

Case Study: 1. The Clarence River Catchment

The NSW coastline is a great natural asset, making an enormous contribution to the economy. The resources of coastal catchments such as the Clarence River Catchment, especially their estuaries and floodplains, collectively support around 90% of the NSW population.

Human activities are placing unprecedented pressure on these coastal resources. There are conflicts over the competing needs of urban development, business, tourism, recreation and conservation.

The coast must be managed effectively to ensure sustainability of these resources. A healthy coast is particularly significant to, tourism, agriculture, aquaculture, recreational and commercial fisheries as well as biodiversity.

Important Features of the Clarence River Catchment

The Clarence River is the largest of all NSW coastal rivers in both catchment area and river discharge. The 250km long river, located on the far north coast of NSW, has a catchment area of approximately 22,400 square kilometres.

The Clarence River Catchment is defined by the following divides:

- the Macpherson Ranges (North);
- the Baldblair and Doughboy Ranges and the Dorrigo Plateau (South); and
- the Great Dividing Range (West).

A large proportion of the Clarence River Catchment is National Park (20%) and State Forest (30%). These protected areas have helped to reduce human impacts on the River.

The Clarence **floodplain** consists of low lying, flat alluvial plains, intersected by lagoons, channels and creeks. The 800 square kilometre floodplain supports the largest commercial fishing region in the State as well as significant sugar cane, timber and beef cattle industries. There is a growing tourist industry focused around water activities such as recreational fishing, swimming, boating and surfing.

The mouth of the river is located between the towns of Yamba and Iluka, with the tidal limit (estuary) reaching 108 km inland to Copmanhurst. The towns of Grafton, Maclean, Yamba and Iluka are the main centres of population along the estuary.

In the **upper catchment** activities such as forestry, farming, water extraction, mining, septic sewage treatment and infrastructure development have an impact on water quantity and quality downstream.

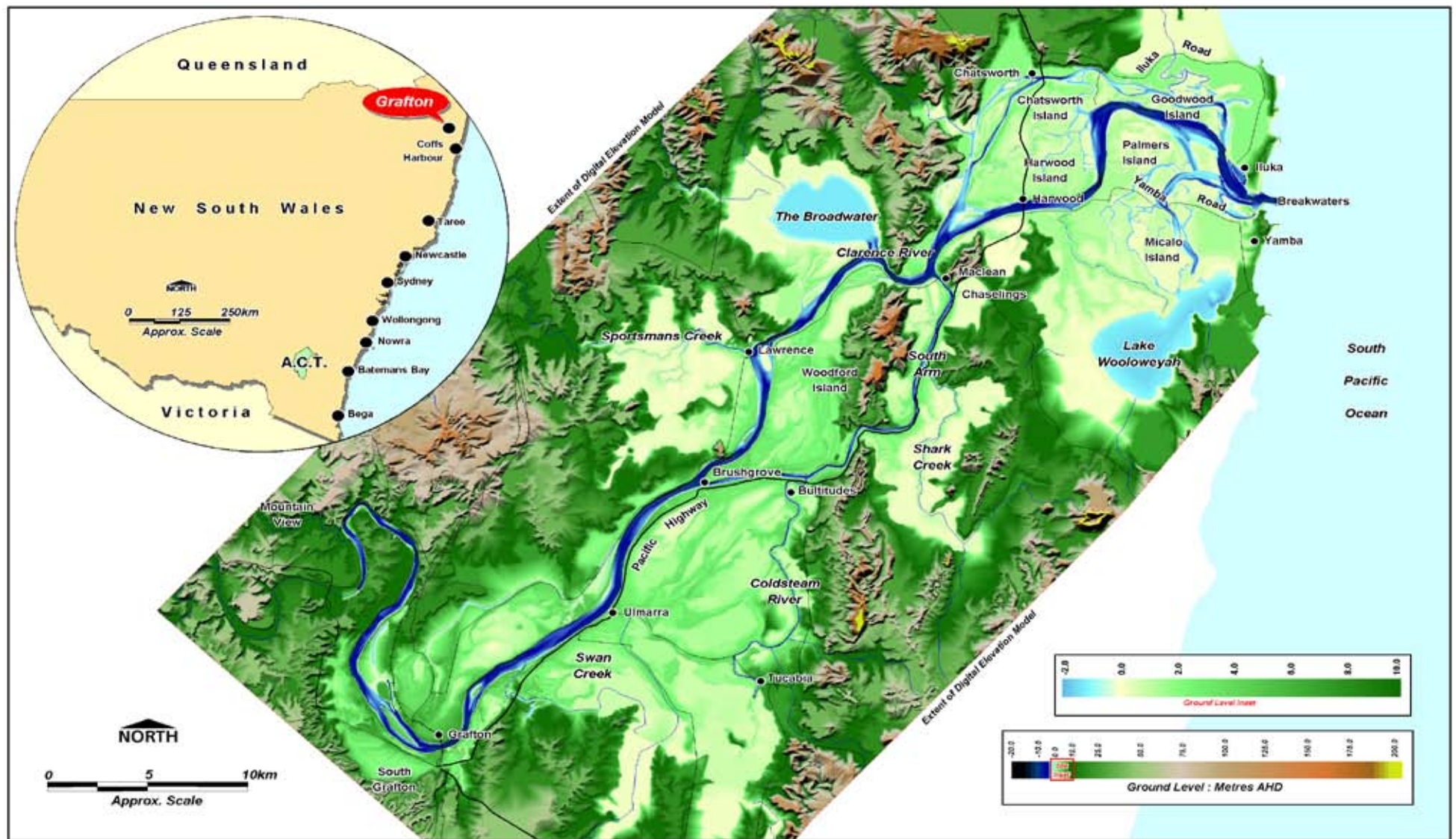
Within the **lower catchment** the loss of wetlands and riparian vegetation, flood mitigation and drainage works, dredging, pollution and associated eutrophication, urban development, commercial and recreational fishing, waste disposal and the exposure of acid sulfate soils have impacted on water quality, estuarine ecosystems and resources.



The Clarence River Estuary, courtesy of DECC



Clarence River floodplain, courtesy of DECC

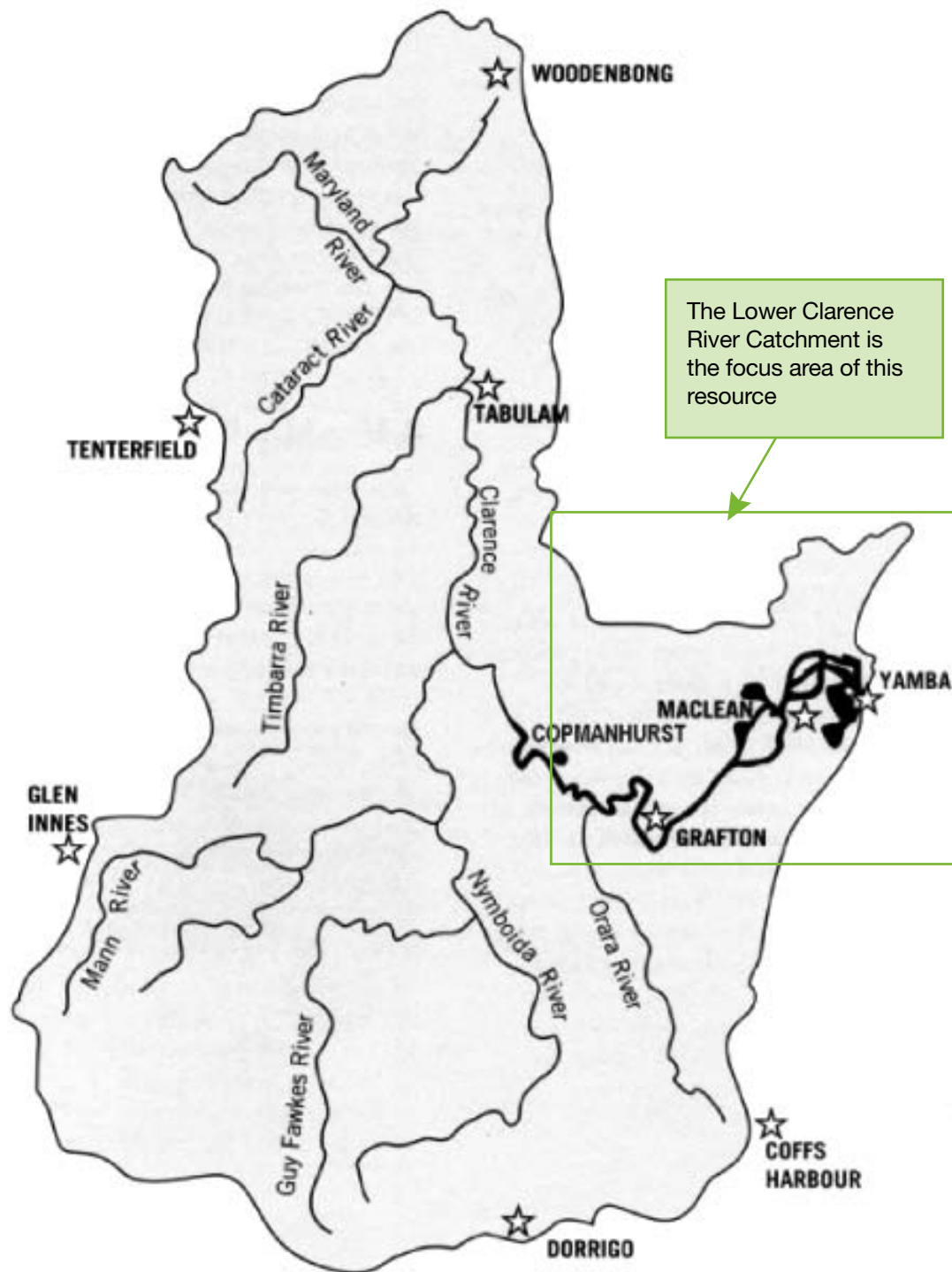


Locality Map and Study Area

Drawing 01

This diagram shows the extent of the Lower Clarence River Catchment, including the estuary, wetlands and floodplain, source: Clarence Valley Council

Figure 1.1: Clarence River Catchment



The Clarence River Catchment and Lower Clarence River Catchment, source: modified from "Independent Inquiry Into The Clarence River System" Final Report November 1999, Healthy Rivers Commission of New South Wales NSW

Snapshot on Important Aquatic Habitats of the Lower Clarence River

The Clarence Estuary has a wealth of aquatic habitats that support many species of fish (e.g. mullet, flathead and bream) as well as crustaceans and also supports the most productive estuarine wild catch fishery in the State. It features:

- the 2nd largest area of seagrass (0.826 square km of *Zostera* and *Halophila*, excluding *Ruppia* which is sometimes classified as seagrass as well);
- the 4th largest area of mangroves (7.653 square kilometres); and
- the 8th largest area of saltmarsh (2.91 square kilometres).

