	0
4	232	27	23	6	58	0	0	0		0	0	0	0
5	64	7	85	72	62	280	0	0		0	0	0	0
6	16	6	81	185	94	184	36	1		0	0	0	0
7	0	5	64	139	72	24	23	1		0	1	0	0
8	4	0	10	22	22	8	16	3		0	0	0	0
9	0	0	2	8	0	0	9	5		0	0	0	0
10	8	0	0	2	0	0	0	3		0	0	0	0
11	0	0	0	0	0	2	0	4		0	0	0	0
12	0	0	0	0	4	2	0	0		0	0	0	0
13	0	0	0	0	0	2	0	0		0	0	0	0
14	0	0	0	0	0	0	0	0		0	0	0	0
15	0	0	0	0	0	0	0	0		0	0	0	0
16	0	0	0	0	0	0	0	0		0	0	0	0
17	0	0	0	0	0	0	0	0		0	0	0	0
18	0	0	0	0	0	0	0	0		0	0	0	0
19	0	0	0	0	0	0	0	0		0	0	0	0
20	0	0	0	0	0	0	0	0		0	0	0	0
21	0	0	0	0	0	0	0	0		0	0	0	0
22	0	0	0	0	0	0	0	0		0	0	0	0
23	0	0	0	0	0	0	0	0		0	0	0	0
24	0	0	0	0	0	0	0	0		0	0	0	0
25	0	0	0	0	0	0	0	0		0	0	0	0

mm CL	W3 11_Oct	28 mm 27_Oct	10_Nov	22_Nov	08_Dec	22_Dec	4_Jan	17_Jan	01_Feb so sample	12_Feb	01_Mar	13_March	28_March
1	0	0	0	0	0	0	0	0		0	no sample	0	0
2	0	0	0	0	0	0	0	0		0		0	0
3	0	0	0	0	0	0	0	0		0		0	0
4	1	0	0	0	0	0	1	0		0		0	0
5	0	0	0	0	0	25	1	0		0		0	0
6	6	0	8	13	6	26	10	0		0		0	0
7	1	2	14	49	39	12	8	1		0		0	0
8	0	0	10	7	14	6	8	1		0		0	0
9	4	0	2	7	0	3	5	5		0		0	0
10	1	0	0	0	1	0	1	3		0		0	0
11	2	0	0	0	1	1	0	0		0		0	0
12	1	0	0	0	0	0	1	5		0		0	0
13	0	0	0	0	0	0	1	0		0		0	0
14	0	0	0	0	1	0	0	2		0		0	0
15	0	0	0	0	0	0	0	1		0		0	0
16	0	0	0	0	0	0	0	1		0		0	0
17	0	0	0	0	0	0	0	0		0		0	0
18	0	0	0	0	0	0	0	0		0		0	0
19	0	0	0	0	0	0	0	0		0		0	0
20	0	0	0	0	0	0	0	0		0		0	0
21	0	0	0	0	0	0	0	0		0		0	0
22	0	0	0	0	0	0	0	0		0		0	0
23	0	0	0	0	0	0	0	0		0		0	0
24	0	0	0	0	0	0	0	0		0		0	0
25	0	0	0	0	0	0	0	0		0		0	0