Camden Haven River Oyster Farmers Environmental Management System

Version 1.3

June 2011

Acknowledgments

The Camden Haven River Oyster Farmers would like to acknowledge the outstanding effort that has been made by all in putting together this EMS, particularly those growers who spent many hours working through the process to develop the EMS. . Special thanks to Northern Rivers Catchment Management Authority for funding this project and also to Department of Primary Industries Aquaculture Section and Port Macquarie-Hastings Council for their time and support in this process. This project has achieved many outcomes, but of most importance is the bringing together a large number of individual oyster businesses into a unique powerful group representing the Camden Haven River oyster industry to drive sustainable change for the Camden Haven River and its oyster industry into the future.

Comments

The term ‘‘Camden Haven River Oyster Farmers’’ refers to those growers that have undertaken this EMS process and committed to undertake best practices in the management of their local industry in order to maintain and improve the health of the Camden Haven River (see Appendix A- commitment sheet).

This document is owned by the Camden Haven Shellfish Quality Assurance Program Committee.

Our EMS is a living document that will be reviewed and updated every year. Please forward any comments you might have to the Camden Haven River EMS Coordinator (Mr Tony Troup) on 0427334649 or troup@camdenhavenoysters.com.au in order to be considered in the upcoming version of the document.

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Disclaimer

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1. INTRODUCTION

Camden Haven River Oyster Farmers recognise that they have a continuing responsibility to cultivate oysters on behalf of the community in a sustainable way through the adoption of best practice technology and techniques.

This Environmental Management System (EMS) provides a mechanism for the ongoing identification and management of environmental impacts, risks and opportunities for the Camden Haven River oyster industry. It is an industry-based initiative that seeks to contribute to the sustainability of oyster farming and the health of the Camden Haven River, as well as increase community understanding of cultivation methods used and the management and regulations that apply to the industry.

This EMS documents how Camden Haven River Oyster Farmers (CHROF) are already meeting their regulatory obligations and are striving for best practice to continually improve their performance in light of new technologies and methods. It also documents how growers work with natural resource managers and the community to manage Camden Haven River estuarine resources in a sustainable way.

2. About this Environmental Management System

Our EMS was developed by Oyster farmers in the Camden Haven River through a series of workshops between March 2010 and May 2011 with a facilitator, Anissa Lawrence from TierraMar Consulting. The project was a part of a broader project of the Northern Rivers Catchment Management Authority to assist coastal and marine resource users to develop and implement environmental best management practices across the Northern Rivers region.

This EMS has been developed in conformance to the International Standard *ISO 14001:1996 Environmental management systems – specification with guidance for use,* using the Australian seafood industry EMS methodology available through the Seafood Services Australia Seafood EMS Resources.

2.1. Scope and purpose of the Environmental Management System

This EMS aims to:

- manage the identification and adoption of new techniques and technology to continually improve operations;
- provide a basis for the Camden Haven River Oyster Farmers to communicate and cooperate with natural resource managers and the community on the environmental management of oyster cultivation, the Camden Haven River and its catchment;
- document how the Camden Haven River Oyster Farmers are currently meeting their responsibility to operate sustainably and responsibly; and
- be a 'living' document that will be reviewed and updated annually to adapt and manage new risks and opportunities.

The scope of this EMS is limited to:

- the environmental aspects concerning all operations of the Camden Haven River Oyster Farmers; and
- the ways in which the Camden Haven River Oyster Farmers may work with other stakeholders on improving the environmental quality of the Camden Haven River, its tributaries and its catchment.

2.2. EMS in relation to other management mechanisms

This EMS has been designed to provide a mechanism for Camden Haven River Oyster Farmers to demonstrate environmental best practice with respect to oyster operations, as well as work with other natural resource managers to ensure the sustainable management and use of Camden Haven River estuarine resources. To that end the EMS does not replace, but rather complements existing laws, regulations and policies under which oyster farming and natural resource management in the Camden Haven River are controlled and managed, including:

- NSW Fisheries Management Act 1994;
- NSW Fisheries Management (General) Regulation 2002;
- NSW Threatened Species Conservation Act 1995
- Environment Protection and Biodiversity Conservation Act 1999;

- Environment Protection and Biodiversity Conservation Regulations 2000;
- NSW Marine Parks Act 1997;
- NSW Oyster Industry Sustainable Aquaculture Strategy 2006;
- NSW Shellfish Program under the NSW Food Act, 2003;
- Crown Land Act 1989;
- Marine Pollution Act 1987;
- Marine Safety Act 1998;
- Commercial Vessels Act 1979;
- Environmental Planning and Assessment Act 1979;
- Protection of the Environment Operations Act 1997;
- Northern Rivers Catchment Action Plan (developed by Northern Rivers Catchment Management Authority);
- Camden Haven River Estuary Management Plan (developed by Port Macquarie-Hastings Council); and
- Other NSW and local government legislation and regulations.

Through this EMS, the Camden Haven River Oyster Farmers have made a commitment to implement the voluntary best practice standards outlined in Section 7 of the NSW Oyster Industry Sustainable Aquaculture Strategy (OISAS).

2.3. EMS REVIEW AND COMMUNICATION

This EMS is based on a framework of continuous improvement and to that end requires a regular review of progress to ensure actions are being addressed in accordance with the timetable established and that the EMS remains relevant and current, in line with emerging new technologies and best practice methods. On an annual basis, the owners of this document, the Camden Haven Shellfish Quality Assurance Program Committees will undertake a review of Camden Haven River Oyster Farmers performance against the EMS and update the document as required. The Camden Haven Shellfish Quality Assurance Program Committees will also as a part of this review process provide opportunity for the community and other stakeholders to provide comment on the performance of Camden Haven River Oyster Farmers against the EMS.

This EMS provides a forum for natural resource managers and the community to access information about environmental best practice management for Camden Haven River Oyster Farmers and for growers to work with these groups in the development of environmental initiatives to improve the sustainability of the Camden Haven River, its tributaries and its catchment. The Camden Haven Shellfish Quality Assurance Program Committees will provide progress updates to these groups from time to time to improve communication between all stakeholders. Refer actions 6,4.1 and 6.4.3 for more information.

2.4. EMERGENCY RESPONSE

The response of Camden Haven River Oyster Farmers to an emergency such as a major flood or outbreak of disease has been examined as a part of the risk assessment process. A number of actions have been identified to ensure Camden Haven River Oyster Farmers are well prepared and have a contingency plan in place for dealing with extreme events. Refer to action 6.2.8 for details.

Camden Haven River Oyster Farmers are unlikely to contribute significantly to water pollution. The importance of protecting and enhancing the habitats of the Camden Haven River have been identified through the risk assessment process. Actions that the Camden Haven River Oyster Farmers will undertake to ensure the ongoing protection and conservation of estuarine habitats include working with Northern Rivers Catchment Management Authority and the local council to identify priority areas for onground works (action 6.1.1), working with key groups to minimise impacts to seagrass (action 6.1.2) and to maintain an extensive water quality monitoring program (action 6.1.4).

2.5. EMS CONTRAVENTION

This EMS is a voluntary commitment by the Camden Haven River Oyster Farmers to document, implement and maintain environment best practice management. It is not enforceable. All growers who have made this voluntary commitment have "signed on" to the EMS (refer Appendix A) and in doing so have committed to implementing the actions identified in the EMS in accordance with the timetable established by them.

Where a grower(s) however fails to reasonably comply with this EMS, the incident will be recorded and investigated by the Camden Haven Shellfish Quality Assurance Program Committee. Failure to comply could be:

- intentional or unintentional
- an indication of inappropriate policy or actions within the EMS
- due to highly unusual circumstances; or
- a combination of the above.

Corrective actions applied could include a review of the EMS, training for the grower(s), or no action. Any EMS contravention will also be noted in the annual EMS review.

The Camden Haven River Oyster Farmers cannot be responsible for the actions of growers in other estuaries or for growers in the Camden Haven River who have not committed to follow the EMS. Camden Haven River Oyster Farmers will however encourage all oyster farmers operating within the catchment area to work with the same duty of care as outlined in the EMS.

3. OUR COMMITMENT

Camden Haven River Oyster Farmers are committed to uniting oyster farmers in the Camden Haven River to pursue goals and outcomes of common interest and benefit to individual growers, businesses, the local community and the environment. This commitment has driven the development of this EMS.

Camden Haven River Oyster Farmers Environmental Policy

Our Vision

To be stewards in the conservation of the Camden Haven River and strive to achieve best practice in environmental sustainability and social responsibility while continuing to provide quality oysters to the community.

Our Environmental Policy

The Camden Haven River Oyster Farmers recognise that the Camden Haven River and its catchment are a shared resource.

The Camden Haven River Oyster Farmers will continually monitor for improvements in environmental best practice relevant to their operations and work to adopt them.

In addition to complying with all relevant regulations and management mechanisms the Camden Haven River Oyster Farmers will strive to meet the following objectives:

1. Protect and enhance the habitat of the Camden Haven River and its catchment.
2. Cultivate oysters in a sustainable manner - minimising resource consumption, waste production and pollution.
3. Recognise and protect the cultural and aesthetic values of the Camden Haven River and its catchment.
4. Conduct environmental management in a transparent and cooperative manner.
5. Contribute to scientific research and management innovation relevant to oyster cultivation and estuarine environments.

These objectives form the basis of our Environmental Action Plan (Section 6)

4. ABOUT THE CAMDEN HAVEN RIVER OYSTER FARMERS

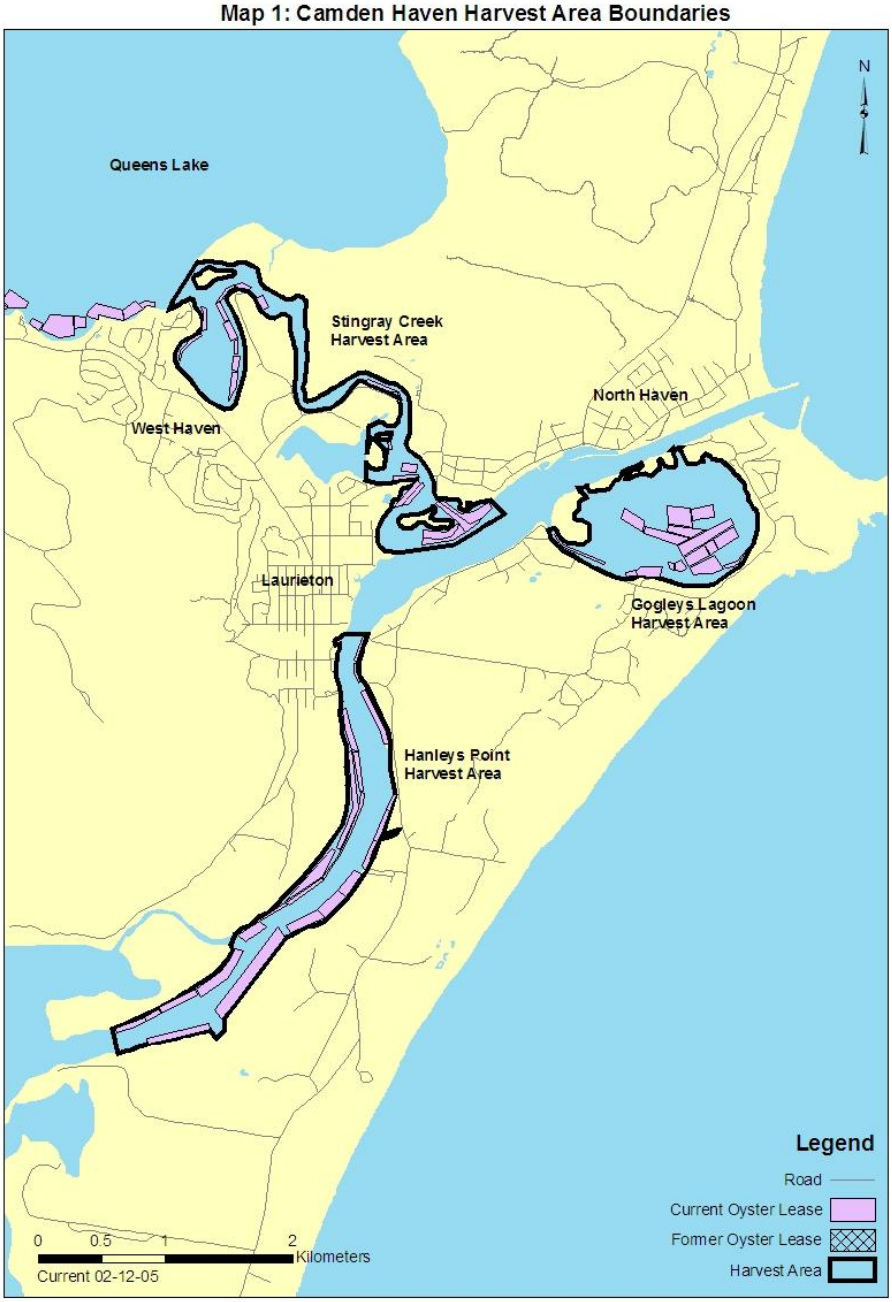
The oyster industry is the largest aquaculture industry in NSW by production value (around 70%) and represents approximately 30% of NSW commercial fisheries production. The NSW oyster industry in 2008/2009 was worth $41 million (I&I NSW 2009a), is the fourth largest aquaculture industry in Australia (the others being bluefin tuna, pearling and Tasmania salmon) and is also Australia's largest producer of edible oysters. Not only is it NSW's most valuable fishery but it is one of the state's most valuable per hectare agricultural enterprises with long term gross average production up to as high as $35,000 per hectare in some estuaries. 91.5% of this production was Sydney rock oysters with Pacific oysters and flat oysters worth 8.1% and 0.4% of production respectively. Around 75% of all oysters grown in NSW are sold within the state, the remaining oysters being shipped to interstate markets.