Mangrove and saltmarsh are also significant habitats for waterbirds, many of which are threatened.

These areas have been mapped by NSW Department of Primary Industries as part of the NSW Comprehensive Coastal Assessment. See below:

<http://www.naturalresources.nsw.gov.au/estuaries/inventory/data/vegetation/clarence.shtml>

The Lower Clarence Catchment also features saltwater wetlands (in the estuary) and freshwater wetlands (just above the estuary). These include:

- Wooloweyah Lagoon – covers an area of 2390 ha and supports large areas of seagrass, mangroves and saltmarsh. It is an important habitat for many species of migratory waders and commercial fish species.
- The Broadwater – a large tidal waterbody of the Clarence estuary fringed by mangroves and supporting seagrass and saltmarsh communities. It provides a drought refuge for migratory species and is an important habitat for many commercial fish species.
- Everlasting Swamp – a freshwater wetland with vegetation including Swamp Oak, Spike-rush, Water Couch, Common Reed and Spiny Mudgrass.

However, many of these habitats have experienced decline in recent years, with seagrass declining by 80% between 1940 and 1986 and by 50% in the last 20 years. This has serious consequences for marine biodiversity, the viability of the fishing industry and for the community in terms of reduced availability of fresh local wild caught seafood in the region.

This has largely been caused by agricultural, industrial and urban development through land clearing (particularly removal of vegetation from riverbanks), nutrient and sediment rich runoff from developed land, dredging, land reclamation and flood mitigation works.

Thus it is important to understand that all activities within a catchment cumulatively impact on land and water resources downstream, particularly on aquatic habitats including saltmarsh, seagrass, mangroves and the fisheries they support and thus must be managed to minimise such negative impacts that result in declines in these habitats (see facts sheets on *Estuaries and Land and Water Management in the Lower Clarence River Catchment*).



Mangroves in the Clarence River Estuary, source: Clarence Valley Council



Mangroves and saltmarsh on Wooloweyah Lagoon, source: Clarence Valley Council

What Are Some of the Natural Resource Management Issues of the Lower Clarence River Catchment?

Some of these issues include:

- managing floodplain activities that impact on water quality in the estuary;
- maintaining riparian and estuarine wetland ecosystems necessary to support the professional and recreational fishing industries;
- minimising the impacts of floods on local towns and agricultural productivity without interrupting water supply;
- ensuring sustainable fishing practices;
- minimising waste created by different land and water uses;
- management of coastal landforms and marine environments; and
- sustainable urban growth.



Fishing boat on the Clarence River, source: Debra Novak

These issues are being addressed by legislation, policy and a variety of management plans and strategies such as Coastal Management Plans (NSW DECC), Catchment Action Plans (CMAs), Regional Growth Strategies (NSW Department of Planning) and Regional Biodiversity Conservation Plans (NSW DECC) and by encouraging many other sustainable practices by everyone operating within the catchment. See fact sheets on *Land and Water Management Issues in the Lower Clarence River Catchment*, *The Lower Clarence River Catchment Fishing Industry* and *Waste Management in the Lower Clarence River Catchment*.

Case Study: 2. Land and Water Management Issues in the Lower Clarence River Catchment

What Are Some of the Land and Water Management Issues in the Clarence River Catchment?

The Clarence River Catchment has many land and water management issues that are typical of many other catchments and estuaries along the NSW east coast.

However these issues have specific details and management options that are unique to the Clarence River. As in any catchment, all of the various land and water management options should be sustainable.

Land and water within a catchment is often managed for multiple benefits that might include such things as agricultural production, biodiversity conservation, good water quality, soil health, flood mitigation and for supporting human lifestyles and living places.

Sustainable land and water management means managing land and water without damaging ecological processes or reducing biological diversity.

Quite often there are competing interests in land use and water management outcomes. For example, an irrigator may wish to extract more water from the river in times of drought, whereas a fisher would want this water to remain in the river for wetland health and fish survival. Thus there needs to be cooperation between individuals, groups and governments to balance often opposing social, economic and environmental needs.

Sometimes people get things wrong and past practices and approaches need to be stopped, refined or modified.

Generally land use and water management options are regulated at a broad scale by Commonwealth and State legislation, and at a more detailed local or regional scale by Council and State Government Departments for such things as approvals for developments and activities. However, it is the actions of individuals at work or at home that can often play a large part in whether the natural resources of a catchment are managed in a sustainable way.



Drained wetland on Bleechmores backswamp, source: Clarence Valley Council

Degradation of the Clarence Floodplain

Around ten years ago the Clarence River Floodplain was far from healthy. Wetlands had been drained, estuaries were cut off from important wetland habitat areas and water of poor quality was entering the river system. This was the outcome after more than a century of modifying the lower catchment with flood protection structures like floodgates and drains and the loss of important habitat areas to other land uses.

Flood mitigation works have been carried out for over a century on the Clarence, particularly in the 1960s and 1970s. Over the years many extensive drainage systems and hundreds of floodgates and other structures have been constructed. Their purpose has been to provide some protection from floods in both urban and rural areas along with drainage of water from the floodplain for agriculture.



An example of floodgate structures on a drained floodplain, source: OceanWatch Australia

Flood mitigation has also had some adverse impacts on the coastal floodplains. A combination of drainage and blockage of natural creek systems has often led to poor water quality, fish kills, and reduced habitat for fish and other aquatic species. In some areas over-drainage has resulted in acid sulfate soils being exposed

and acidic runoff and associated toxic metal pollution problems in waterways, as well as the loss or drying of some natural wetland areas.

As a result, commercial and recreational catches declined, tourism and other local businesses which depend on healthy coastal environments, particularly the availability of local wild caught seafood, suffered.

Fixing Up Habitats on the Clarence Floodplain

There have been several initiatives/projects that have involved a wide range of stakeholders coming together and working on improving habitats on the Clarence Floodplain. This includes the Clarence Floodplain Project.

SNAPSHOT – Clarence Floodplain Project

Background

It was evident that something needed to be done to improve the situation in the Clarence. A group of people came together from various backgrounds including landholders, fishermen, canegrowers, community members, as well as people involved in floodplain management from NSW Government Agencies, Local Council and the Catchment Management Authority and formed a partnership to address these issues as part of the 'Clarence Floodplain Project'. This project commenced in 1997 with the aim of improving the environmental management of the Council's flood mitigation infrastructure and trying to repair some of the past impacts of flood mitigation on floodplain ecosystems.

Funding and Key Stakeholders

The project is mainly funded through State and Federal Government funding grants, through organisations such as the Northern Rivers Catchment Management Authority, Department of Environment and Climate Change, the State Environmental Restoration Trust and Local Council. It is also supported by the Northern Rivers Catchment Management Authority, other NSW Government departments, the Clarence Cane Growers Association, Clarence River Fisherman's Cooperative, North Coast Environment Council, Indigenous Land Councils, the University of New England, Southern Cross University and local landholders and community groups.

What Changes Were Made

One important part of the project involved using advanced floodgate technology that allowed flood mitigation structures to be modified to reduce impacts on watercourses in non-flood times, while still providing flood protection. This included tidal floodgates, winches to lift floodgates, 'fish flaps' in weirs and a range of water retention structures used to raise water levels. The installation of automatic and manually winched floodgates meant that habitat areas were no longer shut off from the estuary permanently and salty tidal waters were able to move up into these areas. Mangrove and saltmarsh wetland areas began to regenerate in response to inundation by these saline tidal waters.

The careful management of the floodgates and drains on the Clarence Floodplain has also been crucial to the project. Clarence Council Floodplain management staff work closely with landowners to develop Management Plans for creeks, drains and wetlands. Landowners often become the authorised 'floodgate operators' and manage the systems once modification works are completed.

As a result of some of these improved land and water management practices, the Clarence Catchment has become much healthier. Water quality has improved, fish and waterbird habitats including wetlands have undergone considerable improvement and grazing, fisheries and sugarcane productivity has increased. However, the main success of the project lies in the cooperation of stakeholders involved in the project, particularly the landowners who have made a big contribution towards this project through involvement in the planning and management of drains and watercourses on their land, operation of the water control structures, monitoring water conditions and working with Council staff.

This project demonstrates how the land use and water management actions of individual landowners can make a dramatic difference to improvements in the health of the estuary environment of the Clarence River.



A tidal floodgate with a winch which allows for improved water exchange, source: Clarence Valley Council



Landholders opening a winch to improve flushing of the drain and thus improve water quality, source: Clarence Valley Council



Drained wetland on the Clarence floodplain, source: Clarence Valley Council



Same wetland with salt couch beginning to grow once month after water works were undertaken to allow water back on the land, source: Clarence Valley Council

Achievements

Since the 'Clarence Floodplain Project' began more than 200 kilometres of waterways have been opened up to more regular flooding, tidal flushing and have regenerated to a much healthier condition. Some 250 landowners have been involved in the management of creeks and drains on their properties and more than 60 watercourse management plans have been developed and put into operation.

