Executive Summary

Smartrivers commenced assessments of the condition of the aquatic environments of the Lower Balonne in June 2000. There is no formal requirement for the program so the sole sponsorship by Smartrivers, a locally based irrigator group, is entirely voluntary. The program has evolved to the stage that it is now routinely conducted in autumn and spring each year at up to 19 riverine sites, including 4 reference sites on neighbouring rivers, and 12 floodplain sites, depending on water availability. This report presents results up to and including those from November 2004. Results are presented for each site followed by regional summaries.

The program includes site-based assessments of physical habitat (riparian and in-stream), water quality, fish and macroinvertebrates. The purpose of the program is to provide long-term baseline data such that significant changes in the condition of the aquatic environment can be detected. Reports of each sampling event are made freely available to any interested party via the Smartrivers web site (smartrivers.com.au).

Initial program design and this report were independently peer reviewed. The program and results to May 2002 were also reviewed as part of the Queensland Governments "*Review of the Science Underpinning Assessment of the Ecological Condition of the Lower Balonne System*" (Cullen, Marchant and Mein 2003). Reviews have been favourable with respect to the scientific basis of the program and its ability to detect change, within reasonable bounds.

The Lower Balonne is an alluvial fan or unconfined floodplain at the southern end of the Condamine Balonne River in south-west Queensland. The area represents an inland delta in that the single channel of the Balonne River splits (at "bifurcations") several times to form the major channels of the floodplain; the Culgoa River, Narran River, Balandool River and Bokhara River. Numerous smaller channels activate during floods and service a wide variety of wetlands and floodplain ecosystems. Discharge decreases in a downstream direction because losses exceed inputs. The rivers flow across the border into NSW where some cease in terminal wetlands (the Narran) while others coalesce and form new systems (Bokhara and Balandool form the Birrie) and others continue through independently (the Culgoa).

The region is summer flow dominant with an extended dry season but major flows have historically occurred in most months. Beardmore Dam and Jack Taylor Weir regulate the system from St George to the first bifurcation at Whyenbah. The dam services the St George Irrigation Area and irrigators within the regulated section. Below Whyenbah irrigation is based on flood harvesting to on-farm storages. Cotton is the major irrigated crop with winter wheat and sheep and cattle grazing the other major agricultural pursuits.

The program to date has largely been conducted during extreme drought conditions in the Lower Balonne. Flows in major floodrunners or on the floodplain did not occur between November 2000 and February 2004. These represent the only times in the reported sampling period in which actual monthly flow exceeded long term average monthly flow. Many floodplain sites and riverine sites on smaller channels or further down the systems have dried completely, in some cases commonly, during the

sampling period. While the reference river to the east, the Moonie, has experienced similar flow conditions to those in the Balonne, the Warrego River to the west emerged from the drought near the commencement of the program and has experienced good summer flows each year since. Little water harvesting occurred in 2002 or 2003 and little cotton was grown outside the regulated area.

Results to date have largely been driven by the drying and re-wetting cycle. The different size of the flows that have occurred has allowed some interpretation of the effects of flushing flows on water quality and on the potential for fish and macroinvertebrates to recolonise previously dry habitats both in the river and on the floodplain.

Riparian zones were assessed using State of the Rivers methodology during the survey of June 2000. A range of levels of disturbance was exhibited but a distinctive riparian corridor was usually present. The species composition was similar at most sites and comprised largely of specialist riparian trees such as river red gum, river tea tree, river cooba and sally wattle along with typically riparian shrubs and ground cover such as lignum, Warrego summer grass, couch, rushes and sedges. Sites surveyed at this time were primarily on larger rivers while those on smaller channels on black soil areas show a greater dominance by coolibah and wattles.

Water quality data shows strong seasonal variation, particularly in isolated waterbodies. Inter-annual differences between the same season were also strong, possibly indicating not only that all years are not the same but that water quality parameters can change markedly over periods of weeks depending on the proximity of sampling to the most recent flow event, amongst other factors. Diurnal variation and vertical stratification tend to be greatest in spring and both forms of variation can be significant. The level of dissolved oxygen in bottom waters was often very low while supersaturation often occurred in surface waters. Floodplain lagoon sites tended to show the greatest range in all forms of measurement.