The first human consumers of Sydney rock oysters were Aborigines whose oyster middens have been carbon dated back to 6000 B.C. Early Europeans gathered oysters not only for food but also to burn their shells for lime, which was used for building mortar. The resulting depletion of wild stocks led to the development of farming practices around 1870.

There are 12 active oyster farmers on 70 leases covering 95 ha in the Camden Haven River system spread throughout the system. Camden Haven River Sydney rock oyster production was worth $1.113k wholesale valued in 2008/9 (I&I NSW 2009b). Two thirds of this production, by dozen, was plate grade, the only estuary in NSW that produces more plate than smaller grades. Growers are also trialing flat oyster and pearl production. The Camden Haven also accounts for a proportion of seed oyster production, both wild and hatchery Sydney rock (*Saccostrea glomerata)*, native flat (*Ostrea angasi*) and Akoya (pearl) (*Pinctada* imbicata) oyster. The river produces no Pacific oysters (*Crassostrea* gigas). The average annual number of oysters produced in the Camden Haven estuary over the last 4 years is 250,000 dozen (I&I NSW 2009b). The Camden Haven River was the 7th most productive river in terms of oyster production on the north coast of NSW in 2008/9 (I&I NSW 2009b).

The following map shows the areas where oyster operations take place.

Map 1: Camden Haven Harvest Area Boundaries



4.1. Recent environmental achievements of the Camden Haven River Oyster Farmers

The Camdem Haven Oyster Farmers have been actively working for improved catchment management in the river and building the capacity of the community to understand the industry and its role within the community through education and awareness raising undertaken for many years. Recent successes include sewage updates and fencing of riparian areas to prevent cattle from entering the river. Oyster farmers also participate in Clean Up Australia day through providing their punts and other equipment to assist in clean up activities.

4.2. SYDNEY ROCK OYSTERS (*SACCOSTREA GLOMERATA*)

The Sydney rock oyster is endemic to Australia and New Zealand and is found in bays, inlets and sheltered estuaries from Harvey Bay in Queensland south to Wingan Inlet in eastern Victoria (AFR, 1993). It is capable of tolerating a wide range of salinities and occupies the intertidal zone to 3m below the low water mark. Within this range they are common on hard rocky substrates but can survive and grow on soft substrates (AFR 1993).

Sydney rock oysters generally spawn in summer. Peak spawning occurs at water temperatures of 21–23° C and time of spawning varies between localities (AFR 1993). The main spawning season in the Camden Haven River is from December to March. Oysters are termed 'serial broadcast spawners'; serial as they will spawn several times in a season, and broadcast as their male and female gametes are released into open water, where fertilisation occurs. Within hours of fertilisation the eggs develop into free-swimming planktonic larvae (AFR 1993). The larvae swim in estuarine and coastal waters for up to 3 weeks during which they develop transparent shells and a retractable foot. The larvae then settle on a clean substrate using the foot to find a suitable site. The foot is resorbed once the larvae are attached, the shell darkens and the small animal takes on the appearance of an adult oyster (AFR 1993). Settled, footless oyster larvae are known as 'spat'. Adult oysters are sessile, i.e. they are fixed to the substrate.

Growth rates vary with local conditions but generally Sydney rock oysters reach 40–60g in 3 - 4 years, with spawning first occurring at 1 year of age. Sydney rock oysters change sex during life and first function as males but later change to females. A later sex reversal is possible but generally 75% of prime eating oysters are female (AFR 1993).

Sydney rock oysters are filter feeders, straining planktonic algae from the water. Mortality is highest in the free swimming and early settlement phases and at this stage oysters are prey to a variety of fish. Once the shell has hardened they are less vulnerable to fish predation but stingrays (*Myliobatidoidei*), mud crabs (*Scylla serrata*), whelks (*Neogastropoda*) starfish (*Asteroidea*) and pied oyster catchers (*Haematopus longirostris*) all feed on adult oysters (AFR 1993).

The Sydney rock oyster industry in New South Wales has been threatened by the introduction of the Pacific oyster (*Crassostrea gigas*), which was introduced to Tasmania from Japan for aquaculture purposes. Pacific oysters can dislodge newly settled Sydney rock oysters and have a faster growth rate which could potentially out-compete native species. Port Stephens is the only estuary in NSW permitted to grow diploid (fertile) Pacific oysters and it is a recognised pest in all other NSW waters. Some other estuaries, for example Wallis Lake, Hawkesbury and Georges Rivers, are now permitted to grow sterile triploid Pacific oysters.

Native flat oysters (*Ostrea angasi*) are also grown in relatively small numbers. The flat oyster is similar to the belon oyster (*Ostrea edulis*) of Europe and the bluff oyster (*Tiostrea chilensis*) of New Zealand. Its breeding process is similar to that of the Sydney rock oyster but natural populations have been reduced to an extent that the stock must be sourced from a hatchery. Most of the oysters produced in this estuary are moved to the NSW south coast for finishing.

There is a fledgling pearl industry in the Camden Haven which is based on the akoya pearl oyster (*Pinctada imbicata*). It is early days but the quality of the pearls produced to date is promising.

4.3. How we farm oysters

Traditional stick method

The intertidal stick and tray method of growing oysters was developed around the turn of the century to avoid losses due to mudworms (Roughly 1933), mostly *Polydora websteri* (Skeel 1979), and has been the most common method of production since 1940 (Malcolm 1987). With this method, oysters are caught and grown on tarred hardwood sticks (usually 183 x 2.5 x 2.5 cm) for 2 to 4 years and then sold or 'finished' on tarred hardwood framed wire or plastic mesh or wholly plastic trays (usually 183 or 275 x 92 x 2.5 cm). These sticks and trays are laid out on post and rail 'racks' constructed from tarred or plastic covered hardwood. These are set at an appropriate height so that the oysters spend approximately 70% of the time under water (Nell 1993). Oysters grown at this height avoid both attack from mudworm, especially if kept clean by hosing with water, or by being overgrown with competitors such as cunjevoi (*Pyura stolonifera*) and barnacles (*Balanus* and *Elminius* spp.). Many stick oyster farmers cover their sticks in a light coating of concrete. These 'concreted' sticks have the advantage of attracting more oyster 'catch', due to the presence of $Ca(OH)_2$ (Anderson 1996), and have better adhesive properties, so fewer oysters fall off the sticks over the 2 to 4 year grow out phase. This means each 'concreted' stick may yield two or three times as many oysters as a plain tarred stick.

The advantage of stick culture is that as the oysters are naturally fixed on the sticks they can be grown in unsheltered areas with relatively little maintenance (Nell 1993). The disadvantages of stick culture are that the oysters grow into, and become attached to each other while on the sticks, necessitating the manual separation of the oysters after removal from the sticks and results in irregularly shaped shells. Also, because the sticks are not handled for a number of years, they must be grown in an area of little or no larval oyster settlement. The settlement of oyster larvae is known as 'catch', and if maturing oysters are settled on by a second or third year's catch, known as 'overcatch', the time taken to separate them becomes prohibitive.

Very few oysters are produced this way now in this estuary but probably half of the state's production is still from this method.

Single Seed

Starting Off – Wild catch

Nearly all Sydney rock oysters produced in this river are single seed. Wild catch single seed oysters are caught on sticks or plastic slats, which are thin strips of arced plastic. Numerous slats are arranged horizontally on a frame 5-10mm apart with the appearance resembling that of a venetian blind. The frame and attached slats are then stacked on top of one another (3-5 high) in blocks to maximise the surface area and reduce predation from fish. They are then laid flat on racks within leases exposed to natural spatfall. In the Camden Haven River most of the catching leases are towards the mouth of the river where the highest concentrations of catch occur. The slats are usually 'stripped' of their spat around

6-9 months after being put out by which time the oysters are large enough to to be handled (>4mm) and before they grow into each other or get the following year's 'overcatch'. Once removed, the spat is then transferred to other grow out methods such as 'tumblers' (discussed later in this section).

The advantages of this method are that the oysters do not have to be separated and they grow into a regular cup shape. Also, because the oysters must be handled regularly they can be treated for overcatch so they can be successfully grown in high catch areas. The disadvantage of this method are that the oysters must be handled much more often during their growth.

Hatchery oysters

The NSW Department of Industry and Investment have had a breeding program in place for Sydney rock oysters now over twenty years. The oysters produced to date are faster growing (reducing time to market by up to twelve months) and/or either QX (*Martelia sydneyi*) or winter mortality disease (probably *Bonamia sp*) resistant.

These oysters are purchased from a hatchery at 1mm and raised in an upweller (or nursery) until they are around 4mm and large enough to be placed on an oyster lease and grown in the normal manner. There are two 'nurseries' on this river at the moment and many hatchery oysters are raised here for sale to growers in other estuaries.

Cultivation methods

There have been numerous different growing methods now being used by growers around Australia and growers in the Camden Haven are using many of them. As previously stated most growers have moved away from the traditional stick and tray method that used tarred timber infrastructure. Some of this infrastructure is still been used but only one grower still uses tar and is phasing this use out. Even though tarred timber tray and stick are still being used, this is being replaced as soon as possible by plastic or plastic coated timber infrastructure.

Once the oysters being grown are removed from the sticks, slats or nursery system they are generally transferred to small mesh 'cylinders' or 'baskets'. At this small size the oysters grow quickly and must be graded and 'thinned' to ensure maximum growth.

As they become larger they are moved to cylinders or baskets with larger mesh or different systems such as intertidal rafts, floating baskets, fixed intertidal baskets and the traditional intertidal tray.

Growers use a range of systems which may depend on their particular site but is often just comes down to personal preference.

Land based activities

The nature of commercial oyster cultivation not only requires significant water based infrastructure but also necessitates a functional land base from which efficient operations can be conducted. Most permit holders on the Camden Haven River have a lease arrangement with the Department of Lands allowing the growers permissive occupancy of a small section of waterfront land and storage area for cultivation infrastructure and associated equipment. .

The majority of the Camden Haven River Oyster Farmers land based facilities are situated on the banks of Gogleys Lagoon Henry Kendall Reserve and Stingray Creek.

The sites on Gogleys Lagoon (6 sheds) and Stingray Creek (1shed) are fully serviced with power and water while the sites (4) in Henry Kendall Reserve are mostly for storage purposes only. One grower has a large freehold site (Diamond Head Rd).

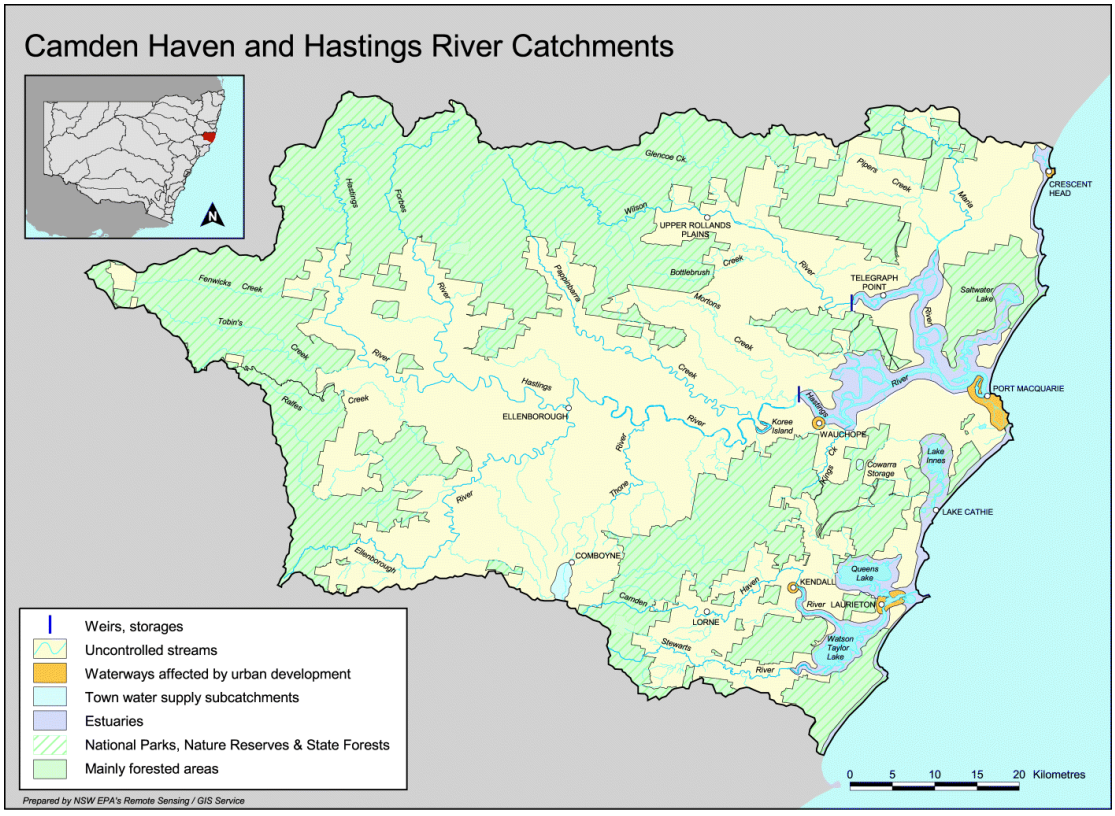
Most of the processing of the oysters occurs on these sites and this includes washing and grading of oysters, cleaning and repair of growing infrastructure, depurating oysters and in some cases opening oysters for the wholesale or retail market.