Benefits from this active management is usually a combination of the following:

- increased tidal exchange to improve water quality;
- improved passage, habitat and breeding areas for fish and other aquatic species;
- reduced risk of fish kills;
- better control of introduced aquatic weeds;
- reduced incidence of algal blooms;
- neutralisation of acid water in creeks with salt water from the river;
- raised watertables in acid sulfate areas (limiting further oxidation);
- improved drainage following floods;
- better water retention and water level control on wetland areas;
- increased grazing productivity on previously drained wetlands during drier months of the year;
- improved waterbird habitat;
- better control of ground water levels;
- stabilised bank erosion; and
- stabilised stock access points and exclusion of stock from unstable banks (areas where they are likely to bog).

Rehabilitating the Little Broadwater

In the past the little Broadwater was a 250 hectare wetland located on the Lower Clarence Floodplain. It was naturally inundated by tidal waters flooding in and out from the sea and the wetland once contained mangroves, swamp oaks and reeds.

However in the 1920's weirs and floodgates were constructed to reduce flooding and allow the wetland to drain so it could be better suited to grazing. However this decision failed to recognise the important role estuary wetlands play in the health of the catchment. These structures isolated the wetland from the river and the land uses that followed resulted in loss of fish habitat and loss of waterbird habitat. The drainage works exposed acid sulfate soils resulting in acid discharge into Sportsmans Creek and reduced availability of the land for uses such as grazing.

Clarence Valley Landowners and the Council developed a Drain Management Plan in 2000. The area now has a winch, fish friendly floodgate, water control structure and tidal gates to reestablish tidal exchange.



An area of former broadwater wetland showing salt and acid sulfate scalding



The same area after changes that allowed normal tidal flushing and the removal of cattle. Much of the wetland vegetation is now returning, source: Clarence Valley Council

The Department of Primary Industries, WetlandCare Australia, Department of Environment and Climate Change, Northern Rivers Catchment Management Authority and both Southern Cross and New England Universities also undertook projects to help rehabilitate the wetland (e.g. fencing off wetlands to restrict cattle access).

The results to date have included:

- a reduction in acid runoff and an improved quality of water in the estuary;
- an increase in overall biodiversity including important estuary and fresh water life such as prawns, mullet, yellow fin bream, herrings, catfish, eels, freshwater turtles and the reappearance of some of the salt tolerant plants and sedges; and
- a vast increase in waterbirds including ibis, terns, brolgas, storks, osprey, black swans and pelicans.

The project depended on the cooperation of landowners who benefited from improvements in land and water resource benefits as did the recreational and professional fishers.

See: Clarence Valley Council booklet “Little Broadwater – a successful partnership in the sustainable management of natural resources” at <http://www.clarence.nsw.gov.au>

Recreational Fishers Funding Habitat Improvements

The NSW Government has brought in a fishing licensing scheme which raises funds from the purchase of the licenses that are directed back into projects for the benefit of all fishers, as part of the NSW Recreational Fishing Trust.

In 2002 the NSW Recreational Fishing Saltwater Trust provided \$120,000 from recreational fishing license fees for a pilot fish habitat rehabilitation program in the Lower Clarence River Catchment. The community responded enthusiastically with successful applications to from individual landholders, Landcare and Rivercare groups, local angling clubs, professional fishers, local government representatives, and environment groups.

As a result 13 projects were undertaken to rehabilitate parts of the local aquatic environment. They made significant improvements to the environmental health of the estuary by achieving the following:

- rehabilitation of over 300 ha of estuarine wetland and other floodplain habitat;
- re-snagging (adding fallen branches or logs into the river for fish habitat) and removing exotic weeds and replanting riparian vegetation along river banks;
- reinstating over 10 km of fish passage by removing barriers to upstream migrations; and
- increasing community interest in and education about rehabilitation projects to improve fish habitat.



Clarence LandCare groups removing exotic weeds, source: LandCare Australia

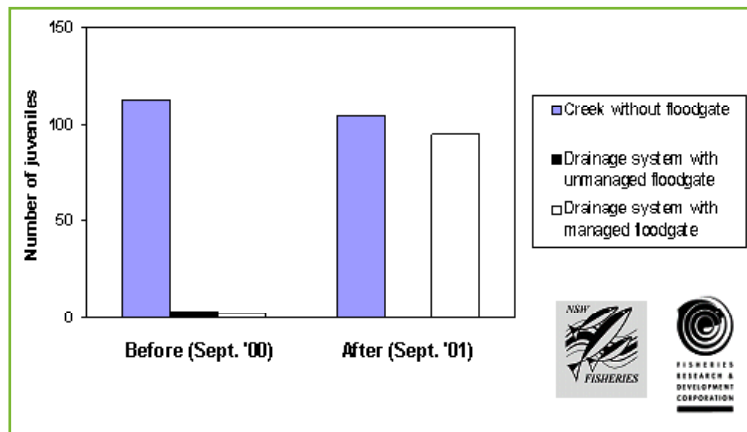
Estuarine fish such as bream, flathead, prawns and mullet have clearly benefited from the rehabilitation of these areas where fish feed, breed and live. The recreational and commercial fishing industries have both benefited.

<http://www.wetlandlink.com.au/content/fixing-fish-habitat-in-the-clarence-estuary>

<http://www.wetlandlink.com.au/content/wetland-management>
<http://www.dpi.nsw.gov.au/fisheries/recreational/your-fees/sw-habitat>
<http://www.dpi.nsw.gov.au/fisheries/recreational/your-fees/sw-habitat/Clarence-Pilot-Habitat-Scheme.pdf>
<http://www.asfb.org.au/pdf/1992/1992-07-03.pdf>
<http://www.oceanwatch.org.au/campaignAquatic.htm>
http://www.oceanwatch.org.au/documents/t2restoringfishhabitatv2_000.pdf

Installing Fish Friendly Floodgates

As mentioned above, many flood mitigation structures have been put in place in the Lower Clarence River Catchment. Some of these structures were designed to reduce tidal flows to make the areas less salty and for better pasture growth (similar works were undertaken in other estuaries of coastal NSW e.g. Hunter and Macleay Rivers). All these structures impacted to some extent on the wetlands and estuarine habitats of the Clarence River Estuary. They also affected fish migrations and prevented fish life cycles from being completed and this reduced fish populations.



This graph below shows the effect of having floodgate barriers on fish migration. The information comes from research carried out by the Department of Primary Industries (DPI) Fishing and Aquaculture. It shows that the number of juvenile yellow-fin bream passing along creeks was reduced to almost zero when floodgates were closed. However the numbers returned almost to earlier levels when the floodgates were opened. As a result, investigations were made into managing floodgates for healthy aquatic habitats, improved fish populations while still being able to protect agricultural land behind the floodgate from most floods.

Projects such as the Clarence River Floodplain Project and the Little Broadwater Project have also benefited from this research and resulted in changes to land and water management via new floodgate installations.

NSW Fisheries at http://www.fisheries.nsw.gov.au/aquatic_habitats/rehabilitating-habitats

Damming the Clarence River

One quite contentious issue that the region faced and will continue to face in the future, particularly with prolonged droughts and climate change impacts, is damming and diversion of Clarence River flood waters over or through the mountains to the drier western parts of NSW and/or possibly South East Queensland. This has been proposed in order to supplement the water supply of drier inland areas and also to supply water to areas that are proposed hot spots for development that do not currently have sufficient water supply available. This has created a level of concern from a range of stakeholders (see information boxes below/over page).

Perspectives on Damming the Clarence River

The Federal Government and community leaders in western NSW have an eye on the Clarence River water resource and have suggested catching the flood flows in a dam before piping it to areas over the ranges where water is critically short.

The river drains close to 23,000 square kilometres of land and discharges five million megalitres of water each year to the sea between the two coastal communities of Iluka and Yamba.

A search through the archives shows there have been several attempts to dam the Clarence in the past with the first initiated around 90 years ago.

In the current debate, the river is portrayed as a potential solution to the water restriction woes of communities battling a prolonged drought along the east coast of the country.

An ABC Rural radio program – Clarence River Stories broadcast in 2007 revealed the following perspectives on the issue.

"It's a beautiful river and I've seen the problems they've had in the Murray Darling and other dammed rivers overseas. Why create a problem and then have to try and fix it afterwards." **Tourism & canoeing operator**

"I think in a normal ordinary season, the river is flat out sustaining itself. I think when they do their sums they'll find that there's not enough water there." **Beef cattle farmer**

At a weekly elders meeting in the riverside community of Maclean, there were cries of "leave the water alone, don't take the water." When the issue came up for discussion among **Local Aboriginal elders**.

A **Clarence Valley Council** spokesperson said "Council will oppose any plans to take water from the Clarence River to pipe into Queensland."

The Mayor said "the proposal will damage the health of the river, and residents will fight to protect their waterway." **Clarence Valley Council**

"When we flood, no-one likes the nuisance value and we all feel sorry for the people who actually have damage, but when it comes through here, you know it's keeping your navigation channels open ... that's critical for the fishing fleet and to keep the tourist yachts visiting Yamba." **Aboriginal community member**

"Floods are a powerful feature in the catchment... that's the time when you think yes you could grab some of that water for the western farmers but if you talk to the fisherman further down the river they really need those floods. Flood events are an important part of flushing the river ecosystem and keeping the waterway healthy." **Grazier and sawmill operator**

"Over the years as a generational fisherman I've seen the river silt up considerably... places where you can't even take boats anymore. So the more water that you do take away in natural flooding is going to lead to more siltation of the river." **Local professional fisherman**

"The sugar industry would get some benefit from holding back 25 per cent of the floodwater. Fisherman could still rely on 75 per cent of the flow. That wouldn't ruin their industry." **Cane farmer**

"People want to eat seafood. Doctors advise us to eat seafood. Thus it is critical the we understand how important freshwater flows are for rivers and for sustaining healthy fish habitats and populations. Water that flows freely down rivers and out to sea should not be seen as a wasted resource, it is absolutely vital for the health of the whole coastal ecosystem." **OceanWatch Australia**

Further Perspectives

ABC Rural Clarence River Stories at <http://www.abc.net.au/rural/features/clanceriver/>

Daily Telegraph News at <http://searchresults.news.com.au/servlet/Search> - then type "Clarence River"

OceanWatch Australia media item www.oceawatch.org.au

Daily Telegraph, April 13th 2007

A MULTI-million dollar plan to plunder water from northern NSW rivers and pipe it to Queensland has been unveiled with the support of Prime Minister John Howard.