The water quality data suffers from the same problems as any broad geographic program with infrequent sampling, such as the effect of sampling program logistics on the time of day at which samples are collected and the fact that only two data points are collected for each site each year. Despite this, the results clearly show the changes that occur as waterbodies dry out, such as increasing conductivity and pH. Turbidity was high across the study area; being commonly greater than 500NTU, though the suspended sediment did tend to settle out when flow ceased and waterbodies remained largely free from disturbance by stock or feral animals. This was evidenced as a less turbid surface layer but a highly turbid layer near the bottom. Small flows such as those of summer 2002 tended to disturb but not flush the loose bottom sediment while larger flows such as those of summer 2004 were followed by periods of lower turbidity.

The channels of the Lower Balonne each showed similar water quality results, so much so that a trend of increasing conductivity in a downstream direction has been noted on occasion in all channels. This is possibly a consequence of the natural drier downstream areas. Conductivity levels were generally a few hundred microsiemens with extreme measures of over 1000 μS/cm measured in the last vestiges of water at lagoon sites.

Aquatic plants are sparsely distributed over the study area and are rarely abundant. The most commonly encountered macrophyte was the native herb *Ludwidgia peploides*, followed by the fern, *Azolla filiculoides*. Nardoo, Spiny Mudgrass and Smartweed have been persistent at a few sites while various sedges and rushes have been very sparse but observed at many sites. Benthic filamentous green alga has been common at the waters edge and attached to substrates at the water surface. Similar surface scums have occurred on occasion and these can be blown by the wind to the edges where they form clumps.

Twelve species of native fish (with *Hypseleotris* pooled) and three introduced species have been recorded by the program from a total catch of 19,674 individuals. The most common species in each catchment has been Bony bream, though not on all sampling occasions or at all sites. In Lower Balonne rivers the order of abundance overall is Bony Bream, Smelt, Mosquitofish, Carp gudgeons, Yellowbelly, Carp, Goldfish, Rainbowfish, Spangled perch, Hyrtl's tandan, Eeltailed catfish, Silver Perch, Murray Cod, Purple Spotted Gudgeon and Olive Perchlet. The last three species have rarely been caught though for Cod this probably reflects the poor ability of the sampling equipment to capture this species. None of these species have been caught at the two sites in the Warrego and only Cod was captured in the Moonie. Catfish and Silver Perch have been uncommon while Spangled perch and Hyrtls tandan have been patchily distributed, though at times in substantial numbers.

The catch in the Moonie was strongly dominated by relatively large Bony Bream and Yellowbelly with few small specimens. Spangled perch and Silver perch have also not been caught at the two sites sampled. The Warrego sites have shown a diverse fauna with a low relative abundance of introduced species. The greatest difference in the program was between the faunas from the two reference systems.

Lagoon sites in the Lower Balonne showed higher abundances of Spangled perch and Mosquitofish and this was largely based on recolonisation of many floodplain sites by these species and Carp during the flood of summer 2004.

Fish lengths are measured uniformly and data to date for Bony bream suggests they breed continuously and small Yellowbelly are also recorded on most sampling occasions, though in this case the effect of stocking may influence the interpretation. Occasional very high catches of particular species have mainly resulted from seine hauls in small pools and this strongly impacts on percentage composition data or average abundances.

Data to date suggests that the fish fauna above Whyenbah is different to that of the black soil systems below that point. Species such as Rainbowfish and Carp gudgeons are more common upstream while Spangled perch and Goldfish are more common downstream. Twinspan analysis showed the reference sites on the Warrego plotted with the Balonne (upstream) sites and this possibly indicates that the reason for the result is that these sites have a much higher proportion of sand, are more permanent and they flow more often. Most floodplain sites also tended to plot together. The twinspan results indicate substantial site fidelity in the fish fauna and as will be noted shortly, this is in contrast to the macroinvertebrate results.

The floods of summer 2004 showed that the fish fauna was highly mobile and could rapidly recolonise newly available habitat. Given the severity of the drought the results also indicate that the fauna is quite resilient.