Two growers also have nurseries, both of which are located in Gogleys Lagoon.

5. THE CAMDEN HAVEN RIVER

The Camden Haven River is located on the New South Wales North Coast approximately 380km north of Sydney and 600km south of Brisbane (figure 1). The Camden Haven estuary consists of two major lakes, Watson Taylor Lake and Queens Lake connected to the ocean by the Inlet of Camden Haven. The Camden Haven and its tributaries drain a 720 km^2 catchment (NSW DNR no date)[i] that is mainly undeveloped with 77% covered in native vegetation (DEC 2005), being mostly State Forest, and National Park (PMHC 2008). Tidal influence up the Camden Haven River extends upstream of Kendall, a town some 22 km from the entrance. The adjacent towns of Laurieton, Dunbogan and North Haven are located close to the entrance. This area is rapidly growing with a combined population for these towns at around 7,400 (PMHC 2001). The surrounding landscape is dominated by the heavily forested North Brother Mountain, which rises almost 500 m above the towns. The approximate length of the Camden Haven River is 40km. The Camden Haven region is a key tourist destination, particularly for recreational fishing and boating in NSW.

The Camden Haven River system contains many significant areas of seagrass as well as saltmarsh, mangroves and wetlands. Several major tributaries enter the Camden Haven in the tidal zone (~29km from the mouth) including Queens Lake, Limeburners Creek, Herons Creek, Camden Haven River, Watson Taylor Lake, Washtub Inlet. Stewarts River, Gogleys Lagoon, Mud Bay, Bensons Inlet, Herons Creek.



Source http://www.environment.nsw.gov.au/ieo/Camden Haven/map.htm

5.1. OYSTER FARMING AND ESTUARY HEALTH

Camden Haven River Oyster Farmers have an intimate understanding of the estuarine environment, and depend on its health and productivity for their livelihood. They are a unique resource for the management of these systems that the government, natural resource managers and the community can draw on.

The oyster farmers of the Camden Haven River like all oyster farmers, operate according to a very simple equation.

good water quality = good product = regional employment and investment

The importance of oyster to river health cannot be understated. The pre-European oyster populations in this river were much larger than they are today; these populations were decimated by overfishing and disease. The quote below (Black 1876, Ogburn 2006) from an audit undertaken in 1876 provides an idea of how many oysters there were in this river and how quickly the populations were decimated:

> *In the 1860's a man could work his warp stake into the bed and not leave that spot for sixteen or twenty days, getting fifteen to twenty bags a day all that time. For a long time ten to twelve or even fifteen boats were so employed until only three of four bags could be got….some came back in about three years only to get at most six or seven bags per day.*

Oysters provide critical ecosystem services including reduction of water turbidity through active water filtration, stabilisaton of substrate, habitat provision for many other marine organisms and enhanced benthic-pelagic coupling though the transfer of nutrients from the water column to the benthos. (pers comm. Harwell, J. of Shellfish Research, 2010). In spite of seemingly large quantities of wild oysters in the intertidal zone there are now virtually no natural 'beds' of oysters in the estuary. Given the quote above an estimate of the standing stock of oysters prior to 1860 would be: 15 boats taking 15 bags a day, 5 days a week for 30 weeks a year (when the oyster would be 'fat') means that 33,750 bags of oysters were taken from this estuary per annum for perhaps 10 years. If half that stock was 'replacement' stock over this time that would still place the standing stock of oysters at around 160,000 bags. This is compared to the present annual production of around 1,500 bags with a standing stock of at most 4,500 bags; less than 3% of the pre-European population. The commercial crop of oysters in this estuary, although small compared to pre-European times, is vital for the health of the estuary.

Conversely, oysters are also at the front line of water quality issues. As filter feeders and bio-accumulators oysters are the first to show signs of water quality deterioration. The Camden Haven is fortunate to be one of the 'safer' growing areas in the state; a small catchment with virtually no industry, relatively small urban areas, little acid sulphate soil areas and no incidence of the two major oyster diseases (QX and winter mortality). In spite of this the area is not pristine. There is work to be done in regards to stormwater management and riparian restoration. The area also has one of the fastest growing populations in Australia and growers need to remain vigilante. The oyster industry occupies the cusp of land and sea and is vulnerable to projected terrestrial and marine climate changes. Potential ocean acidification, increased East Australia Current flows, increased storm intensity and frequency, increased heatwaves and sea level rises are likely to mean that oyster farmers will need to adapt in diverse ways (Leith & Haward, 2010).

Source http://www.dnr.nsw.gov.au/estuaries/inventory/pictures/camden-00.shtml

5.2. WATER QUALITY MONITORING

The NSW Food Authority implements the Australian Shellfish Quality Assurance Program and oversees all oyster harvest areas in the state. The program is based on a system of classifying harvest areas according to results of shoreline surveys and water and oyster meat samples. Details of this program can be found on the NSW Department of Industry and Investment website.

The Camden Haven has been divided up into three harvest zones:

- Hanleys Point - from leases across from the Fishemans' Coop to Watson Taylors Lake;
- Stingray Creek – the entrance of Queens Lake to the leases closest to the river entrance; and
- Gogleys Lagoon – all the leases in the lagoon.

There are a few leases in both lakes that fall outside of these harvest areas but these are for growing oysters only, all oysters taken from these leases must be relocated into a harvest area for at least six weeks before they can be harvested.

All zones are classified as conditionally restricted. This means that after an adverse event, for example rainfall in excess of 50-60mm, harvesting ceases until water and meat quality tests reveal that conditions have returned to normal. Also, oysters are required to be depurated for 36 hours prior to sale.

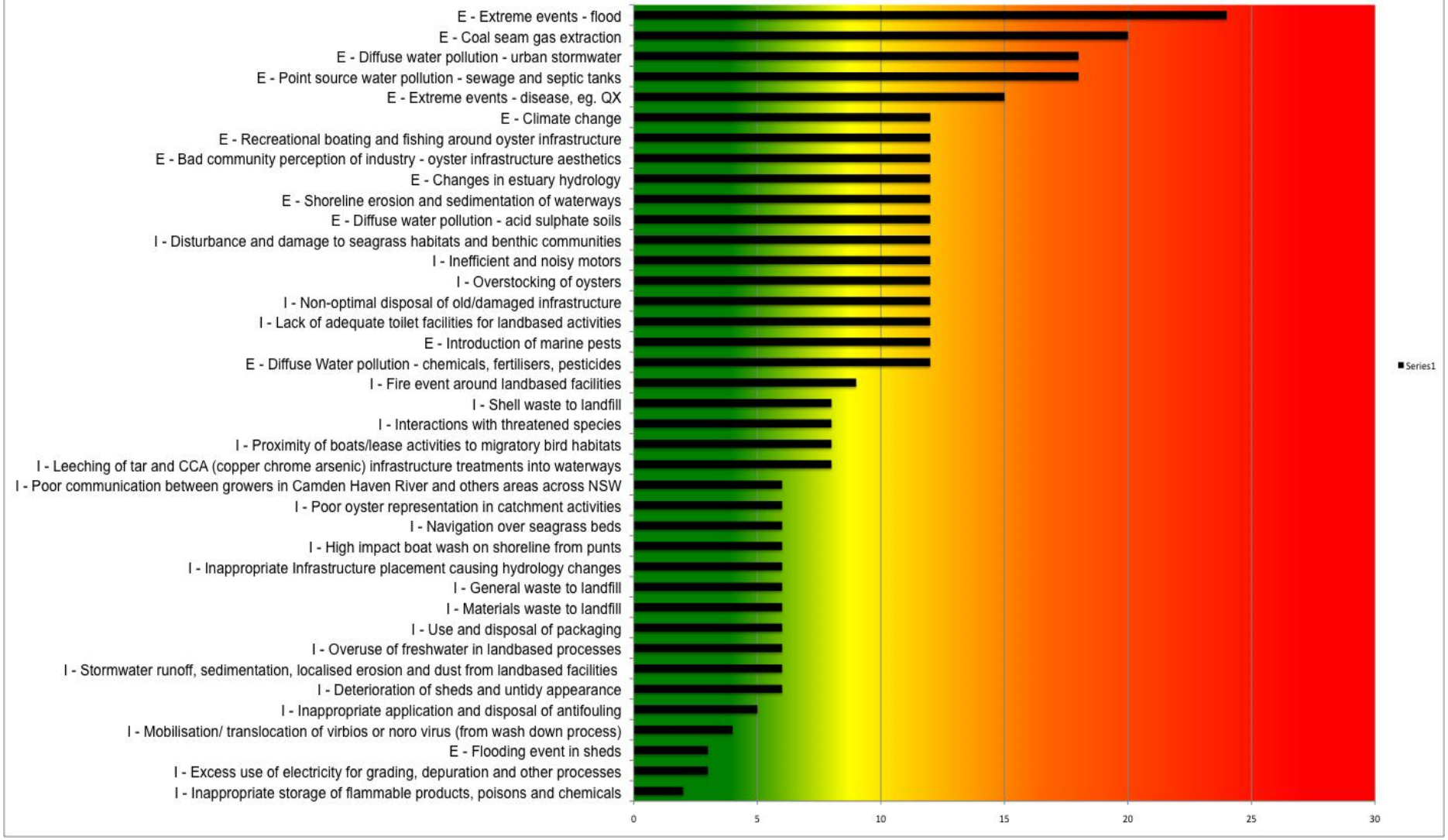
The local growers oversee their own management plan for the area. This entails fortnightly and monthly testing of phytoplankton and for biotoxins respectively. The program is also required to do a minimum of 5 adverse samples (taken where it may be there is a chance of elevated results, for example rainfall of less than 50mm, a particularly high tide or the presence of large numbers of tourists) to ensure that the program is allowing only high quality product onto the market.

6. ENVIRONMENTAL ACTION PLAN

Camden Haven River Oyster Farmers (CHROF) have undertaken an environmental risk assessment to identify and assess the environmental impacts of all operations for Camden Haven River oyster enterprises and address any unacceptable risks that their activities pose to the environment. All risks identified have been prioritised according to the potential impact that an activity may have on the environment as well as the likelihood of that impact occurring. Addressing all high risk activities as well as some medium risk activities through appropriate actions forms the basis of this EMS in its first years.

The risk assessment methodology and results table presented in Appendix 2 provides a summary of the existing and proposed measures that Camden Haven River Oyster Farmers have/will put in place to address each priority risk activity identified. Priority risks have been defined to include all high and medium risks identified). The justification and background for each of the priority risks impacting the Camden Haven River Oyster Farmers is provided in this section. Figure 1 provides a summary of the risks identified by growers and the risk level scored through the risk assessment. Risks have been split in two main categories: 1) industry-related activities, which are those primarily controlled and managed by the oyster industry and 2) external activities, which are those impacting the oyster industry but, in most cases, they are beyond the control of the oyster industry. The Camden Haven River Oyster Farmers will seek to work with key stakeholders and the community collaboratively towards minimising the external risks.

Figure 1. Identified risks prioritised according to potential impacts and likelihood of occurrence (Note: I relates to potential industry related risk impacting on the environment and E relates to potential external risk impacting on industry)



6.1. OBJECTIVE 1 PROTECT AND ENHANCE THE HABITAT OF THE CAMDEN HAVEN RIVER AND ITS CATCHMENT

The actions identified against Objective 1 aim to mitigate and address priority risks (note no high risks have been identified against this objective) to protect and enhance the habitat of the Camden Haven River and its catchment.

Industry related risks

- Disturbance or damage to seagrass habitats and benthic communities
- Fire event around landbased facilities
- Impacts to migratory birds and protected or threatened species

External risks

- Shoreline erosion and sedimentation into waterways
- Changes in estuary hydrology
- Introduction of marine pests
- Deterioration of water quality from point source sources - sewage and septic tanks
- Deterioration of water quality from diffuse sources – urban stormwater
- Deterioration of water quality from diffuse sources - acid sulphate soils
- Deterioration of water quality from diffuse sources - chemicals, fertilisers, pesticides
- Deterioration of water quality from potential coal seam gas extraction within the catchment

Shoreline erosion and sedimentation into waterways, changes in hydrology and water quality

Action 6.1.1 Assist the Northern Rivers Catchment Management Authority, OceanWatch Australia. WetlandCare Australia and the Port Macquarie-Hastings Council in identifying priority areas requiring on--ground works. Ensure regular liaison with local council and NSW Maritime and participate in key meetings.