The water plan is in a report which gives the top five options for transporting up to 100,000 megalitres of water each year from NSW into Queensland.

The **Prime Minister** yesterday declared there was no such thing as NSW water.

"If we're ever to solve our water problems, we have got to stop automatically thinking in terms of the reaction of jurisdictions and think nationally," he said.

"As far as I'm concerned I don't care very much about state borders. I'm very sensitive to the problems of southeast Queensland. Let's be broad-minded and instead of having a knee-jerk reaction,"

"Oh, you can't take NSW water into Queensland. To heck with that, it's Australian water. It's not NSW water."

However, the **NSW Premier** said:

"There's a thriving fishing, prawning and boating industry in northern NSW and we don't support this proposal whatsoever."

The **Clarence Valley Mayor** said if there was one issue that united the 51,000 residents living in the valley it was the 'mighty Clarence River'. *"We'll be standing shoulder to shoulder to stop the proposals going ahead,"* he said. The Mayor expected there would be job losses in the region's fishing industry if the river was dammed.

An industry representative for the **Clarence River Professional Fishermen's Association** said he feared some or many of the region's 200 professional fishermen could lose their jobs if the river was dammed.

"The Clarence River is the lifeblood of our industry and there could be severe negative impacts from interfering with the natural flows of the river."

Courier Mail April 16th, 2007

On the surface, what seemed a reasonable solution to an ongoing problem was swiftly condemned by those living on and near the Clarence as politically motivated, impractical and unworkable. Scientists, fishermen and residents alike say the plan has the potential to destroy the 400km-long river system for good.

Some, like one **fisherman**, have a range of concerns. At risk, he says, is the local fishing industry and most importantly, the continued survival of the Clarence. *"It's so easy to see the Clarence as being big – it is – but it's also very touchy,"* he said. *"People think you can dam it but you can't. It's very fragile."*

A **Clarence River Professional Fishermen's Association Representative**, said the proposal was ridiculous. *"There have been cases across the world where major diversions of river systems have had disastrous consequences,"* he said. *"If this proposal goes ahead, it will have a massive negative impact on fisheries resources and the ecology in general."*

Nature Conservation Council of NSW's Executive Director said damming the Clarence would be enormously destructive to the biggest commercial fishery in NSW, as well as a range of agriculture and important ecosystems. *"The solution to our urban water crisis lies in a widespread rollout of rainwater tanks, vastly increased recycling and stopping water wastage, not more dams and desalination plants"* she said.

Other Government Initiatives That Help to Improve the Health of the Lower Clarence River Catchment

Other statewide or national programmes that have and/or continue to assist to improve the health of the Clarence River estuary include:

- [Australia's National Programme of Action for the Protection of the Marine Environment from Land-based Activities](#);
- [Coastal Catchments Initiative \(CCI\)](#);
- Coast and [Clean Seas program](#) of the National Heritage Trust (NHT);
- [Cleaning Our Waterways Industry Partnership Program \(COWIPP\)](#);
- [Urban Stormwater Initiative \(USI\)](#) encourages Water Sensitive Urban Design (WSUD); and
- Landcare, Bushcare, Dunecare programmes.

<http://www.environment.gov.au/coasts/pollution/npa/pubs/townsville.pdf>

<http://www.environment.gov.au/coasts/pollution/index.html#land>

<http://www.nht.gov.au/publications/annual-reports/1997-98/pubs/partmarine.pdf>

<http://www.environment.gov.au/coasts/pollution/cowipp/index.html>

<http://www.publish.csiro.au/samples/UrbanStorm.pdf>

<http://www.landcareonline.com/page.asp?plD=75> <http://www.landcare.com.au/>

<http://www.daff.gov.au/>

<http://www.nht.gov.au/publications/brochures/bushcare.html>

<http://www.nsw.nationaltrust.org.au/bush/bush10.html>

http://www.nsw.nationaltrust.org.au/bush_new/default.asp

<http://www.nrc.nsw.gov.au/content/documents/Standard%20for%20quality%20NRM.pdf>

<http://www.cma.nsw.gov.au/> <http://www.northern.cma.nsw.gov.au/>

Clarence Valley Council also has further important roles to play in its approval and regulation of activities within the Local Government Area (LGA). These roles include:

- landuse zoning within the LGA;
- stormwater management and providing efficient sewerage and drainage systems;
- approval of development proposals including the clearing of land;
- erosion and sediment management on its own land and the regulation of others;
- establishing best practice Development Control Plans (DCPs) requiring water sensitive urban design;
- waste disposal regulation and provision of efficient facilities;
- involvement with other organisations and landholders in specific land and water rehabilitation projects e.g. 'Clarence Floodplain Project'.

<http://www.clarence.nsw.gov.au/cmst/cvc009/nova.asp>



LandCare groups restoring riparian habitat, source: LandCare Australia

What Can Individuals do to Reduce Their Impact on the Clarence Catchment and its Freshwater, Estuarine and Marine Habitats?

People who live or work in the catchment either as individuals or as part of a group all have a role to play and can contribute to the sustainable use of land and water resources and their management in the Clarence Catchment. They can make a difference and do this by:

- minimising their impact through waste minimisation and careful waste disposal;
- carrying out remedial works on affected land and water;
- sustainable use of resources;
- volunteering for habitat rehabilitation projects;
- supporting government and group initiatives to improve land and water resources; and
- complying with the law.

Additional Information

NSW Department of Environment and Climate Change www.decc.nsw.gov.au

Australian Government Department of Environment, Water, Heritage and the Arts (DEWHA)
<http://www.environment.gov.au/coasts/pollution/index.html>

Australian Maritime safety Authority http://www.amsa.gov.au/Marine_Environment_Protection/

“Court fines dredging operator for damage to Clarence River seagrass bed” 18 May 2006

... the court’s ruling was confirmation that there are serious consequences for unauthorised works that impact on fish habitat.

Source: NSW DPI, note: this news release has now been archived and may contain outdated information

How Will Climate Change Affect the Clarence River Catchment and Sustainable Land and Water Use and Management?

Other global influences may also change the nature of the Clarence River catchment, particularly the estuary and other near coastal areas. Predictions regarding human accelerated global climate change include increased fluctuation in extremes of weather and longer term sea level changes. These phenomena would influence the Clarence River area as well as other parts of the NSW and Australian coastline. Storm surge and rainfall extremes may increase the frequency of flooding, erosion and other effects particularly on low lying coastal environments where many people live.

This table compares current and future predicted changes in weather patterns in the Northern Rivers region over the next 20 to 60 years.

What is the current weather pattern like?

Summer weather patterns in the Northern Rivers region that includes the Clarence River catchment are relatively warm average maximum temperatures of 27-30°C during January. Yamba experiences only 1 day above 35°C in an average year. Whilst warmer and generally more inland locations such as Lismore experience more frequent temperature extremes. Winters are cool to mild with average maximum July temperatures of 19-20°C toward the coast but only 12°C at more elevated and inland locations such as Armidale. The Northern Rivers region's catchment areas receive approximately 1350-1650 mm of rainfall annually near the coast falling to about 800mm further inland. Peak precipitation occurs between November to April each year on average however variability from one year to the next can be high.

What are the predicted climate changes for the region?

Since about 1950 the Northern Rivers region has experienced warming of around 0.8-1.3°C. This is likely to be partly due to global human activities. The region has also experienced a significant drop in annual rainfall at a rate of approximately 10mm per decade in the west and 50mm nearer the coast. How much of this is due to human activities is difficult to determine from natural variations.

From this information it is possible to predict the likely future climate for the Northern Rivers region. Generally it is likely to be warmer but projected changes in rainfall are not clear but with likely greater evaporation the region will be drier. While the trend might be to drier conditions overall there will also be a potential for increased incidence of extreme rainfall events. Climate change predictions also include increases in the number of heatwaves, extreme winds and associated bush fire risks.

http://www.greenhouse.nsw.gov.au/_data/assets/pdf_file/0007/7828/NorthernRiversDetailedFinal.pdf

| Table 2. Current and Projected Climate Change in the Catchment Area | | | |
|---|---|----------------------|----------------------|
| | Present (1990) ¹ | Projected Change | |
| | | 2030 | 2070 |
| Temperature | | | |
| Average | Armidale: 12 – 27°C ² Coffs Harbour: 19 – 27°C ² Lismore: 20 – 30°C ² Yamba: 19 – 27°C ² | +0.2 – +1.8°C | +0.7 – +5.6°C |
| No. Days below 0°C | Yamba: 0 | Yamba: 0 | Yamba: 0 |
| No. Days above 35°C | Yamba: 1 | Yamba: 1 – 2 | Yamba: 1 – 7 |
| No. Days above 40°C | Yamba: 0 | Yamba: 0 | Yamba: 0 |
| Rainfall | | | |
| Annual Average | Armidale: 790 mm Coffs Harbour: 1,647 mm Lismore: 1,343 mm Yamba: 1,457 mm | -7 – +7% | -20 – +20% |
| Extreme Rainfall³ | | -10 – +5% | +5 – +10% |
| Evaporation | | +1 – +13% | +4 – +40% |
| No. Droughts per decade⁴ | 2 | 2 – 4 | 1 – 9 |
| Extreme Winds | | -5 – +8% | -16 – +24% |
| No. Fire Days⁵ | Coffs Harbour: 4 | Coffs Harbour: 5 – 6 | Coffs Harbour: 5 – 8 |

What Effects Might Predicted Climate Change Have on Biodiversity and Rural Landuse Activities in the Northern Rivers Region?