The results are compared to those of the Pilot Sustainable Rivers Audit which was conducted in the Condamine Balonne in 2002. Despite major differences in sampling techniques, the method of site selection and the number of sites sampled, of the 13 species captured by both programs at the time, 11 were in common. The differences related to species captured in very low numbers. Relative abundance however showed some very significant differences and this appeared more to reflect the sites surveyed because the SRA program incorporated more tributary sites and fewer main channel sites. Of the four valleys tested in the Pilot SRA the Condamine Balonne scored highest for fish fauna (compared to the Lachlan, Ovens and Murray).

Ninety-four macroinvertebrate taxa have been identified from the sites to date, mainly at family level or higher. Of these only 17 would be considered common and this form of distribution is common in freshwater systems. The benthic fauna away from the edge tends to be depauperate and consists mainly of chironomids and oligochaetes. The fauna of the edge, not including macrophytes, is diverse, at times abundant and apparently strongly related to the substrate type and the level of development of benthic filamentous algae. This zone is very narrow, possibly reflecting the high turbidity and lack of light penetration but also responding to changing water quality conditions with depth. The edge fauna is dominated by micro-crustaceans, chironomids, ceratopogonids and corixids. The fauna within specialised habitats such as macrophytes or tea tree roots tends to be the most diverse and it can also be very abundant. This habitat shows higher abundances of gilled species such as trichopterans, odonates, baetid mayflies and gastropods. The preference may be a reaction to the substrate itself but also to the oxygen levels in these elevated habitats.

Repeated collection from fixed sites has shown that between 30 and 50% of the taxa collected on one occasion are likely to be captured on the next. This reflects both the intensity of sampling in that more samples would find more species but also the changing of species relative abundance as conditions change. This characteristic is common across test and reference sites. Multivariate analysis showed strong clustering by sampling event, rather than by site as had been the case with fish. There was some association of sites within a river but this was not consistent over time. There was some consistency again with the plotting of Balonne River (upstream) sites with those from the Warrego and in this case it may reflect the dominant substrate and permanence.

Like the fish, the macroinvertebrates showed the ability to rapidly recolonise both riverine and floodplain habitats as they became available.

One interesting trends that was present to various degrees on a number of occasions was increasing diversity and / or abundance of the edge fauna in a downstream direction. The trend was not present in the total fauna because the number of habitats sampled varied between sites but in the edge, which is sampled in a quantitative replicated manner. The result was not caused by different taxa to those that occurred upstream but simply by members of the same community. Possible causes of the

result may relate to habitat concentration downstream or to the greater area of floodplain whereby riverine diversity may reflect floodplain diversity.

Three tortoises have been captured during sampling; Broad-shelled tortoise, Murray River tortoise and Eastern Snake-necked tortoise. The latter has been by far the most common.

Current Status

The data to date indicates that the test and reference rivers have similar water quality and similar ecologies with respect to how they react to seasons and droughts or floods. The macroinvertebrate fauna, based on the level of taxonomic differentiation used, is very similar across the rivers. The fish community is essentially the same but varies greatly between sites. The fish community of the sites sampled in the Moonie is noticeably poorer and the reasons are unknown but it is suggested that local management groups should instigate sampling at a larger number of sites.

The changes in the fish community downstream of Whyenbah appear most likely to be related to changes in the available habitat. Habitat is also a key driver of macroinvertebrate distributions and it is questioned whether more macrophytes were historically present and if land use activities throughout the catchment coupled with the local impacts of grazing and feral animals may have caused a reduction in their distribution and abundance.

The sometimes observed trend of increasing macroinvertebrate diversity and abundance in a downstream direction is at odds with historic perceptions of impact in the Lower Balonne.

The fauna is undoubtedly flexible and resilient and is able to recolonise as habitats become available, including habitats on the floodplain. It will be informative to follow the system through a period of less severe conditions.

Recommendations for Ongoing Monitoring

The report recommends continuation of the program using the same sampling techniques though suggests refinement of water quality data collection and the possible long-term change of nets to electro-fishing as the means to sample fish. Sites should remain fixed as the primary purpose is to detect trends over time.

There is no doubt that when decisions are made in the future with regard to possible management actions that might impact upon aquatic ecosystem health that the results from this program will be the most valuable available to assist all parties. It is therefore extremely regrettable that Smartrivers is the only organization that has recognised this role and seen fit to sponsor the program.