Responsibility	Performance Target	Action owner
CHROF	Work underway for 2 projects in priority areas as identified by CHROF by December 2011. Identification of project sites by August 2011.	Harry van Haren
OceanWatch Australia	Work underway for 2 projects (5km fencing) in priority areas as identified by CHROF by December 2011	Simon Rowe, Tide to Table Manager
WetlandCare	Work underway for 2 projects (5km fencing) in priority areas	Josh Keating, Regional

Responsibility	Performance Target	Action owner
Australia	as identified by CHROF by December 2011	Coordinator
Local Council	Work underway for 2 projects (5km fencing) in priority areas as identified by CHROF by December 2011	Thor Aaso, Natural Resources Officer, Port Macquarie – Hastings Council
NRCMA	Work underway for 2 projects (5km fencing) in priority areas as identified by CHROF by December 2011	NRCMA Community Support Officer/ Industry Partnerships Officer
CHROF	Regular participation in Estuary Management Committee.	Tony Troup
CHROF	Ongoing liaison with Council, Maritime, EPA (Office of Environment and Heritage) in place for discussion around water quality issues, coal seam gas extraction, dredging and sewage upgrade timetables etc	Tony Troup
CHROF	Invitation to Council and NRCMA to attend CHROF AGM made by July 2011.	Tony Troup
CHROF	Brochure on importance of using sewage pumpout facilities developed and distributed to boaters by December 2011.	Tony Troup

Background

The Camden Haven River contains many significant areas of seagrass. Funding is available from various sources and programs administered by the Australian and NSW Government including Caring for our Country, NSW Environmental Trust as well as funding administered by NRCMA for onground works to undertaken bank stabilization works, rehabilitate river and estuarine habitats, reduce erosion and improve water quality off farms. The NRCMA has indicated that effective and efficient investment can only be achieved through partnerships with existing land owners, land managers and industry. For example, while funding may be available, other organisations, individuals can assist projects through contributing expertise and/or labour and machinery.

OceanWatch Australia is currently delivering a small recreational fishing trust project in the Hastings River as a part of its Tide to Table program. The Tide to Table program could be used as a model to facilitate coordination of government agencies and community groups for the benefit of commercial fishers, recreational fishers and oyster farmers in the Camden

Haven River. Tide to Table is about drawing the connection between activities that occur in the upper catchment to the delectable seafood on our dinner plates. The project is operating across the Sydney Metropolitan, Camden Haven Nepean and Hunter Central Rivers regions in NSW and the Burnett Mary and Burdekin Dry Tropics regions in Queensland. It concentrates on partnering water based primary producers and land based primary producers with the community to restore fish habitat. It strives to highlight the importance of land management activities in the catchment that impact on estuarine wetlands and water quality and have a flow on effect to the productivity of the seafood industry.

WetlandCare Australia are currently undertaking bank stabilisation projects and erosion control works in the Hastings and Maria Rivers, in partnership with the Council and Hastings Landcare group.

Recreational boating is a key activity occurring within the Camden Haven River. A number of Sewage pumpout facilities are freely available for use by boaters at Laurieton Wharf or Fishing Coop. The CHROF have been working with a number of stakeholders and the Council to successfully have sewage treatment facilities upgraded on the Camden Haven Rive which is still progressing although the areas of most concern have been rectified.

The classification of estuaries for oyster harvesting, as part of the Shellfish Harvest Area Classification (HAC) scheme compiled by the NSW Food Authority required comprehensive studies of each estuary to assess influences and risks regarding water quality. In a relatively undeveloped catchment such as the Camden Haven, the Camden Haven River Oyster Farmers see the potential in using this information as a benchmark of river status, to which a database of water quality (collected and maintained by the oyster farmers, described in section 5.3. & action 6.1.4) could be compared to over a long-term to see if correlation exists between completed on-ground works and improvements in water quality.

Seagrasses and benthic communities

Action 6.1.2 Minimise effects on seagrasses and benthic communities. Report significant changes in seagrass to Industry and Investment NSW (Fisheries branch). Provide inkind support to NGOs involved in estuarine ecosystem conservation and rehabilitation.

Responsibility	**Performance Target**	**Action owner**
CHROF	Changes in seagrass coverage or condition reported to Industry and Investment NSW as identified on an ongoing basis.	Camden Haven Shellfish Quality Assurance Program in conjunction with NSW Farmers Hastings River Shellfish Branch
CHROF	Review of the effects of racks vs floating cultivation on seagrass and identify suitable actions if required for management by December 2013. Opportunities identified for partnerships with universities and others to undertake review completed by June 2011.	Shane Harper

CHROF	Best Practice procedures for navigation and cultivation around seagrass maintained and updated in line with improvements in technology on ongoing basis.	Camden Haven Shellfish Quality Assurance Program in conjunction with NSW Farmers Hastings River Shellfish Branch
CHROF	100% use of floating cultivation in areas where suitable by July 2013	Shane Harper

Background

Oyster farming methods of the past have been known to affect seagrasses and benthic communities (i.e groups of plants and animals living on the floor of a water body) via the placement of infrastructure, the shade that infrastructure casts on the floor of the water body, and the waste products produced by the oysters. In present times, this concern is now focused on derelict and unused infrastructure.

Stick and tray farming methods have been used on the Camden Haven River for many years. Studies completed in other estuaries, for e.g. Crawford, 2003; Lasiak and Underwood, 2002; Porat, 2001, indicated oyster growing activities do not have any widespread impacts on seagrass or benthic communities, with any dieback or community change strictly localised to the immediate vicinity of the oyster leases.

It should be noted that while seagrass dieback is of major concern in NSW, oyster farming is very rarely identified as one of the causes. The National Oceans Office (1997) states that "Increased sedimentation and nutrients from catchments have been linked with massive die-back of seagrasses in many areas."

Impacts from waste material generated by oysters are generally only associated with highly intensive farming (Crawford, 2003), a method not employed by the Camden Haven River Oyster Farmers.

The extensive removal of large volumes of derelict infrastructure throughout the Camden Haven catchment has reduced shading and allowed regrowth of seagrass, however more work needs to be achieved in this area (Refer action 6.2.5).

The use of tumblers in early production stages (see section 5.1) raft culture and long-line and floating bags in the grow-out phase significantly reduces shading through less infrastructure, and the tendency for these methods to move with the wind and tide. Oysters have differing requirements at different ages and in order to maximise productivity trays are rotated between areas. This process also rests certain areas allowing seagrass shaded by trays or sticks to re-establish.

Inappropriate Infrastructure placement - hydrology changes

Action 6.1.3 Minimise effects on natural sedimentation. Report significant changes in sedimentation to Industry and Investment NSW.

Responsibility	**Performance Target**	**Action owner**
CHROF	Best Practice procedures for infrastructure placement and	Camden Haven Shellfish Quality

	stocking densities maintained and updated in line with improvements in technology on ongoing basis.	Assurance Program in conjunction with NSW Farmers Hastings River Shellfish Branch
CHROF	Changes in sedimentation coverage or condition reported to Industry and Investment NSW as identified on an ongoing basis.	Camden Haven Shellfish Quality Assurance Program in conjunction with NSW Farmers Hastings River Shellfish Branch

Background

Large-scale intensive oyster farming may affect natural sedimentation by altering water flows and by adding material through shell loss.

The long-established oyster farming industry of the Camden Haven River has not lead to any apparent changes in the local sedimentation regime. More widely, sedimentation is rarely considered as a significant environmental effect associated with the types of oyster farming generally employed in Australia (Crawford, 2001). As mentioned in action 6.1.2 new methods being employed by a number of Camden Haven River Oyster Farmers reduces seafloor-based infrastructure, further reducing the potential of oyster cultivation to affect natural sedimentation processes.

The CHROF have commenced a process to develop a Stock Management Plan for the Camden Haven River to ensure stocking densities are optimal for estuarine health and oyster production. This plan will also contribute to reducing any impacts from sediment buildup associated with infrastructure placement. (Refer action 6.2.3)

Deterioration in water quality

Action 6.1.4 Maintain existing water quality monitoring program. Report detected or suspected pollution incidents immediately to the NSW Food Authority.

Responsibility	**Performance Target**	**Action owner**
CHROF	Shellfish Quality Assurance Program water quality monitoring maintained in accordance with regulatory requirements	Camden Haven Shellfish Quality Assurance Program Committee
CHROF	Any deterioration in water quality results identified reported on timely basis to NSW Food Authority.	Camden Haven Shellfish Quality Assurance Program Committee
CHROF	Investigate potential to lessen expense of water quality monitoring	Camden Haven Shellfish Quality Assurance Program

Background

The Camden Haven River Oyster Farmers maintain a regular water and meat quality-monitoring regime as a part of the Shellfish Quality Assurance Program (SQAP) to ensure that immediate action can be taken should pollution levels threaten the health of the Camden Haven River and oyster stocks. There are two parts to the program:

1) Testing for bacterial indicators (bacto testing) which detect potential contamination that may cause outbreaks of food poisoning by norovirus. Both water and oyster meat is tested. This has been done over a number of years and elevated results have been shown to be correlated with rainfall so that the different harvest areas are closed for harvest after given amounts of rain. Before opening after a closure the harvest zones must be tested; there are 13 water testing sites and 9 meat testing sites in the estuary. The number of tests depends on the amount of rainfall that falls during the harvest season. As well as testing for opening after closures the program tests when there are other potential problems such as increased population during holiday periods, extremely high tides, strong winds or rainfall close to closure levels. A minimum of five of these extra tests must be done per annum to maintain the harvest area classification.

2) Testing for potentially harmful algae and their associated toxins. We test at three sites, one in each harvest area. Samples of algae are gathered by dragging an algae net at each site and taking a water sample. These samples are sent to Micoalgal Services in Melbourne where the algae present are identified and numbers estimated. If potentially toxic species are found in sufficient numbers then oysters in the area are checked for toxins. Algal samples are taken fortnightly while an area is open for harvest.

As well as checking the algae present in the harvest areas fortnightly the program also sends oyster from each site (while open for harvesting) monthly for toxin testing. Eighteen oysters from each site are tested for ASP, DSP, and PSP using Jellet kits.

In addition to the monitoring program each grower must do post harvest oyster meat bacto testing monthly if harvesting from a conditionally restricted harvest zone where the harvested oysters must be depurated before sale. Oysters harvested from a conditionally approved zone do not need to be post tested.

Anecdotal evidence suggests that NSW oyster industry is often the first to detect local pollution events such as sewage spill, toxic algae, chemical and fuel spills. Such pollution events not only threaten the local oyster industry, but also have severe implications for public and ecological health within the catchment. The SQAP also uses set parameters, which are standardised and therefore comparable among all NSW estuaries. This is not true of other water quality monitoring programs, such as local governments, which vary considerably in terms of parameters measured and frequency of sampling.

Port Macquarie-Hastings Council conducts regular chemical and bacteria sampling once every 4 months along the river. The council is also proactive in monitoring the status of the 4,600 septic systems in use across the catchment (PMHC 2008). The number of septic systems in use is growing as a direct reflection of increasing rural and rural residential development, but with this growth is improved monitoring of on-site sewage management systems by Council. The total annual number of inspections represents only a small percentage of the total number of on-site sewage management systems in the local government area. Many systems, particularly in the outlying rural areas have not been inspected to date. Detailed inspections of septics are categorised using an On-site Septic Management System (OSMS) whereby each septic system in the area is ranked according to

the risk it is to the surrounding environment. Septics are given a 1,2 or 5 rating that refers to year(s) between the required follow-up inspection (i.e. a rating of one is a high risk - due to its proximity to water courses, within 100 year flood limit etc.). On inspection of septics, all associated plumbing and fittings, tank contents, absorbent trenches and transpiration beds are all checked to ensure there no risk of contamination risk to the surrounding environment or waterways.

The intensive testing required by all oyster farmers comes at a considerable cost to the individual and the Camden Haven River Oyster Farmers will investigate the possibility of being compensated to broaden their water quality monitoring regime to cover other agency standards (councils, state government etc.) in an attempt to offset the expense incurred by each grower.

Action 6.1.5 Report all suspected pollution incidents to NSW Maritime, NSW Office of Environment and Heritage (OEH), formerly Environment Protection Authority and NSW Food Authority. Ensure a process is in place for NSW Maritime to notify oyster farmers of any spills. Investigate CHROF in conjunction with Sea Rescue Volunteers being trained in incident response and maintaining a fuel containment kit for on water incident response to support local authorities.

Responsibility	**Performance Target**	**Action owner**
CHROF	All water pollution incidents identified reported immediately to NSW Maritime, OEH and the NSW Food Authority on an ongoing basis.	Camden Haven Shellfish Quality Assurance Program Committee
CHROF	Process in place for NSW Maritime to notify CHROF of pollution incidents in a timely manner via Industry and Investment NSW by December 2011	Tony Troup
CHROF	Investigation for CHROF in conjunction with Sea Rescue Volunteers to be trained in incident response and maintain a fuel containment kit for on water incident response to support local authorities completed by December 2011.	Jason Armstrong

Background

Agricultural and urban stormwater runoff, acid sulphate soils, fuel and chemical spills may lead to water pollution incidents. Oyster farmers have a unique understanding of the estuary in which they work, with an ability to identify point sources of pollution through their rigorous water quality regime.

The local council and NSW Maritime are responsible for dealing with events which involve oil and/or fuel spillages. It may be beneficial for such agencies to equip Camden Haven River Oyster Farmers' representatives in conjunction with Sea Rescue Volunteers with spill containment kits, to enable and inhibit the spread of pollutants. This may be through provision of absorbent barriers to apply to affected areas.