- Reductions in stream flows are likely to have a negative impact on aquatic biodiversity and wetland ecosystems.
- Plants and animals may become 'stranded' in isolated remnants of vegetation due to changing climate and continued development within the catchment.
- More frequent droughts and fires are likely to increase stress on plants and animals.
- Sea-level rise is likely to inundate coastal wetlands and change the discharge of freshwater into estuaries, with potential negative effects on coastal wetland habitat.



The Lower Clarence River Catchment has many low-lying residential and rural areas which will be subject to inundation from sea level rise, courtesy of DECC

What Things Communities in the Clarence River Catchment do to Better Prepare For and Offset These Events?

People can:

- improve water-use efficiency (waste less water; recycle more water, use appliances etc that use less water)
- reduce the reliance on surface water flow surface water during low flow conditions, such as in drought (e.g. instead of using water straight from rivers, look towards using other water sources such as rainwater, recycled water etc);
- change to crops that are more tolerant of heat and drought;
- change planting times and practices for crops;
- provide more shade and cooling for livestock;
- provide migration corridors for vulnerable wildlife; and
- review flood and fire management arrangements.

The document called Climate Change in the Northern Rivers Catchment prepared by the CSIRO and NSW Government can be found at http://www.greenhouse.nsw.gov.au/_data/assets/pdf_file/0007/7828/NorthernRiversDetailedFinal.pdf and provides further detailed projections for changes and impacts on the Clarence River Catchment.

Northern Rivers Catchment Management Authority Working With Schools to Address Climate Change

The Northern Rivers Catchment Management Authority is working with schools in the region to develop environmental management plans to reduce greenhouse gas emissions. This involves carrying out an audit of water, energy, waste and resource use on the school grounds then coming up with actions to reduce resource use and greenhouse gas emissions. In addition, through student/teacher education forums, a network of students and teachers is cooperating to develop strategies to improve natural resource conditions, specifically addressing climate change impacts. <http://www.northern.cma.nsw.gov.au/education.html>

Non-Government Organisations Working with Communities to Address Climate Change

The Nature Conservation Council of NSW has received fund from the NSW Department of Environment and Climate Change's Climate Action Grants Program to run their "Climate Challenge" initiative.



It provides easy, practical steps for individuals and communities to work together to save energy, save money and save our climate by reducing our greenhouse gas emissions.

Clarence Valley residents who have taken part in the Challenge, have so far saved over 12,800 tonnes of greenhouse gases. Many more tonnes have been saved by doing simple things like changing to energy efficient light bulbs, washing laundry in cold water, turning off appliances at the wall, and switching their electricity to Accredited Green power.

Challenge participants are now turning their attention to what they can do in the community. Saving electricity at home is very important to help stop climate change, but we can make a major and long lasting difference by working together as a community.

Residents across the Clarence Valley have formed teams to complete the Climate Challenge. From parents organising walking school buses for their kids and neighbours, to letter writing groups, to office workers making their workplaces more eco friendly, people are getting creative and making a positive difference in the public arena.

<http://www.clarence.nsw.gov.au/cmst/cvc009/lp.asp?cat=198>

http://www.clarence.nsw.gov.au/cmst/cvc009/view_doc.asp?id=4033&cat=198

Additional Information Sources

www.greenhouse.nsw.gov.au

www.livingthing.net.au

www.greenhouse.nsw.gov.au/_data/assets/pdf_file/0007/7828/NorthernRiversDetailedFinal.pdf

<http://www.climatechangeinaustralia.gov.au>

<http://www.northern.cma.nsw.gov.au>

www.nccnsw.gov.au

Case Study: 3. Waste Management in the Lower Clarence River Catchment

What are the Waste Management Issues of the Clarence River Catchment?

With increasing population, increasing living standards and a growing tourism industry, waste creation in the Clarence River Catchment is likely to increase. All types of waste have a potential to impact negatively on the environment and in particular water quality. Water quality is critical to the survival of estuarine and marine ecosystems on which many Clarence River Valley industries depend. The fishing industry, in the Clarence River coastal zone (estuary and ocean), is particularly vulnerable to declining water quality which in turn affects fish habitats and fisheries productivity.

Waste Streams or Sources of Waste in the Clarence River Catchment

Household or Domestic Waste

The population of the Clarence Valley in 2006 was 50,102 and is increasing at an average annual rate of 0.6%. Grafton, Yamba, Maclean and Iluka are the main urban centres. A total domestic waste stream of 19,444 tonnes of domestic waste was produced in 2005/2006 with most of this waste coming from packaging. See Clarence Valley Waste Stream data at <http://www.clarence.nsw.gov.au/>

What are the possible impacts of increasing amounts of domestic solid wastes?

Some of the impacts include:

- loss of natural resources used to create the packaging and products;
- an increasing demand for land fill sites;
- impacts on water quality - chemicals and other pollutants from landfill sites can escape into groundwater and enter nearby streams and rivers:
 - Leachate develops when waste is buried and decomposes. This can also seep into waterways and cause serious pollution and result in eutrophication (increasing nutrient levels), algal blooms, the loss of aquatic habitats and fish kills; and
- impacts on air quality from landfill sites and burning solid waste:
 - Methane, a greenhouse gas can escape into the atmosphere.
 - Dumps act like large compost heaps and can heat up and catch alight.
 - Dumps are smelly and unattractive and can contribute to air pollution on windy days.



Household waste with lots of packaging, source: OceanWatch Australia

Industrial and Commercial Waste

In 2007 there were 10,500 registered businesses in the Clarence Valley, an increase of 9% from the previous year.

In 2005/2006, industrial and commercial waste made up 36% of the total waste stream for the area. Most of this waste was generated in urban centres such as Grafton, Maclean and Yamba. Not all of this commercial and industrial waste ends up in landfill, with about 38% was diverted for recycling or other uses.



New Grafton landfill during construction, source: Clarence Valley Council

Many businesses also produce what is known as “liquid trade waste”. This is usually discharged into the sewerage system and is additional to the liquid wastes from showers, toilets, and baths. The types of businesses producing liquid trade waste include restaurants, coffee shops, supermarkets, hairdressers, funeral parlours, dry cleaners, clubs, laundromats, abattoirs, service stations, car wash facilities and sewage treatment plants (STPs) at marinas.

Some of the identified high risk or high volume of waste producing activities require a special licence from the Department of Environment and Climate Change (DECC). These activities or businesses are said to be ‘scheduled’ e.g. concrete batching plants, STPs and intensive agriculture - such as piggeries and feedlots above a certain size.



Sewage treatment plant at Yamba, source: Clarence Valley Council

<http://www.environment.nsw.gov.au/licensing/>. These licences are inspected and strictly regulated by DECC. Other activities and premises that are not ‘scheduled’ are regulated by the Clarence Valley Council.

What are the consequences of poor liquid trade waste management?

- Grease, oil, solid material, if not removed on-site may cause blockages in the sewerage system and result in overflows of untreated sewage into the environment.
- Strong waste may cause odour problems and corrosion of the sewerage system infrastructure with potential environmental impacts such as leaks or seepage of sewage into waterways.
- Illegal practices may lead to serious pollution of the waterway including fish kills, mangrove die-off and other long term harm to the waterway and estuary. Such events are investigated by the DECC with heavy fines and cleanup notices imposed.

Those Clarence River industries that are licensed to dispose of their liquid wastes directly into the Clarence River include aquaculture (prawn farms), sewage treatment works and timber mills. The Harwood Sugar Mill has the largest water discharge rate to the Clarence River, however this is primarily river water used for cooling and the nutrient input from this source is relatively small. The DECC licensing schemes usually contain incentives to reduce the level of contaminants entering the waterway including hefty licensing fees. These fees collected by DECC are directed back into improving the environment through the Environmental Trusts.



Harwood Sugar Mill located next to the river, source: NSW Sugar

<http://www.environment.nsw.gov.au/prpoe/licences/L171.PDF>

<http://www.environment.nsw.gov.au/grants/envtrust.htm>

Construction waste

Soil that is exposed at construction site can be washed from the sites into stormwater drains if measures to keep this soil at the site in place (sediment controls) are poor. This sediment is eventually deposited into the Clarence River or its tributaries and can even make its way into the ocean through the river mouth at Yamba.

Although a single block of land may seem a small part of the river catchment, the cumulative (additive) effect of polluted sediment-rich runoff from a number of building sites can have a dramatic impact on water quality.

Thus, there are a number of environmental impacts directly associated with pollution from building sites.



Soil erosion on building and infrastructure sites can be a major source of sediment pollution in waterways. A single building block can lose four truckloads of soil in one storm event, source: OceanWatch Australia

For example, water which runs off building sites, carries pollutants like soil and soil nutrients, as well as building materials such as concrete residues, and enters stormwater drains with subsequent pollution of natural waterways. Furthermore, changes that are made to natural land surfaces and drainage patterns during construction and urban development can result in natural watercourses becoming turbid, silted, littered and undesirably enriched with nutrients (eutrophication). This nutrient-rich water often develops algal blooms. When turbid water restricts sunlight filtration, photosynthesis is reduced and productivity of the aquatic ecosystem suffers. This affects habitats (particularly seagrass), marine life and has negative consequences for the fishing industry.



Sediment curtain in place to help stop soil from washing into nearby creeks source: OceanWatch Australia

Most councils have sediment and erosion guidelines for building and construction works and approvals for these types of development generally require inclusion of the sediment and erosion control procedures to be employed or are required as a condition of consent by Council.

<http://www.healthywaterways.org/PAGE270506PML45HL8.html>

<http://www.infolink.com.au/dir/Erosion-And-Sediment-Control>

http://www.byron.nsw.gov.au/pdfs/stormwater/sediment_erosion.pdf

Agricultural Waste

Sugar Cane Growing

Sugar cane production is an important industry in the Clarence River Catchment; however it does pose a number of identified environmental risks to the River. For example, sugar cane production typically requires application of lots of fertiliser, pesticides and herbicides and is usually grown immediately next to the river/ estuary, meaning that there is a high potential for large amounts of nutrients and toxic materials to run off this land and enter the estuary. Scientists believe the high nutrient loads in the Clarence may be causing ulceration of mullet in the Clarence River Estuary with other negative impacts for the aquatic ecosystem.

Agricultural activities such as surface ploughing and tilling generate additional sediment loads which may also contain high levels of nutrients and pesticides (insecticides and herbicides) that can runoff the land and degrade natural river and estuarine systems.

Furthermore, many areas on the Clarence Floodplain have been drained to create land that is suitable for sugar cane and other agricultural (and urban) activities. Unfortunately, this exposes acid sulfate soils to the air. These soils react with oxygen so that when it rains, toxic acidic runoff and associated toxic metals contaminate estuarine waterways with serious environmental consequences. (See Case study fact sheet 2. Land and Water Management Issues in the Lower Clarence River Catchment).

Beef and Dairy Cattle Farming

Grazing cattle requires extensive areas of grassland for pasture. This not only requires an initial clearing of land but also results in progressive loss of tree cover of adjoining areas because seedlings are eaten by stock.



Drained backswamp for agricultural use, source: Clarence Valley Council

Other detrimental effects include trampling of flora, the compaction of soils, increased nutrient levels in runoff (from faecal matter) and the destabilisation of river banks (unless these areas are fenced off or the accessible area restricted).

Dairying requires the regular congregation of large numbers of cattle to a small area for milking. This can lead to high levels of nutrient runoff from accumulated faecal matter unless these milking areas are well positioned and designed. The consequences for water quality can therefore be similar to that from cane farming.

Prawn Farming

Several aquaculture facilities are located on the land adjacent to the Clarence River estuary near Yamba. These premises are licensed to discharge waste water into the estuary. Return flows to the estuary can have very high concentrations of organic matter and other pollutants (prawns are fed with food pellets). This can impact on water quality in the estuary if not carefully monitored. These premises are also at risk from flood events that could defeat pollution control measures (see DECC scheduled premises licensing above).

Other Clarence River catchment agricultural activities that occur include, on a smaller scale, potato growing, tea tree production and oyster farming.

Fishing Industry Waste

As outlined in fact sheet 4. Waste Management, waste generated by the fishing industry can include:

- plastics
- fishing line and nets,
- offal (left over fish carcass from filleting/processing); and
- fuel emissions.

One of the main issues for this industry is the impact of discarded fishing equipment such as tangled fishing line, torn nets, hooks and ropes etc which pose a threat to aquatic life. It should be noted, however, that the fishing industry is only ONE of the sources of marine debris and other waste impacting on our estuaries and marine ecosystems.

Investigate regulation of waste from boats, antifouling paints, tributyl tin, oil spills, pump-out facilities in the Clarence estuary, exotic plants and animals from untreated ballast waters, Caulerpa.



Abandoned prawn farm, Lower Clarence River, source: Nigel Blake, Northern Rivers Catchment Management Authority



Fishing waste, source: OceanWatch Australia

Stormwater Runoff

The creation of 'hard stand' surfaces such as roofs, driveways, footpaths and impermeable pavers, creates a significant increase in stormwater runoff volume and duration. These increased flows carry sediment and other organic waste from households and councils into water bodies through the kerb and gutter system. This stormwater carries nutrients and other wastes into the Clarence River and eventually the ocean resulting in increased siltation and nutrient pollution.

Sewage

The Clarence River Valley has 11 centralised Sewerage Treatment Plants (STPs) to service an estimated population of 30,000 with a peak of 39,000 persons in summer. The remaining population is serviced by on-site sewerage systems (septic). Leaks occur when pipes break and septic systems overflow in flood times resulting in untreated sewage entering the Clarence River. Untreated sewage contains harmful bacteria and nutrients. Many coastal urban areas such as Iluka, Minnie Waters and Brooms Head remain unsewered and these are also close to sensitive waterways and wetlands as well as oyster growing activities. Contamination of oyster leases can have serious human health consequences.

Investigate Vibrio and oyster depuration, STPs operated by Clarence Valley Council their location and processes how do the non sewerred areas of Clarence Valley treat their effluent.



Hard stand surfaces in Grafton town centre, source: Clarence Valley Council

Air pollution from waste

Air quality in the Clarence Valley is influenced by pollution from bush fires, controlled burning for hazard reduction, burning for agriculture (including burning of cane for harvesting), industrial discharges both licensed and unlicensed, solid fuel heaters, backyard burning of green waste, transport pollution including private vehicle use, commercial cooking activities, sewerage treatment plants, landfills, dust from agriculture and building activities and indoor air pollution such as smoking and heating.

The impacts of air pollution in the Clarence River Valley include:

- contributing to global warming;
- contributing to Ozone depletion;
- declining water quality when the air borne wastes settle onto and/or wash into waterways; and
- human health issues from air borne particles.



Fire was used as a tool in the past to address pests on sugar cane fields, however it is not such a common practice now, source: OceanWatch Australia

Water pollution from waste

The Healthy Rivers Commission's *Independent Inquiry into the Clarence River System* (1999) summarises the major water quality issues of concern throughout the Clarence Catchment. They include:

- suspended solids (during high flows), in both freshwater and estuarine locations;
- nutrients in small estuarine tributaries, and high nitrogen levels in the estuary;
- pathogenic organisms around Grafton;
- pH – acid levels measured in the estuary; and
- drains coming from cane farms and urban areas.



Runoff from agriculture can be a major source of nutrients, source: NSW DPI

Nutrients, in small amounts, are required for plant growth but in large amounts they can cause excessive algal growth in waterways (including blue green algae) which can put natural ecosystems out of balance, harming water-life and animals. Blue-green algal growth can also seriously affect human uses of water for purposes such as drinking, recreation, stock water and irrigation.

Sediment smothers aquatic habitats such as seagrasses and high turbidity interrupts photosynthesis. Both of these events reduce plant production and interrupt food chains. These habitats are important breeding grounds and nurseries for many aquatic species such as prawns and fish. If breeding is interrupted and nurseries destroyed, fishery productivity is reduced and therefore the fishing industry (recreational and commercial) suffers.

Major sources of nutrients in the lower Clarence River Catchment are:

- run-off from urban and rural residential areas;
- erosion and run-off from grazing and cultivated land;
- discharges from sewage treatment plants and septic systems; and
- runoff water from irrigation areas.

What are Some of the Ways These Waste Management Issues are Dealt With in the Clarence River Catchment?

Waste management is an issue that we can all influence. Some of the ways we can all reduce the impact of wastes in the environment are:

- reduce the production of waste and therefore the demand for natural resources;
- dispose of all types of waste in a way that minimises environmental and human impacts;
- recycle or reuse waste products where possible to reduce the demand on natural resources and the need to dispose of the waste into the environment; and
- educate groups and individuals on the role they can play in waste minimisation and responsible disposal of waste to minimise environmental impacts.

Councils, schools, State and Commonwealth Governments along with individuals have a responsibility to improve waste impact on the environment through educating themselves and others. The Clarence River Catchment has implemented many strategies to achieve effective waste mitigation and promote improved sustainability (as illustrated in the diagram).

While a lot has been achieved there is still progress to be made to reduce the environmental impacts from waste and in particular the impacts on water quality caused by waste disposal.



Source: Clarence Valley Council

What are the Types of Strategies for Improving Waste Management? What Can Governments Do?

In NSW the DECC is the lead government agency responsible for state-wide regulation of waste management. Local Government is vested with the regulatory responsibility at the local level of carrying out waste management services within this state-wide framework. The Commonwealth Government is also involved through incentives and partnerships with Local and State Governments as well as with industry. Councils develop policy and operating plans to ensure that they meet their obligations under legislation. See fact sheet 4. Waste Management Issues.

http://www.environment.nsw.gov.au/waste/waste_regulation.htm

<http://www.environment.gov.au/settlements/waste/index.html>

<http://www.environment.nsw.gov.au/waste/>

<http://www.environment.nsw.gov.au/households/recwaste.htm>

<http://www.environment.nsw.gov.au/waste/consult.htm>

How Does Clarence Valley Council Carry Out Its Waste Management Functions?

Disposal of solid waste

A business unit of Clarence Valley Council, Clarence Waste Solutions, has been established to administer domestic and commercial/industrial waste collection services.

A regional landfill site is located at Grafton with smaller sites located at Copmanhurst and Glenreagh. There are also commercial and domestic waste collection services based around the provision of coloured bins for different types of materials, including recyclables. The details of these schemes can be found on the Clarence Valley Council website at <http://www.clarence.nsw.gov.au>



Source: Clarence Valley Council

Commercial waste collection is a user pays system for shops, offices and industrial premises. General rubbish collection is twice per week in the urban areas of Grafton, Maclean, Yamba and Iluka. Recycling waste is collected weekly. Services to other centres are weekly. Each bin is micro chipped as well as colour coded. The microchip enables the correct business to be billed.

Currently 41% of domestic waste and 28% of commercial waste in the Clarence Valley goes to landfill sites.

To reduce the environmental impacts of landfill sites the council has implemented many strategies to make these sites ecologically sustainable including:

- a hazardous waste store at the Regional landfill Grafton;
- using contour drains and flood detention dams to prevent runoff water from mixing with waste water and leachate;
- a leachate collection and treatment system to prevent water pollution including clay soil liners to reduce infiltration into the groundwater; and
- waste screening to ensure prohibited wastes are not dumped in landfill sites.

The Clarence Valley Council has implemented strategies to mitigate specific types of waste in order to reduce environmental and health impacts. Some of these wastes include: concrete, soil, cooking oils, mobile phones, asbestos, pesticides, bulk motor oil, sediment runoff from building and construction sites and the disposal of “sharps” used for medical purposes such as the treatment of diabetes, cancer or multiple sclerosis.