Fire management around landbased facilities

Action 6.1.6 Liaise with the Rural Fire Service and develop and implement a best practice fire policy around the shed areas at Gogleys Lagoon, Stingray Creek, Diamond Head Road and Henry Kendall Reserve

Responsibility	**Performance Target**	**Action owner**
CHROF	Fire management policy developed and implemented for facilities at Gogleys Lagoon, Stingray Creek, Diamond Head Road and Henry Kendall Reserve by December 2011	John Eggins

Background

The forested nature of area surrounding the land-based facilities at Gogleys Lagoon, Stingray Creek, Diamond Head Road and Henry Kendall Reserve and the volume of gear stored on-site pose a significant risk in the event of a fire. Over the next six months the Camden Haven River Oyster Farmers will work toward developing and implementing a fire policy to minimise these risks. The creation of asset protection (buffer) zones through actions associated with the removal of waste and disused infrastructure in and around the shed area is the first step in minimising the potential for rapid spread between dwellings and to surrounding bushland in the event of fire.

Marine Pests

Action 6.1.7 Ensure all Camden Haven River Oyster Farmers have a copy of marine pest identification cards and best practice biofouling guidelines for aquaculture being developed by the National Introduced Marine Pest Coordination Group (NIMPCG). Report with a sample if possible, any detection of an unusual plant or animal. Follow requirements of government agencies in combating marine pests.

Responsibility	**Performance Target**	**Action owner**
CHROF	Marine Pest Identification Guide and best practice biofouling guidelines for aquaculture obtained and distributed to all growers by December 2011.	Camden Haven Shellfish Quality Assurance Program in conjunction with NSW Farmers Hastings River Shellfish Branch
OceanWatch Australia	Marine Pest Identification Guide and best practice biofouling guidelines for aquaculture distributed to CHROF by	NSW SeaNet Officer

	October 2011	

Background

Translocation of marine pests and subsequent settlement is an increasing risk in Australian waters as populations become more mobile and exposure to potential sources increase (eg. contaminated bilge water from merchant vessels, translocation of species from other regions by travelling fishers). Introduction of such species can have severe impacts on native species and lead to a total deterioration of ecological processes.

Education in the identification of pest species and correct reporting mechanisms of those with a unique understanding of the estuarine environment, such as commercial fishers and oyster farmers will greatly assist in early identification of such species, a key process in preventing the spread of marine pests. Currently a National System for the Prevention and Management of Marine Pest Incursions is being developed by the National Introduced Marine Pest Coordination Group (NIMPCG), which includes members from Commonwealth and State agencies, scientific organisations, and industry representatives. Part of the project objectives is the development and dissemination of educational material to oyster farmers, which will be incorporated into future versions of this EMS upon completion.

Protected species, migratory shorebirds and their habitats

Action 6.1.8 Provide information to conservation and management organisations regarding important bird habitats.

Responsibility	**Performance Target**	**Action owner**
CHROF	Intellectual knowledge provided to OEH National Parks and Wildlife branch and Birds Australia etc to identify key habitat areas on an ongoing basis.	Camden Haven Shellfish Quality Assurance Program Committee

Background

Estuaries provide important habitat for nesting and breeding birds, including migratory and resident threatened species. The Camden Haven River Oyster Farmers have a unique understanding of the environment in which they work and will assist OEH National Parks and Wildlife North Coast Shorebird Recovery Program if required to identify areas that provide important habitat.

Action 6.1.9 Report incidents of bird entanglements to Australian Seabird Rescue and OEH. Train CHROF in seabird rescue.

Responsibility	**Performance Target**	**Action owner**
CHROF	Selected Camden Haven River Oyster Farmers trained in seabird rescue by December 2011. All injuries and entanglements identified reported to Australian	Camden Haven Shellfish Quality Assurance Program in conjunction with NSW Farmers Hastings River Shellfish Branch

	Seabird Rescue and OEH National Parks and Wildlife on ongoing basis.	

Background

Birds can become entangled in litter and lost fishing line. Oyster farmers spend extended periods of time on the water, and are in an ideal position to report bird entanglements. The Camden Haven River Oyster Farmers will assist in seabird rehabilitation and release where able and report sightings of entangled or injured birds to Australian Seabird Rescue and OEH. An informal workshop educating the Oyster farmers about correct handling procedures for birds could assist in this process.

Action 6.1.10 Suspend operations immediately in the event of an interaction with a protected or threatened species. Allow the animal to escape without harm. Develop a Code of Conduct for Camden Haven Oyster farmers.

Responsibility	**Performance Target**	**Action owner**
CHROF	Zero interactions with protected or threatened species eg,, dolphins or turtles	All members
CHROF	Any Interactions reported to Industry and Investment NSW	All members
CHROF OceanWatch Australia	Code of Conduct developed and implemented by all CHROF members by December 2011. All members provided with copy of Protected Species Handling Manual from OceanWatch Australia by December 2011.	Tony Troup NSW SeaNet Officer

Background

Protected and threatened species include those listed, at a state level, under Part 2 Div 1 of the Fisheries Management (General) Regulation 2002, and Schedules 1 and 2 of the Threaten Species Conservation Act 1995. At a Commonwealth level, approximately 2000 species are listed under the Environment Protection and Biodiversity Conservation Act 1999.

It is highly unlikely that any commercial oyster farming activities will interact or harm a protected or threatened species, but as responsible oyster farmers, CHROF have provided actions that would be taken by the CHROF in the rare event of this happening.

Any interaction with protected or threatened species must be reported to Industry and Investment NSW.

6.2. OBJECTIVE 2 CULTIVATE OYSTERS IN A SUSTAINABLE MANNER - MINIMISING RESOURCE CONSUMPTION, WASTE PRODUCTION AND POLLUTION.

The actions identified against Objective 2 aim to mitigate and address priority risks to cultivate oysters in a sustainable manner – minimising resource consumption, waste production and pollution.

Industry related risks

- Inefficient motors emissions and noise pollution
- Lack of adequate toilet facilities
- Shell waste to landfill
- Overstocking of oysters
- Non optimal disposal of old/damaged infrastructure
- Deterioration of water quality from leaching of tar and timber treatments

External risks

- Extreme events - floods
- Extreme events - disease outbreak eg. QX
- Climate change

Outboard motor emissions, efficiency and noise

Action 6.2.1 Upgrade outboard motors to meet the current USEPA fuel efficiency and emissions standards.

Responsibility	Performance Target	Action owner
CHROF	100% of outboard motors in use meeting USEPA emissions standards by December 2012.	John Eggins
CHROF	Regular updates on latest technologies provided to CHROF at meetings.	John Eggins

Background

The NSW Office of Environment and Heritage (OEH) (formerly the EPA) currently adopts the USEPA emissions standards as a means of rating the environmental performance of outboard motors. Motors meeting these standards have significantly lower air and water emissions than conventional outboard motors and are also more fuel-efficient.

Australia does not manufacture any outboard motors and subsequently we have no control over the development of standards specific to Australian conditions. Fortunately the levels set in other countries is quite high, and the OEDA (Outboard Engine Distribution Association) in Australia through discussions with the Australian Government has formed a rating benchmark similar to energy ratings seen on electrical appliances. This will increase the marketing opportunities of manufacturers that produce motors with a lower emission rating than required by the standards and allow consumers to make choices based on environmental performance.

Some CHROF members have upgraded from older style 2-stroke engines, to those with a superior emission standard which reduces the use of fossil fuels and eliminates contaminants entering the waterways. There are however around 50% of growers using old style engines in that will be upgraded as cost permits over the next 5 years.

Action 6.2.2 Minimise fuel consumption and improve vessel stability, longevity.

Responsibility	**Performance Target**	**Action owner**
CHROF	100% of identified vessels injected with foam by December 2012	Brandon Armstrong

Background

Traditionally, timber punts were used in the oyster industry. However, the use of aluminum style punts is now considered the norm. Aluminum punts are constructed generally from hollow cell aluminum planks welded together. In the past 2 years, improvements in marine foam applications have resulted in the direct injection of older/ wearing punts with marine foam. These changes mitigate water absorption into the aluminum cells, reducing the weight of the punt and reducing fuel consumption. This proved to be very effective, and consequently improved floatation, stability and visually reduced the punt wake/wash (helping to control river bank erosion).

Stock management

Action 6.2.3 Develop a stock management plan for the Camden Haven River

Responsibility	**Performance Target**	**Action owner**
CHROF	Discussion with Industry and Investment NSW regarding a review of carrying capacity of river completed by December 2011	Tony Troup
CHROF/ Industry and Investment NSW	Stock management plan developed for the Camden Haven River by June 2014	Shellfish Quality Assurance Program Committee in conjunction with NSW Farmers Hastings River Shellfish Branch Industry and Investment NSW – Tim Gippel

Background

Oyster farming generally employed in Australia has not been identified as an activity impacting on the environment (Crawford, 2003). Oysters are not cultivated using intensive farming systems as mentioned in section 4.3. If growers try to cultivate more oyster stock than their enterprise or the environment is capable of managing, detrimental effects could come about due to inadequate husbandry or by exceeding the carrying capacity of the

system, respectively. Therefore, by not overstocking the lease areas, growers will ensure maximum productivity and a healthy lease area.

Camden Haven River Oyster Farmers will incorporate the above project findings and the recommendations provided by available oyster research studies (Troup, et al., 2005; Rubio, 2008) and the NSW Oyster Industry Sustainable Aquaculture Strategy, into their management to ensure optimum production and long-term sustainability of the Camden Haven River oyster industry.

Management of water based infrastructure

Action 6.2.4 Work toward eliminating the use of tar and treated timber.

Responsibility	Performance Target	Action owner
CHROF	100% of trays converted from tar/treated timber to polyurethane by December 2015.	Shellfish Quality Assurance Program Committee
CHROF	No lease areas using tarred/treated timber rails by December 2015.	Shellfish Quality Assurance Program Committee
CHROF	All tarred/treated timber disposed of correctly	Shellfish Quality Assurance Program Committee

Background

For many years, tarred or CCA (copper chrome arsenic) treated timber has been used for the sticks and trays on which oyster larvae are caught and grown into oysters. This increases the durability of the timber and protects it from marine borers and pests. There is no evidence indicating that this contaminates the oysters or neighbouring species (White, 2001), however, there is potential for chemicals to leach into the surrounding waters.

Oyster farmers throughout NSW are now phasing out the use of tarred and treated timber by using specially produced polyurethane trays, plastic sleeves around timber posts and sticks, or adopting alternative farming methods (as described in section 4.3.).

CHROF members have utilised extruded plastic products (built from recycled materials) for use in oyster cultivation infrastructure, including extruded plastic rails, plastic sleeves, posts and trays. The price/metre is cheaper than using timber products. The use of these recycled materials will eliminate ongoing maintenance and potential contaminants entering the river.

Collectively, CHROF are phasing out the use of chemically treated (tarred timber) through the utilisation of new technologies.

Ongoing infrastructure maintenance ensures active replacement at opportune stages of production. Many of the growers are working toward the exclusive use of polyurethane trays, and other plastic products. The process of changing over technologies is costly, time consuming and a labour intensive task. Conversion to non--- degradable products will

ultimately save the growers time and money, however, the shear logistics of such an operation means the change will not occur overnight.

All tarred and treated timber will be disposed of via OEH EPA approved controlled landfill sites.

Action 6.2.5 Remove and where possible recycle or reuse decommissioned infrastructure

Responsibility	**Performance Target**	**Action owner**
CHROF	Annual clean up of infrastructure and leases targeting water based infrastructure undertaken by June 2012. Liaison with OEH undertaken by December 2011 to discuss timetable for removal of infrastructure under their management. Timetable for removal to be completed by July 2015.	Brandon Armstrong

Background

Over the years oyster farmers have accumulated old trays, sticks and various pieces of equipment.

Camden Haven River Oyster Farmers recognise that current members play a key role in the removal of derelict infrastructure (disused racks, trays, posts etc). The Camden Haven River Oyster Farmers have already been proactive in instigating group clean- ups and the Council has assisted by waiving tipping fees. Around 100 tonnes of decommission infrastructure has been removed to date however water based infrastructure clean ups of harvest areas are yet to occur.

Camden Haven River Oyster Farmers will communicate with Port Macquarie-Hastings Council on this initiative to assist in the process to make it more economically viable for the ongoing appropriate disposal of removed derelict infrastructure. Currently, it is not economically feasible to appropriately store or dispose of derelict infrastructure. To assist in reducing the economic burden to individual Camden Haven River Oyster Farmers members achieving environmental cleanup activities in the catchment, a request will be made for ongoing waiving of Council tip fees for derelict infrastructure disposal.

The ongoing practice of adopting recycled plastic materials, e.g., replacing damaged infrastructure (previously tarred posts and racks) will eliminate any further introduction of these problems).

In addition there remains around 10 tonnes of infrastructure not under the management of industry that is located adjacent to national parks. CHROF have no authority to access or remove this infrastructure but will engage with OEH to discuss removal options.

Toilets

Action 6.2.6 Review options for portable toilet facilities in priority areas – Gogleys Lagoon, Henry Kendall and Stingray Creek.

Responsibility	Performance Target	Action owner
CHROF	Suitable toilet facilities installed in priority locations by June 2012.	Brandon Armstrong

Background

As well as spending considerable amount of time on the water tending their leases, the nature of commercial oyster cultivation also requires the growers to spend extended periods at their shore based facilities, whether it be culling, grading or maintaining equipment. Adequate toilet facilities at priority sites are currently limited or non-existent.

Use of shell waste

Action 6.2.7 Investigate opportunities for reuse of shell waste with Council, Department of Lands, Office of Environment and Heritage and local farming businesses.

Responsibility	Performance Target	Action owner
CHROF	Alternate uses for shell waste identified and action initiated to provide shell as required by December 2011. Zero shell waste to landfill by December 2012.	Brandon Armstrong

Background

Camden Haven River Oyster Farmers use and will continue to use waste shell as a means of erosion control and road base around land based activities. There may however be further opportunities where shell waste that currently goes to landfill could be reused. CHROF will investigate alternate uses for shell waste and liaise with key groups who may take shell waste to ensure by December 2011 CHROF have zero shell waste to landfill.

Contingency planning for extreme events

Action 6.2.8 Contingency plans to be developed to address Camden Haven River Oyster Farmers response to extreme events (flood, drought, disease)

Responsibility	Performance Target	Action owner
CHROF	Contingency Plan developed by June 2012. Plan to include: • development of specific infrastructure design standard for Camden Haven	Brandon Armstrong/ Harry van Haren

Responsibility	Performance Target	Action owner
	River and guidelines developed by DII • communication to all growers on best practice • annual inspection of mooring lines. • requirement to track rainfall figures upriver and develop an information network(via phone) to warn farmers • stockpile use of QX resistant oysters • potentially the establishment of an emergency fund	

Background

Extreme events, whether they be flood events, drought or disease outbreaks can have a devastating impact on an oyster industry as has been seen in recent years with the outbreak of QX in the Camden Haven River and water quality problems in the Kalang River and Tiligery Creek. The CHROF have identified as a priority the need to be better prepared for extreme events such that the impacts to growers can be mitigated as much as possible. To that end CHROF have identified a number of actions around training/communication and infrastructure design and mitigation techniques that require further exploration. Following this a Contingency Plan will be developed for all growers to follow in extreme events.

Climate change

Action 6.2.9 Maintain ongoing participation in climate change discussion and in the development of an adaptation plan for the industry.

Responsibility	Performance Target	Action owner
CHROF	Participation in key climate change discussions and in the development of an adaptation plan for the industry on an ongoing basis.	Tony Troup

6.3. OBJECTIVE 3 RECOGNISE AND PROTECT THE CULTURAL AND AESTHETIC VALUES OF THE CAMDEN HAVEN RIVER AND ITS CATCHMENT.

The actions identified against Objective 3 aim to mitigate and address priority risks to recognise and protect the cultural and aesthetic values of the Camden Haven River and its catchment.

Industry related risks

- Deterioration of sheds and infrastructure
- Non optimal disposal of old/damaged infrastructure

External risks

- Recreational boating and fishing around oyster infrastructure

Infrastructure aesthetics

Action 6.3.1 Keep all sheds and leases tidy and uniform.

Responsibility	Performance Target	Action owner
CHROF	Participation in Clean Up Australia Day 2012	Kerry Simmonds

Background

The leases used by the Camden Haven River Oyster Farmers are integral to the industry that has been part of the economy, appearance and culture of the Camden Haven River for over 120 years.

The development of the NSW Oyster Industry Sustainable Aquaculture Strategy, outlines criteria for an acceptable lease and shed site e.g. materials, maintenance and visual amenity. Camden Haven River Oyster Farmers take great pride in the appearance of their leases and sheds. Extensive work has already been initiated on infrastructure improvements and derelict infrastructure removal; in adherence to this strategy. Camden Haven River Oyster Farmers recognise that more work needs to be done through to remove derelict infrastructure.

Navigation

Action 6.3.2 Maintain all navigation and marker requirements in line with NSW Maritime and Industry and Investment NSW requirements. (Linked to Action 6.2.6)

Responsibility	Performance Target	Action owner
CHROF	No infringements of navigation and marking regulations.	Shellfish Quality Assurance Program Committee

Background

Derelict infrastructure can become a navigational hazard. Camden Haven River Oyster Farmers members are proactively removing disused and derelict infrastructure from the catchment.

Theft

Action 6.3.3 Report occurrence of theft to police and Industry and Investment NSW.

Responsibility	Performance Target	Action owner
CHROF	Authorities alerted of theft and vandalism as a part of Operation Trident and on an ongoing basis.	Shellfish Quality Assurance Program Committee
Community	CHROF members and the NSW Food Authority alerted to any unregulated sale of oysters.	Shellfish Quality Assurance Program Committee

Background

Unregulated sale of oysters can pose a serious health threat to unsuspecting consumers as they may have been stolen during times when it was unsafe to directly harvest from the leases.

Respecting culture and other river users

Action 6.3.4 Respect the indigenous culture of the Camden Haven River catchment.

Responsibility	Performance Target	Action owner
CHROF	No complaints received from Traditional Owners in relation to oyster industry activities	Shellfish Quality Assurance Program Committee

Action 6.3.5 Respect other users of the Camden Haven River system. Identify hotspot areas where conflicts occur. Liaise with the relevant authorities to develop information awareness on accessing waterways around leases and the recreational take of oysters. Liaise with Maritime to develop signage for dangers and channel identification, speed zones.

Responsibility	Performance Target	Action owner
CHROF	Hotspot areas where conflicts occur between oyster farmers and other users identified in consultation with authorities by December 2011.	Kerry Simmonds
CHROF	Awareness campaign for recreational and other users moving around leases or taking oysters for recreational purposes when river closed in place by December 2011.	Kerry Simmonds
CHROF	Signage developed and installed at key problem locations by	Kerry Simmonds

	June 2012.	

Background

Camden Haven River Oyster Farmers members realise the importance of maintaining and promoting a harmonious relationship with other uses of the Camden Haven River catchment, commercial fishers, recreational anglers, locals and tourists.

Camden Haven River Oyster Farmers members are happy to educate the broader community and give a detailed explanation of their operations to interested people.

A number of safety concerns have been identified by Camden Haven River Oyster Farmers related to recreational boating and fishing around leases and other infrastructure as well as the discharge of effluent and the take of oysters off rocks for recreational use when the river is closed for harvest.

6.4. OBJECTIVE 4 CONDUCT ENVIRONMENTAL MANAGEMENT IN A TRANSPARENT AND COOPERATIVE MANNER.

The actions identified against Objective 4 aim to mitigate and address priority risks to facilitate Camden Haven River Oyster Farmers to conduct environmental management in a transparent and cooperative manner.

Industry related risks

- None

External risks

- None

EMS reporting, stakeholder comment and review

Action 6.4.1 Report on progress of EMS annually. Allow stakeholders to comment on EMS report. Review EMS annually.

Responsibility	Performance Target	Action owner
CHROF	EMS reviewed annually and documented for circulation to key stakeholders by July each year.	Shellfish Quality Assurance Program Committee

Background

Continual improvement, fundamental to the success and implementation of EMS actions, requires regular reporting and review of the document by Camden Haven River Oyster Farmers business members. Each year, the Camden Haven River Oyster Farmers will report on the progress and maintenance of each action in relation to their responsibility, performance target(s) and timeframe(s).

The EMS report will be made available to all stakeholders on request and to all stakeholders who have commented on, or shown interest in the operations of Camden Haven River Oyster Farmers. Following documentation and circulation of the report, the Camden Haven River Oyster Farmers will review the EMS, considering:

- stakeholder comments

- an assessment of the adequacy and relevance of the environmental policy (see environmental policy);
- changes in oyster farming technology and management; and
- emerging issues in the environmental management of the Camden Haven River and its catchment.

One or more of these events may trigger a review outside of the annual review process. In response to a review, any part of the EMS may be changed and reports and past versions of the EMS will be kept as records.

Action 6.4.2 Compile a record of stakeholders. Provide a process for all stakeholders to comment on the EMS generally and the annual EMS report.

Responsibility	**Performance Target**	**Action owner**
CHROF	Mailing list established by August 2010. Process for receiving comments developed by June 2011.	Shellfish Quality Assurance Program Committee

Stakeholders will include:

- Industry and Investment NSW (formerly Department of Primary Industries, Fisheries)
- NSW Food Authority
- NSW Office of Environment and Heritage (formerly EPA and National Parks and Wildlife Service)
- Northern Rivers Catchment Management Authority
- Port Macquarie-Hastings Council
- Key departments involved in catchment and natural resource management'
- Community groups and community members

Community Education

Action 6.4.3 Establish a process that provides the community information on the operation and environmental management of the Camden Haven River oyster industry.

Responsibility	**Performance Target**	**Action owner**
CHROF	Community Communication and Education Strategy developed by December 2011.	Brandon Armstrong

Background

Camden Haven River Oyster Farmers will actively seek to provide opportunities for the local community to obtain more information about the oyster industry and the environmental management of their operations in an informed manner. Activities may include providing community tours, joining landcare groups and attending community meetings, providing field days for university students and local schools, work experience, talk with rotary/lions, regular newspaper/radio updates

6.5. OBJECTIVE 5 CONTRIBUTE TO SCIENTIFIC RESEARCH AND MANAGEMENT INNOVATION RELEVANT TO OYSTER CULTIVATION AND ESTUARINE ENVIRONMENTS

The actions identified against Objective 5 aim to mitigate and address priority risks to facilitate Camden Haven River Oyster Farmers to contribute to scientific research and management innovation relevant to oyster cultivation and estuarine environments.

Industry related risks

- Lack of adequate toilet facilities
- Overstocking of oysters
- Non optimal disposal of old/damaged infrastructure
- Disturbance or damage to seagrass and benthic communities
- Inappropriate Infrastructure placement - hydrology changes

External risks

- Extreme events - floods
- Extreme events - disease outbreak eg QX
- Climate change
- Deterioration in water quality from potential coal seam gas extraction

Participation in research

Action 6.5.1 Provide assistance, wherever possible, to government agencies and researchers investigating improved farming practices and environmental management.

Responsibility	Performance Target	Action owner
CHROF	Priority list of research topics provided to universities by December 2011	Shellfish Quality Assurance Program Committee
CHROF	Inkind support provided to all key research projects that are of relevance to CHROF.	Shellfish Quality Assurance Program Committee

Background

Camden Haven River Oyster Grower members have been of great assistance to research projects completed and ongoing on the Camden Haven River, including issues that affect the entire catchment. Camden Haven River Oyster Grower members currently practice an extensive water quality monitoring program, which could prove valuable for external agencies concerned with river health. These attributes place the members in a unique position to assist catchment managers.

Camden Haven River Oyster Farmers have also contributed time and/or oysters to the following projects:

- Sydney rock oyster breeding program;
- oyster cool chain project;

- oyster refrigeration index project;
- Nutritional Testing of oysters project;
- Australian Oyster Industry Business Management Plan;
- Australian oyster industry benchmarking project; and
- the proposed formation of the Australian oyster industry association known as Oysters Australia.

APPENDIX 1.THE CAMDEN HAVEN RIVER OYSTER FARMERS COMMITMENT

This EMS applies to the oyster farmers that are members of the Camden Haven River Oyster Farmers and the following list has been compiled to document those members who agree to commit to adopt this EMS and undertake their responsibilities as outlined in the Environmental Policy and Action Plan of this EMS.

Name/Business	**Signature**

APPENDIX 2. RISK ASSESSMENT TABLE

Risk is the chance of something happening that will have an impact on the oyster industry, the wider industry and/or the environment). Risk Analysis involves consideration of (i) the sources of risk and (ii) the consequences and likelihood that those consequences may occur.

A risk assessment can help to separate and highlight major unacceptable risks from minor acceptable risks.

Each specified risk identified by the Camden Haven River Oyster Farmers (CHROF) has been ranked by the CHROF, using the scoring system in the tables below, according to the consequence and likelihood of the risk.

Table 1 Likelihood of risk occurring (Source Seafood Services Australia 2006)

Likelihood	Score	Definition
Remote	1	Never heard of, but not impossible
Rare	2	May occur in exceptional circumstances
Unlikely	3	Uncommon, but has been known to occur
Possible	4	Some evidence to suggest this may possibly occur
Occasional	5	May occur
Likely	6	It is expected to occur

Table 2 Consequence if risk does occur (Source Seafood Services Australia 2006)

Consequence	Score	Definition
Negligible	0	Very insignificant impacts. Unlikely to be measurable
Minor	1	Possibly detectable but minimal impact on structure/function
Moderate	2	Maximum acceptable level of impact - recovery measured in months or years
Severe	3	Will result in wider and longer term impacts - recovery measured in years
Major	4	Very serious impacts with relatively long time frame likely to be needed to restore to an acceptable level – recovery measured in years to decades
Catastrophic	5	Widespread and permanent/irreversible damage or loss will occur – unlikely to ever be fixed

Table 3 Risk Ranking – likelihood x consequence (Source Seafood Services Australia 2006)

	Consequence					
Likelihood	Negligible	Minor	Moderate	Severe	Major	Catastrophic
Remote	0	1	2	3	4	5
Rare	0	2	4	6	8	10
Unlikely	0	3	6	9	12	15
Possible	0	4	8	12	16	20
Occasional	0	5	10	15	20	25
Likely	0	6	12	18	24	30

Table 4 Risk score (Source Seafood Services Australia 2006)

Score	**Category**
0 =	Negligible risk
1-6 =	Low risk
8-12 =	Moderate risk
15-18 =	High risk
20-30 =	Extreme risk