Source: Clarence Valley Council

Disposal of liquid waste

Sewage, liquid trade waste and stormwater waste disposal systems are found throughout the Clarence River Valley. Sewerage treatment plants are monitored under licence to DECC and, where necessary, upgraded to reduce leaks and breakdowns. In many new urban developments, lakes and wetlands are being constructed to filter stormwater waste and protect downstream water quality. Water Sensitive Urban Design (WSUD) is now an important part of planning processes for all new developments.



Leachate and sedimentation dams at Grafton landfill, source: Clarence Valley Council

Unsewered towns and rural properties with on-site sewage systems or septic systems are managed under Council's *On-Site Waste Water Management Plan 2005* which requires inspections, minimum treatment standards, and upgrading of treatment systems to reduce environmental threats.

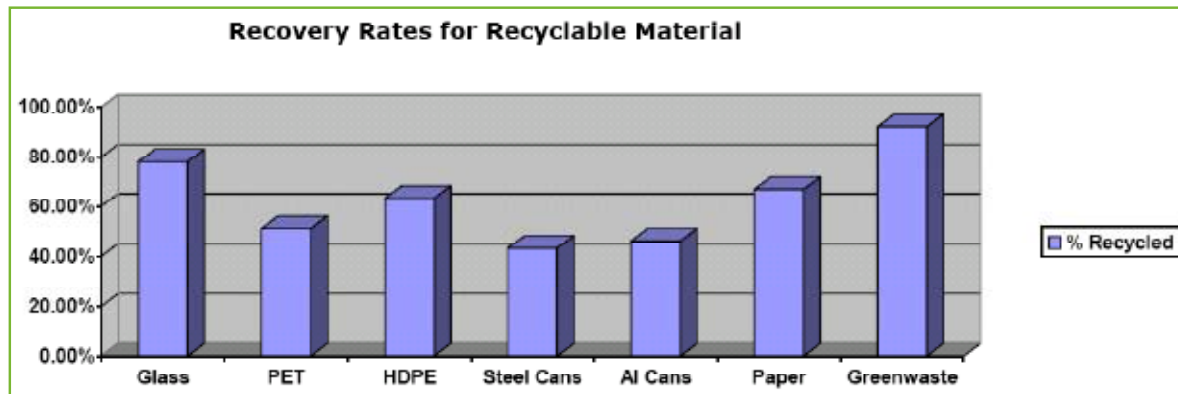
Recycling and waste minimisation

Solid Waste

There are recycling centres for solid wastes at Grafton and MacLean. The Clarence Valley Council and its residents have a good record of waste minimisation and recycling of domestic waste.

Reducing the contamination of recycled materials caused by people putting the wrong materials into recycling bins is now a challenge.

The graph below illustrates the high percentage of waste recovered for some selected recyclable items generated in the Shire.



Source: Clarence Valley Council

Urban residents are supporting recycling initiatives and the focus of recycling is now turning to business, commercial and industrial sectors that produce 37% of the waste collected by Council. Clarence Valley Council provides a specialised recycling service to commercial and industrial premises and about 800 premises make use of this facility but more education and awareness is needed to increase the level of usage.

The Business Waste Reduction strategy identifies the producers that create the most waste and then assists them in reducing waste generation and waste disposal to landfill. Grafton gaol and Acmena Juvenile Justice Centre have carried out waste audits and developed management to reduce waste levels. The project has been successful in achieving waste reduction and financial savings for the participating businesses and at the same time reducing environmental impacts.



Mulched green waste, source: Clarence Valley Council

There are also facilities for green waste recycling. Green waste is regularly mulched and is now marketed by MI Organics a local business in the area. <http://www.miorganics.com.au/>

The materials recycled in the Clarence Valley have resulted in significant reductions in Greenhouse gas emissions and created energy and water savings.

The table below summarises the benefits achieved in recycling by Clarence Valley residents.

| Environmental Benefits of Recycling | |
|---|--|
| Greenhouse Benefit | |
| Net Savings in CO2 from recycled materials | Equivalent cars Permanently Removed From The Road |
| 3,094 tonnes | 743 |
| Energy Benefit | |
| Net Energy Savings from recycled materials | Annual Electricity Usage Saving, Equivalent Households |
| 102,859 gigajoules | 4760 |
| Water Benefit | |
| Total Water Savings from recycled materials | Annual Water Usage Savings (equivalent persons) |
| 87,822 tonnes | 939 |

Source: Clarence Valley Council

Gaseous Waste

Council regulates backyard burning and non scheduled industrial emissions into the atmosphere. These regulations reduce waste that impacts on air quality in urban areas. Council is also able to regulate open burning-off under the Protection of the Environment Operations (Control of Burning) Regulation 2000.

Council has participated in the Sustainable Energy Development Authority Energy Smart Homes program that requires new homes meet minimum energy efficiency requirements to reduce greenhouse emissions. New homes must comply with the requirements of BASIX (Building Sustainability Index).

Liquid Waste

Around 12% of treated effluent from STPs is recycled and diverted to off stream uses.

For example: an Australian Government Community Water Grant of over \$45,000 was used to undertake an initiative the Yamba Golf Course Recycled Water Irrigation Expansion project. This scheme will increase the reuse of treated effluent from the Yamba Sewage Treatment Plant to irrigate sections of the Yamba Golf Course. This project will save 53,000,000 litres of water a year and reduce the amount of treated effluent entering the Clarence River directly.

The main urban areas of Clarence Valley Shire now have stormwater management plans developed. Strategies for Water Sensitive Urban Design in new release areas include constructed wetlands, retention basins and in existing areas offering rebates for rainwater tank installation.

Education

Education for sustainability is a State wide initiative that recognises the vital role education has across all sectors of the community. Clarence Valley Council (CVC) in recognition of its important local role in educating its community has employed a waste education officer who responsible for developing education strategies for the community on waste matters with the aim of reducing the amount of waste both generated and ultimately disposal to landfill.

<http://www.environment.nsw.gov.au/cee/lfs.htm>

<http://www.environment.nsw.gov.au/cee/lfsPlan0710.htm>

<http://www.environment.gov.au/education/>

<http://www.environment.gov.au/education/publications/index.html>

CVC has also developed and provided resources to deliver waste education programs in partnership with the North East Waste Forum.

These programs include:

- promotional campaigns e.g. composting, worm farms, reuse directory;
- second hand Saturday events to promote reuse of household items;
- "Greenhouse" mobile waste education trailer;
- landfill/recycling tours;
- waste reduction projects;
- waste wise events targeting local event organisers; and
- regular community newsletters

Community involvement in National initiatives such as "Clean up Australia" and the former EPAs "Litter" campaign helps to promote waste minimisation and appropriate disposal messages in the Clarence Valley catchment.

How is the Fishing Industry in the Clarence addressing Waste Issues?

The commercial fishers in the Clarence are addressing waste issues through various means (see General Waste Fact Sheet) such as through OceanWatch Australia's "Fishing for Waste Program".

Clarence River Council has partnered with OceanWatch Australia to help reduce the impacts of recreational



Source: North East Waste Forum



Fishers in the Clarence collecting nets for recycling as part of OceanWatch Australia's "Fishing for Waste" Program, source: OceanWatch Australia

fishing waste through OceanWatch Australia's **Tangler Bin** project. This project aims to reduce discarded fishing line and the issues associated with it (see fact sheet 4. on Waste Management).

How Can Locals Respond to the Local Clarence Valley Waste Issues?

Businesses, environmental groups, government bodies and individuals can all get involved in waste minimisation and awareness projects such as those outlined.

Often when community members, groups and businesses all get together to work on special projects it benefits the whole community in ways beyond just that project.

For example, in 2005 and 2006, NSW Department of Environment and Conservation (now DECC), Clarence Landcare groups and Yamba Yacht Club worked together with other individual volunteers, and businesses to clean up the Clarence Estuary.

<http://www.envite.org.au/index.html>

Further actions individuals can take to minimise waste

Ultimately it is the at home, at play or at work practices of individuals that make a difference.

At home ask the question Do I –

- recycle all the recyclable containers and packaging?
- make sure I don't contaminate waste by putting the wrong things in the wrong bin?
- compost all the organic and green waste that I can?
- ensure that I don't litter?

Reduce waste when shopping by:

- avoiding excessive packaging on items you purchase;
- taking your own bags or shopping basket to reduce the use of plastic bags;
- buying your fresh food and vegetables loose;
- avoiding the use of freezer bags in your supermarket;
- avoiding pre-packaged fresh foods;
- cutting packaging - buy in bulk;
- buying concentrated products; and
- not buying things that you don't need.

Contribute to cleaner waterways by:

- preventing pollutants including soil, leaves, detergents, litter and animal faeces from washing into stormwater drains;
- protecting trees and other vegetation along local waterways (and planting more);
- encouraging the protection of local wetlands as these act as natural filters for pollutants, as well as providing habitat for birds and aquatic life; and
- recycling products and their packaging.



Taking your own re-usable bag shopping, source: OceanWatch Australia



Buying fruit and vegetables loose, source: OceanWatch Australia



Volunteers planting trees next to waterways, source: LandCare Australia

Case Study: 4. The Lower Clarence Catchment River Fishing Industry

Why is the Clarence River Fishing Industry Important?

The Clarence River supports the largest concentration of commercial fishers in New South Wales, producing quality seafood for domestic and export markets. The seafood industry makes a large contribution to the local economy directly through the sale of product and indirectly through employment and benefits to seafood retailers, seafood restaurants etc. The estimated value of the seafood industry in the Clarence region is between \$40-60 million annually.



The Clarence River Fishermen's Co-operative, Yamba, source: OceanWatch Australia



Quality local seafood, source: OceanWatch Australia

The broader socio-economic benefits provided by the seafood industry to the community cannot be understated, with fishers spending an estimated 90% of their income in the area, allowing flow on effects to disperse to many local businesses. Furthermore, consumption of seafood has been shown to have many health benefits such as a reduction in heart disease and mental illness.



Ocean Trawl boats docked at Yamba (near the mouth of the estuary), source: OceanWatch Australia

Why is a Healthy, Sustainably Used Clarence Catchment Important to the Local Fishing Industry?