Industry-related activities

Activity	Risk Description	Potential Impacts	Current Mitigation Activities/ Controls	Likelihood Score	Consequence Score	Risk Score (L x C)	Proposed Risk Mitigation Actions	Timeframe	Action Owner
Industry related land based activities									
Buildings and surrounding infrastructure such as retraining walls	Deterioration of sheds and untidy appearance	Visual impacts, smell and aesthetics Loss of mangroves	Do annual clean ups around sheds General maintenance Permit required	6	1	6	None given low risk score		
	Stormwater runoff/localised erosion.	Waterway contamination and impacts on fish habitat	Minimal controls	6	1	6	None given low risk score		
Tap water usage	Overuse of freshwater while washing/ opening oysters and for grading and ice	Waste of water resources Unnecessary cost	Considering moving to tank water. Minimal use of freshwater other than for	6	1	6	None given low risk score		

Activity	Risk Description	Potential Impacts	Current Mitigation Activities/ Controls	Likelihood Score	Consequence Score	Risk Score (L x C)	Proposed Risk Mitigation Actions	Timeframe	Action Owner
	production		processing for shop and nursery washing.						
Electricity usage	Excess use of electricity for grading, depuration and other processes	Waste of energy resources Unnecessary cost	Could move to wind/solar power. High for nursery, depuration but low power for remaining processes	3	1	3	None given low risk score		
Toilets	Lack of adequate toilet facilities	Potential pollution from septic or chemical systems Runoff of untreated effluent into river	Nearly all sheds do not have toilet facilities.	6	2	12	Review options for portable toilet facilities in priority areas – Gogleys Lagoon, Henry Kendall and Stingray Creek.	12 months	Brandon Armstrong

Activity	Risk Description	Potential Impacts	Current Mitigation Activities/ Controls	Likelihood Score	Consequence Score	Risk Score (L x C)	Proposed Risk Mitigation Actions	Timeframe	Action Owner
Vehicular access to sheds	Dust, erosion and sedimentation issues	Reduced light penetration smothering seagrass and phytoplankton	Driveway/road to Armstrong Shed, Pilots beach road, Henry Kendall road. Fill pot holes with shell waste Maintenance of road is a requirement of lease agreement. May become an issue if want to export.	6	1	6	Liaison with Department of Lands for sealing of roads and establishing drainage.	12 months	Brandon Armstrong
Fuel and chemical storage areas	Multiple storage places of potential ignition sources	Explosive spread in event of fire Reduced water quality and	Small quantities of around 100lites stored on site per shed.	1	1	1	None given low risk score		

Activity	Risk Description	Potential Impacts	Current Mitigation Activities/ Controls	Likelihood Score	Consequence Score	Risk Score (L x C)	Proposed Risk Mitigation Actions	Timeframe	Action Owner
	Leakage from poor storage or adverse events	localised fish kills	Kept in small containers.						
Fire	Fire event in sheds	Loss of facilities and impacts on production	Bush fire risk Clearing around shed as allowed by law. Insurance Pumps available for fire management	3	3	9	Liaise with the Rural Fire Service and develop and implement a best practice fire policy around the shed areas at Gogleys Lagoon, Stingray Creek, Diamond Head Road and Henry Kendall Reserve	6 months	Josh Dunn
Flood	Flooding event in sheds	Loss of facilities and impacts on production	Lift key equipment off fall.	3	1	3	None given low risk score		
Packaging and transport of product to market	Single use packaging Use of diesel	Resource wastage Greenhouse	Food safety regulations require single	6	1	6	None given low risk score		

Activity	Risk Description	Potential Impacts	Current Mitigation Activities/ Controls	Likelihood Score	Consequence Score	Risk Score (L x C)	Proposed Risk Mitigation Actions	Timeframe	Action Owner
	fuel and refrigerants by trucks	Gas emissions and air pollutants	use. Not cost effective but could potentially use something like blue crates used to transport fish.						
General garbage	Non-recyclable and recyclable general waste generated from landbased activities	Use of limited landfill resources	Council picks up general waste regularly. Around 1-2 wheelie bins of general waste generated per month per grower. Council does not offer recycling services where landbased facilities are	6	1	6	None given low risk score		

Activity	Risk Description	Potential Impacts	Current Mitigation Activities/ Controls	Likelihood Score	Consequence Score	Risk Score (L x C)	Proposed Risk Mitigation Actions	Timeframe	Action Owner
			located – not regular service area.						
Disposal of waste shells	Waste shell to landfill	Use of limited landfill resources	Potential opportunity to sell as road base. Use to fill pot holes 1-2 tonnes per grower per year. No shell currently goes to landfill	4	2	8	Liaise with Council/Department of Lands re use for road base or potholes. Review opportunities for use of shell eg. with farmers, etc	6 months Ongoing	Brandon Armstrong
Disposal of materials waste	Non recyclable and recyclable materials waste from oyster processing as	Use of limited landfill resources	Limited reuse or recycling potential but recycle what can via tip facilities.	3	2	6	None given low risk score		

Activity	Risk Description	Potential Impacts	Current Mitigation Activities/ Controls	Likelihood Score	Consequence Score	Risk Score (L x C)	Proposed Risk Mitigation Actions	Timeframe	Action Owner
	well as oyster production		Timber gets recycled at tip. Mostly less than a tonne per grower per year.						
Punt maintenance	Inappropriate application and disposal of Antifouling	Chemical leaks into the environment	One grower undertakes antifouling activities occur using slipway which has a bund to contain antifouling. Vessels lifted out of water daily so no fouling of waterways. Small number of vessels get defouled on	5	1	5	None given low risk score		

Activity	Risk Description	Potential Impacts	Current Mitigation Activities/ Controls	Likelihood Score	Consequence Score	Risk Score (L x C)	Proposed Risk Mitigation Actions	Timeframe	Action Owner
			bank near boat ramp.						
Tarring and treated timbers	Leaching from application areas Leaching from infrastructure in water	Reduced water quality and stress on oysters Issue high on public agenda	Only one grower applies tar to new infrastructure – plans for phase out. Other growers still use treated or tarred infrastructure however this is replaced with plastic when replacement needed All tarred/treated timber disposed of correctly	6	2	12	Move to 100% of trays converted from tar/treated timber to polyurethane Move to no lease areas using tarred/treated timber rails.	December 2015 December 2015	Shellfish Quality Assurance Program Committee

Activity	Risk Description	Potential Impacts	Current Mitigation Activities/ Controls	Likelihood Score	Consequence Score	Risk Score (L x C)	Proposed Risk Mitigation Actions	Timeframe	Action Owner
Disposal of owned but unused infrastructure.	Non-optimal disposal of old/damaged infrastructure	1. Use of limited landfill resources 2. Potential chemical leakage if tarred infrastructure stored for long periods in an area	Estimated 100 tonnes to be cleaned up. All unused leases/infrastructure are on work plans and annually do some clean up to progress.	6	3	18	Identify opportunities for partnership to access funding for cleanups. Potential to do joint cleanups between growers. Participate in Clean Up Australia Day annually.	5 years	Brandon Armstrong
Disposal of old infrastructure/derelict leases that are unowned	Non-optimal disposal of old/damaged infrastructure	1. Use of limited landfill resources 2. Potential chemical leakage if tarred infrastructure stored for long periods in an	10 tonnes. Located in national parks. Not allowed to clean up.	6	2	12	Liaise with OEH (national parks) regarding timing for removal of derelict infrastructure.	12 months	Tony Troup

Activity	Risk Description	Potential Impacts	Current Mitigation Activities/ Controls	Likelihood Score	Consequence Score	Risk Score (L x C)	Proposed Risk Mitigation Actions	Timeframe	Action Owner
		area							
Pest control	Poisons and chemicals leaking into the environment	Reduced water quality Impacts of estuarine health	Food safety regulations provides eradication program.	2	1	2	None given low risk score		
Industry related water based activities									
Oyster stocking densities	Reduction in oyster productivity (growth & condition)	1. Depletion of food resources due to high stocking densities 2. Increased of oyster disease 3. Reduced oyster growth rates	Currently use natural processes to control ie if too many oysters there won't be enough food and small product or prone to predators increases because weakened state and lead to	4	3	12	Liaise with DII to investigate review of carrying capacity of river Develop stock management plan.	6 months December 2015	Tony Troup Camden Haven Shellfish Quality Assurance Program in conjunction with NSW Farmers

Activity	Risk Description	Potential Impacts	Current Mitigation Activities/ Controls	Likelihood Score	Consequence Score	Risk Score (L x C)	Proposed Risk Mitigation Actions	Timeframe	Action Owner
			predator increases.						Hastings River Shellfish Branch
Changes to hydrology	Inappropriate Infrastructure placement	Decreased water flow and increased siltation Sediment build up Disruption to natural processes	Move to floating cultivation may address this. Limited problems occur on inside of bends eg Ryan's bend and entrance to Gogleys Lagoon. Active management to pull out when becomes problem.	6	1	6	None given low risk score		

Activity	Risk Description	Potential Impacts	Current Mitigation Activities/ Controls	Likelihood Score	Consequence Score	Risk Score (L x C)	Proposed Risk Mitigation Actions	Timeframe	Action Owner
Oyster boating activities - shoreline	High impact boat wash on shoreline	Navigation collision Loss of habitat Destruction of sensitive areas of saltmarsh, unstable banks	No speed limits but no-wash zones in place. Non displacement hulls used on punts that reduce boat wash.	6	1	6	None given low risk score		
Oyster boating activities – aquatic habitats	Navigation over seagrass beds	Loss or damage of seagrasses (zostra) from propellers or racks, reducing habitats for juvenile fish and other animals, sediment stabilisation	Try and avoid and tilt motors when in shallow water.	6	1	6	None given low risk score however addressed in seagrass action below.		
	Mobilisation/ translocation of virbios or noro	Oyster stress and mortality	Vibrios not issue for SRO.	1	4	4	None given low risk score		

Activity	Risk Description	Potential Impacts	Current Mitigation Activities/ Controls	Likelihood Score	Consequence Score	Risk Score (L x C)	Proposed Risk Mitigation Actions	Timeframe	Action Owner
	virus etc (from wash down process)	Human health issues	Shellfish Quality Assurance food safety requirements control wash down. Some wash down on shore and some on lease (but normally not near other leases).						
Inefficient motors	Fuel and oil spill Noise pollution	Greenhouse Gas emissions Reduced water quality Imacts on wildlife eg birds, turtles Unhappy water	About half of growers using old 2 stroke outboards/ pumps/ crane motors vs 4 stroke compliant outboards etc being used.	6	2	12	Review opportunities for participating in programs that provide funding for upgrading of motors and reducing emissions. Liaise with NSW	5 years	John Eggins

Activity	Risk Description	Potential Impacts	Current Mitigation Activities/ Controls	Likelihood Score	Consequence Score	Risk Score (L x C)	Proposed Risk Mitigation Actions	Timeframe	Action Owner
		neighbours	Regular maintenance.				Farmers Association for funding available. Replace old non compliant motors where possible. Minimise fuel consumption and improve vessel stability, longevity.	December 2012	Brandon Armstrong
Lease establishment	Habitat/ seagrass shading, substrate damage	Disruption of ecological functioning of estuary	Tray racks create more shading than cylinder racks but create habitat in other places.	6	2	12	Move to floating cultivation where suitable. Seek opportunities for partnership with universities and others to undertake a review of the effects of racks vs	3 years	Shane Harper

Activity	Risk Description	Potential Impacts	Current Mitigation Activities/ Controls	Likelihood Score	Consequence Score	Risk Score (L x C)	Proposed Risk Mitigation Actions	Timeframe	Action Owner
							floating cultivation on seagrass and identify suitable actions if required for management.		
Migratory bird habitats	Proximity of boats/lease activities to migratory bird habitats	Reduced breeding success and disturbance to feeding patterns	Current oyster growing practices have not been found to interfere with migratory bird habitats. Growers avoid areas where nesting and feeding takes place.	4	2	8	Provide information to conservation and management organisations regarding important bird habitats. Report incidents of bird entanglements to Australian Seabird Rescue and OEH. Train CHROF in seabird rescue	Ongoing June 2012	Camden Haven Shellfish Quality Assurance Program in conjunction with NSW Farmers Hastings River Shellfish Branch

Activity	Risk Description	Potential Impacts	Current Mitigation Activities/ Controls	Likelihood Score	Consequence Score	Risk Score (L x C)	Proposed Risk Mitigation Actions	Timeframe	Action Owner
Protected species (ie estuary cod, marine turtles, dolphins, ospreys)	1. Boat strike	Injury or mortality to protected species	No known interactions have been recorded in Camden Haven River and sightings of protected uncommon. Spacing between trays has been reduced. Travel fast in some areas so turtle strike could occur but has not to date	4	2	8	Suspend operations immediately in the event of an interaction with a protected or threatened species. Allow the animal to escape without harm.	Ongoing	Camden Haven Shellfish Quality Assurance Program Committee
	2. Interactions, entanglements or bycatch	Injury or mortality to protected species	Minimal ropes etc for entanglement Shake modules	6	2	12	Development of a Code of Conduct for Camden Haven Oyster	6 months	Tony Troup

Activity	Risk Description	Potential Impacts	Current Mitigation Activities/ Controls	Likelihood Score	Consequence Score	Risk Score (L x C)	Proposed Risk Mitigation Actions	Timeframe	Action Owner
			before bring up to remove bycatch (rafts) Return everything back to water quickly.				farmers.		
General									
Interaction with community & stakeholders	Poor oyster representation in catchment activities	Lack of engagement in catchment activities/decisions	Some participation in estuary mgt committees, community events, OISAS requires developments to consider impacts on oyster industry.	3	2	6	None given low risk score		
Communication among oyster	Poor communication	1. Slower industry	Good communication	2	3	6	None given low risk score		

Activity	Risk Description	Potential Impacts	Current Mitigation Activities/ Controls	Likelihood Score	Consequence Score	Risk Score (L x C)	Proposed Risk Mitigation Actions	Timeframe	Action Owner
industry members	1- between growers in Camden Haven River 2- with NSW and other states oyster members	development 2. Lack of integration for Camden Haven River oyster industry 3. Miss out in industry related opportunities- no sharing of ideas and effort. 4. No communication pathways with authorities and related agencies	within Camden Haven River. Most growers are members of NSW Farmers Association and kept up to date with events and issues. Access to committees through one participant sitting on most committees.						