As with all river systems, the productivity of the Clarence River is very closely linked to the health of the estuary and the state of the surrounding catchment and the habitat contained within it, both terrestrial and aquatic.

Commercial fishers spend extended periods on the water and have an intimate understanding of the environment in which they work, and in many cases, knowledge that has been passed down through generations of fishing families.

Since fishermen are dependent on the health of the river system for a viable and sustainable livelihood, no other individuals have as great a vested interest in the health of these systems and are often the driving force behind advising government authorities about questionable development or habitat destruction.

What are the Main Fishing Methods Used by Commercial Fishers in The Clarence?

Fishers in the Clarence use a wide range of fishing methods to suit seasonal fluctuations, locations fished and the species targeted. Each commercial fishing license carries special approvals/endorsements, which dictate the methods and gear fishers are allowed to use. Fishers pay a large annual fee to the Department of Primary Industries for their licenses which entitle them to target species for commercial sale.

The Fisheries of the Clarence Northern Rivers Region include:

- **Ocean Trawl** – the ocean trawl fishery is divided into two sectors: prawn and fish. It is further divided into northern and southern areas of the State. The Ocean Trawl Fish is a sector that operates to the south of the Clarence but the Ocean Trawl Prawn sector (inshore) operates from the Queensland border south and takes in the Clarence/northern rivers region.
<http://www.fisheries.nsw.gov.au/commercial/commercial2/ocean-fish-trawl-fishery#fish>
- **Ocean Haul** – this is a type of fishing where fishers target specific coastal species that congregate in coastal 'gutters' or migrate at certain times of the year in nearshore locations. The species commonly harvested by this method in the Clarence are sea mullet and sand whiting. The mullet are harvested for their flesh and also the roe (fish eggs) which is exported to many Asian countries including Japan.
http://www.fisheries.nsw.gov.au/commercial/commercial2/ocean_hauling_fishery
- **Estuary Prawn Trawl** – this fishery operates within an estuary and uses specific fishing methods with approved nets that are pulled through the water by trawl boats. The main species harvested by this method are school prawns.
- **Estuary General** – this is a fishery that operates within an estuary using a number of approved methods including gill nets and traps for a variety of species including bream, luderick, flathead and crabs.
- **Ocean Trap and Line** – includes two fishing methods:
 1. line fishing using multiple hook rigs for both demersal (bottom dwelling) and pelagic (found in the ocean water column) species e.g. tuna; and
 2. using traps to harvest species such as snapper and spanner crabs.
http://www.fisheries.nsw.gov.au/commercial/commercial2/ocean_trap_and_line_fishery

Some of the fishers, who are licensed to operate in the above fisheries, may also have approvals or endorsements for Lobster trapping (however Lobster harvesting is not as common in Clarence/northern rivers region compared to the south). Furthermore, The Clarence River does not have an abalone fishery and the oyster industry is also quite small in the Clarence. This may be in part due to the incidence of Qx disease which affected many oyster growing areas in the Clarence.

Investigate Qx disease and its impact on the oyster industry.

Investigate aquaculture research on the north coast near Grafton by NSW DPI (Fishing and Aquaculture)

<http://www.dpi.nsw.gov.au/fisheries/aquaculture/publications/species-freshwater/silver-perch---aquaculture-prospects>



Estuary Prawn Trawling, source: Koen Dijkstra



An Estuary Prawn Trawler working on the Clarence River, source: Debra Novak

How are These Fisheries in the Clarence Regulated?

Each of the Clarence River Fisheries is regulated by the NSW Department of Primary Industries (DPI) Fishing and Aquaculture division. Each fishery has a number of complicated conditions that restrict the areas that can be fished, the equipment that can be used, the size of the boat, the timing or season during which the fishing can occur and quotas on catch (number of or weight of fish that can be caught).

Each fisher is required to fill in log books to record where they fished, the species and the quantity caught. This information provides vital data to researchers and managers about stock levels, and provides a good indication about the health of the waterway.

Many commercial fishers on the Clarence River go above and beyond their regulatory requirements and continue to design, experiment and adopt advances in environmental best practice fishing gear. For example the Clarence River commercial fishermen use of a range of bycatch reduction devices (BRDs) in various fishing gears to exclude unwanted catch or juvenile target species whilst fishing (see pages 4-5 for further details). They also have self imposed bans on fishing in known nursery grounds and seagrass areas. The fishermen of the region are also one of the only fishing industry groups in Australia that employ a full time industry representative. The representative voices industry's concern on various issues and decisions concerning the health and management of the Clarence River and its catchment, and the impacts of such decisions and activities on fish habitat, water quality and ultimately fish stocks.

What are Some of the Internal Issues of the Fishing Industry?

These include:

- the need to re-organise the way fishing operates and how it is regulated;
- the need to reduce the total numbers of fishers within each fishery;
- an aging industry (mainly older fishers, with few younger fishers taking their place);
- lack of encouragement for younger people to come into commercial fishing (costs and uncertainty); and
- removal of latent capacity/effort i.e. to remove licences which exist, but are not being used.

All these areas have been addressed in proposed changes and submissions to the regulatory authority (NSW DPI Fishing and Aquaculture) but as yet have not been addressed by government.

What are the External Factors Affecting the Fishing Industry in the Clarence?

The major factors external to the industry itself that affect the fishing/seafood industry in the Clarence relate to water quality issues that are generally the result of inappropriate or unsustainable landuse practices on industrial, agricultural and urban lands of the Clarence River catchment. Moreover, the loss or degradation of fishery nursery habitats including wetlands such as mangrove and saltmarsh areas as well as seagrass beds affects the productivity of the Clarence River fisheries.

Investigate where most of the mangroves, wetlands and seagrass habitats are located in the Clarence estuary.



Mangroves cleared from river banks along the Clarence River, source: Clarence Valley Council



Healthy mangroves on the banks of Clarence River, source: Clarence Valley Council

What are Some of the Initiatives Practiced and/or Promoted by the Fishing Industry in the Clarence?

The Clarence River region has established partnerships between the fishing industry, sugar growing industry, Clarence Council and other local sectors to undertake projects that aim to reverse the many years of altered estuary management and poor landuse practices which have resulted in degraded estuarine and marine ecosystems.

Programmes and other initiatives that are ongoing in the Clarence include:

Cooperative endeavours

This includes initiatives/partnerships between the fishing industry, agricultural landowners (cropping and grazing) and the Clarence Valley Council to return marginal lands back to being naturally wetted/inundated by tidal flows coming in and out of the estuary and river. Tidal floodgates and other structures have for many years prevented the saltier tidal water from coming up onto the land with the rising of the tide to protect agricultural land. However, recent initiatives have meant that both cane growers and cattle farmers have been managing these structures on their land to ensure that there is regular tidal exchange of water in the lower estuary and creeks. This not only returns areas to more productive wetland condition but also prevent the build up of deoxygenated and noxious 'blackwater' and associated diseases that become more prevalent in water that becomes stagnant behind closed floodgates. In the past when these situations have been allowed to persist, regular fish kills in the estuary were a more common occurrence and the Clarence estuary was much less healthy. See fact sheet Case Study: 2. Land and Water Management Issues in the Lower Clarence River – Clarence Floodplain Project).



An area of former broadwater wetland showing salt and acid sulfate scalding



The same area after changes that allowed normal tidal flushing and the removal of cattle. Much of the wetland vegetation is now returning, source: Clarence Valley Council

<http://www.clarence.nsw.gov.au/cmst/cvc009/lp.asp?cat=211>

Investigate red spot and causes of fish kills; types of floodgate structures in the Clarence

Use of Bycatch Reduction Devices (BRD)

Estuary Prawn Trawlers in the Clarence use a type of bycatch reduction device called a square mesh codend. This has special gates or mesh panels which are woven into the top of the net. This BRD allows fish and small prawns (bycatch), to escape out of the top of the net whilst still harvesting the targeted larger prawns (as prawns tend to collect at the bottom of the net, whereas fish tend to swim near the top). Reducing bycatch reduces the impact of the fishery on the environment, while also reducing the time the fishers have to spend sorting through their catch.



One type of BRD which is used by many prawn trawl fishing boats is the square mesh codend (part of the net where the catch collects). The square shape of the mesh means it remains open when it is full, allowing juvenile prawns and fish to escape, source: OceanWatch Australia

Turtle exclusion devices (TEDs) are a special type of bycatch reduction device which are used wherever marine turtles are found (Northern NSW and Queensland). TEDs allow larger animals like turtles to escape after entering the net. They are fitted into a trawl net in such a way that the TED separates target species such as prawns and scallops from non-target animals like sea turtles. Sea turtles and other large animals and debris slide along the TED to an exit hole cut in the top or bottom of the TED.

Note: marine turtles are also vulnerable to human disturbance at beach nesting sites, due to the activities of introduced animals like foxes that raid their land based nests and occasional losses from drownings in fishing nets. All marine turtles in Australia are protected.

<http://www.csiro.au/science/ps11j.html>

http://www.sea-ex.com/ted/html/about_us.html

Investigate which species of marine turtle regularly nest on the north coast of NSW

Fishing for Waste

Local fishers and the Clarence River Fishermen's Cooperative have been a pioneer in the Fishing for Waste project (run by OceanWatch Australia), which collects and recycles the commercial fishing industry's old nets and fishing line for recycling. In the past, the majority of disused gear would end up in land fill, however this program allows the old gear to be turned into useful plastic products such as fence posts used for farming and infrastructure used in oyster cultivation.

<http://www2.dpi.qld.gov.au/fishweb/18560.html>

<http://www2.dpi.qld.gov.au/fishweb/3387.html>

http://www.fisheries.nsw.gov.au/commercial/commercial2/bycatch_and_its_reduction

Investigate the different types bycatch reduction devices and how they work.



TED, source: James Lauritz



Fishers working with Clarence River Fishermen's Cooperative Association to collect old nets and line for recycling, source: OceanWatch Australia