Activity	Risk Description	Potential Impacts	Current Mitigation Activities/ Controls	Likelihood Score	Consequence Score	Risk Score (L x C)	Proposed Risk Mitigation Actions	Timeframe	Action Owner
External activities									
Coal seam gas extraction	Establishment of coal seam gas extraction processes and facilities on private property throughout catchment	Contamination of groundwater and surface water	Liaise with Council and DII on where potential facilities will be established and assessment and management of risks to water quality contamination.	4	5	20	Continue to monitor progress and liaise with the appropriate agencies to prevent this industry from establishing in the catchment.	Immediate and ongoing	All

Activity	Risk Description	Potential Impacts	Current Mitigation Activities/ Controls	Likelihood Score	Consequence Score	Risk Score (L x C)	Proposed Risk Mitigation Actions	Timeframe	Action Owner
Deterioration of water quality with increased urban growth	1. Sewage pollution (i.e. septic tanks at Comboyne, Kendall, Ryan, Pilots Beach and Henry Kendall Reserve, Johns River, Ross Glenn plus old tanks not identified).	1. Contamination of waterways = closure of harvest area ⇒unsafe oyster consumption	1. Shellfish Quality Assurance Program Septic Tank Safe System (state gvt program) that requires all tanks to be registered and inspected yearly, but not clear how effective – Council responsible for inspections.	6	3	18	Ongoing liaison with Council regarding upgrades to sewage systems. Develop a regular liaison with Council Sewage Manager and invite Council to AGMs.	Ongoing 3 months	Tony Troup
	2. Effluent of untreated sewage entering	Contamination of waterways = closure of harvest area	Pumping station overflow system being	6	3	18	As above. Develop brochure for raising awareness with	6 months	Tony Troup

Activity	Risk Description	Potential Impacts	Current Mitigation Activities/ Controls	Likelihood Score	Consequence Score	Risk Score (L x C)	Proposed Risk Mitigation Actions	Timeframe	Action Owner
	waterways (i.e. pumping stations and pipe overflow in wet and dry events, vessel holding tanks, dogs, cattle)	⇒unsafe oyster consumption	developed. No enforcement of vessel pumping direct to river.(waterways should enforce). Some riparian fencing but still areas where no fencing.				boaters on need for pump out and handout to boaters on river. Seek Opportunities for partnership for onground works to establish or maintain riparian fencing. Eg Council, OceanWatch, WetlandCare etc). Report all suspected pollution incidents to NSW Maritime, NSW Office of Environment and Heritage (OEH), formerly Environment	6 months Ongoing	Harry van Haren Camden Haven Shellfish Quality Assurance Program Committee

Activity	Risk Description	Potential Impacts	Current Mitigation Activities/ Controls	Likelihood Score	Consequence Score	Risk Score (L x C)	Proposed Risk Mitigation Actions	Timeframe	Action Owner
							Protection Authority and NSW Food Authority. Maintain existing water quality monitoring program. Report detected or suspected pollution incidents immediately to the NSW Food Authority	Ongoing	Camden Haven Shellfish Quality Assurance Program Committee
	3. Disturbance of acidic soils (Ross Glenn, Stuart River, Stingray Creek) or areas of heavy metals accumulated	1. Contamination of waterways = closure of harvest area ⇒unsafe oyster consumption 2. Water acidification	3) Education programs with landholders and field days. Minor issue in Camden Haven River. Slipway	3	4	12	Regular Liaison with Council and participation in estuary management committee	Ongoing	Tony Troup

Activity	Risk Description	Potential Impacts	Current Mitigation Activities/ Controls	Likelihood Score	Consequence Score	Risk Score (L x C)	Proposed Risk Mitigation Actions	Timeframe	Action Owner
	in sediment (from slipway/ marina area)	and/or chemically polluted= oyster mortalities, deformity, reduced production	bunded. Heavy metal testing every 2 years and nothing found.						
	4. Primitive Stormwater System (ie few of Gross Pollutant Traps)	Contamination of waterways = closure of harvest area and unsafe oyster consumption	Artificial wetland created at North Haven. Shellfish Quality Assurance Program monitoring Council has regular water quality monitoring program in place along river (number	6	3	18	As above re liaison for sewage. Seek opportunities for onground partnerships with groups like Wetlandcare to establish artificial wetlands and other measures to address stormwater priority areas.	Ongoing	Tony Troup / Harry van Haren

Activity	Risk Description	Potential Impacts	Current Mitigation Activities/ Controls	Likelihood Score	Consequence Score	Risk Score (L x C)	Proposed Risk Mitigation Actions	Timeframe	Action Owner
			of sites tested every 4 months)						
Unsealed roads	1. Run-off into waterways 2. Dust pollution 3. Increased sedimentation in waterways	1. Reduction of oyster filtration and therefore production 2. Increased turbidity levels, decreased water quality and potential pollution of waterways	No major problems with unsealed roads Lot of silt from flood events from further up catchment.	2	2	4	None given low risk score		
Loss of riparian vegetation from clearing and/or poor cattle infrastructure	1. Increased sedimentation in waterways 2. Shore erosion due to livestock pathways down to waterways/	1. Poor water quality 2. Loss of buffer zone in shoreline 3. Destruction of sensitive ecological habitats:	Some areas in the catchment have been fenced off and re-vegetated, but still other areas where is an issue - Stingray	6	2	12	As for above onground program actions	6 months	Harry van Haren

Activity	Risk Description	Potential Impacts	Current Mitigation Activities/ Controls	Likelihood Score	Consequence Score	Risk Score (L x C)	Proposed Risk Mitigation Actions	Timeframe	Action Owner
	intertidal zone	mangroves and saltmarsh	Creek, Stan's Place at Deauville. Shellfish Quality Assurance Program monitoring						
Changes in hydrology	1. Changes in natural sedimentation processes due to ocean processes and catchment activities 2. Dredging	1. Change of water flow quantity/ direction 2. Change in food level availability for oysters 4. Siltation, acidic sediment stirred up/ drainage problems all leading to stress of oysters 5. Navigation	Dredging rarely occurs once every 15 years.	6	2	12	Liaise with Maritime and OEH and Council regarding proposed dredging timetables / plans through estuary management plan committee	Ongoing	Tony Troup

Activity	Risk Description	Potential Impacts	Current Mitigation Activities/ Controls	Likelihood Score	Consequence Score	Risk Score (L x C)	Proposed Risk Mitigation Actions	Timeframe	Action Owner
		problems to lakes.							
Visual pollution and aesthetics of oyster leases (including urban growth pressures)	Bad community perception due to exposed oyster infrastructure	Negative attitude of community to oyster farming Loss of access for industry	Keep lease areas tidy.	6	2	12	Links to Disposal of owned unused/ derelict infrastructure action above.		
Use of non-environmentally friendly horticulture & agriculture products (i.e. fertilizers, pesticides)	Chemical (nitrogen and phosphorous) pollution of waterways. Establishment of horticulture downstream eg Pesticides and herbicides, siltation from increasing horticulture – mangos,	1. Increase nutrient levels entering waterways ⇒ potential algae bloom 2. Poor water quality 3. Stress that can lead to mortality of oysters	Remoteness and diluting as travels downstream currently	2	4	8	Ongoing monitoring and liaison with OEH/ DII Report all suspected pollution incidents to NSW Maritime, Office of Environment and Heritage (OEH), formerly Environment Protection Authority and	Ongoing Ongoing	Tony Troup Shellfish Quality Assurance Program Committee

Activity	Risk Description	Potential Impacts	Current Mitigation Activities/ Controls	Likelihood Score	Consequence Score	Risk Score (L x C)	Proposed Risk Mitigation Actions	Timeframe	Action Owner
	avocados, macadamias, kiwi fruits currently at top of Camden Haven and Upsalls Creek						NSW Food Authority. Ensure a process is in place for NSW Maritime to notify oyster farmers of any spills. Investigate CHROF in conjunction with Sea Rescue Volunteers being trained in incident response and maintaining a fuel containment kit for on water incident response to support local authorities.	December 2010 December 2010	Tony Troup Brandon Armstrong
Forestry within the	Changes in	Deterioration of	Forestry	6	2	12	Attend community	Ongoing	Harry van

Activity	Risk Description	Potential Impacts	Current Mitigation Activities/ Controls	Likelihood Score	Consequence Score	Risk Score (L x C)	Proposed Risk Mitigation Actions	Timeframe	Action Owner
catchment	NSW Forests harvesting process to clear fell and use of herbicides causing contaminated runoff into water quality	water quality causing mortality to oysters and other aquatic life.	regulations.				meetings and liaise with Council, I&I and with the estuary management committee to ensure appropriate recognition and management of risks downstream to oyster industry		Haren
Rec fishers, water users, tourist	1. Mooring to and fishing around oyster leases 2. Navigation over oyster infrastructure 3. Boat wash (i.e. large vessels)	1. Loss/damage of oyster infrastructure 2. Erosion of shoreline (i.e. protected areas) 3. Impact on oysters	Signage Local enforcement from growers but minimal enforcement by government agencies.	6	2	12	Liaise with local authorities to develop information awareness on accessing waterways around leases. (Combine with info on pump outs). Local clubs could be used to	6 months	Kerry Simmonds

Activity	Risk Description	Potential Impacts	Current Mitigation Activities/ Controls	Likelihood Score	Consequence Score	Risk Score (L x C)	Proposed Risk Mitigation Actions	Timeframe	Action Owner
			Some no wash areas around leases.				promote this to those re fishers/ yachts, as well as through DII at boat ramp signs and throughs liaison with fishing clubs etc.		
Pest species & other fouling species (eg Pacific Oysters, Caulerpa taxifolia, fireweed. Green shore crabs)	1. Enhancement of exotic & fouling species settlement, growth and dispersion on oyster infrastructure/ cultivation units 2. Transfer of pests & fouling	1. Competition for food sources by pest & fouling species 2. Oyster mortalities - ⇊ production = Economic losses 3. Impact on overall aquatic ecosystem	1. Growers have been given ID cards and trained on pest species identification & they are taking part of pest monitoring programs (pacific oysters only) 2. Growers participate in	3	4	12	Ensure all Camden Haven River Oyster Farmers have a copy of marine pest identification cards and best practice biofouling guidelines for aquaculture being developed by the National Introduced Marine Pest Coordination	December 2010	Camden Haven Shellfish Quality Assurance Program in conjunction with NSW Farmers Hastings River Shellfish Branch and NSW

Activity	Risk Description	Potential Impacts	Current Mitigation Activities/ Controls	Likelihood Score	Consequence Score	Risk Score (L x C)	Proposed Risk Mitigation Actions	Timeframe	Action Owner
	species between sites/estuaries 3. Impact on overall ecology of aquatic ecosystem		monitoring/research 2. Use of oyster shipment logbook part of biosecurity program				Group (NIMPCG). Report with a sample if possible, any detection of an unusual plant or animal. Follow requirements of government agencies in combating marine pests.		SeaNet Officer
Extreme weather events	Flood events	Changes to salinity and increased sediment Lost infrastructure Navigation hazard	Tie infrastructure down. Locate lost infrastructure after events	6	4	24	Development of Contingency Planning - development of specific infrastructure design standard for Camden	12 months	Brandon Armstrong

Activity	Risk Description	Potential Impacts	Current Mitigation Activities/ Controls	Likelihood Score	Consequence Score	Risk Score (L x C)	Proposed Risk Mitigation Actions	Timeframe	Action Owner
							Haven River and guidelines developed by DII - communication to all growers of best practice - Annual inspection of mooring lines. - Track rainfall figures upriver and develop an information network(via phone) to warn farmers.		
Disease/ virus	QX, etc	Increased stress	Lease	3	5	15	Contingency	12 months	Harry van

Activity	Risk Description	Potential Impacts	Current Mitigation Activities/ Controls	Likelihood Score	Consequence Score	Risk Score (L x C)	Proposed Risk Mitigation Actions	Timeframe	Action Owner
outbreak		to oysters, deformity or mortality	condition requirement to notify DPI if greater than 10% mortality event and send samples for testing.				planning - Stockpile use of QX resistant oysters - Investigate establishing an emergency fund – talk to Manning about how their fund operates.		Haren
Climate change	1. Sea level rise 2. Increased storm surge and extreme events	1. Changes to salinity, pH and food chain, algal blooms 2. Increased stress on oysters or mortality due to	Attend relevant meetings	3	4	12	Contingency planning and changes to farming practices etc	Ongoing	Tony Troup

Activity	Risk Description	Potential Impacts	Current Mitigation Activities/ Controls	Likelihood Score	Consequence Score	Risk Score (L x C)	Proposed Risk Mitigation Actions	Timeframe	Action Owner
	3. Changes to currents, water temperatures and rain events 4. Acidification of the waterways	oysters being incapable of adapting to environmental conditions					Ongoing participating in meetings		

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