PLAN OF MANAGEMENT FOR THE MIABOOLYA BEACH FISH HABITAT PROTECTION AREA

Prepared by Shane Aylmore and Sarah Anderson

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1.0 INTRODUCTION

Miaboolya Beach is an area of the Gascoyne River delta near Carnarvon. The Fish Habitat Protection Area (FHPA) covers the nearshore waters and extends north to South Bejaling and south to the northern side of the Gascoyne River mouth. In addition, it includes the adjoining mangrove system, associated seasonal creeks and salt marshes (see Figure 1).

The aim of this management plan is to protect and rehabilitate the aquatic habitat of Miaboolya Beach, the associated mangrove ecosystem, and involve the community in their management.

By setting the area aside as a FHPA, the Department of Fisheries has established a framework to promote and actively conserve all the habitats within the Miaboolya system, as described in Section 3 of this document.

Currently, the area is mainly used for recreation, including fishing and mud crabbing. Other recreational uses include horse riding, tourism, camping and swimming. The Miaboolya area also holds significant cultural value for the local Aboriginal people.

Studies conducted by Carnarvon Senior High School and the Department of Fisheries indicate that the Miaboolya Beach area is a nursery for fish species of importance to recreational fishers, along with other aquatic life. It is the only identified tailor (*Pomatomus saltatrix*) nursery area in the Gascoyne Region.

There are concerns that recreational netting in the Miaboolya Beach area may be impacting on juvenile fish who use it as a nursery. The associated mangroves provide important mud crab habitat.

Carnarvon Senior High School first proposed the conservation of the Miaboolya area, in response to concerns about the environmental degradation of the mangrove system and the possibility that over-fishing and inappropriate fishing practices could lead to local depletions of finfish and mud crabs.

In 1998, the Department of Fisheries obtained a grant from Coastcare/Coastwest to produce a draft management plan for a FHPA at Miaboolya Beach. The draft plan was released for public comment in March 2002 for a period of six weeks.

This document is the final management plan - aimed at helping the management of human activities within the Miaboolya area, thus minimising their impacts.

2.0 METHODOLOGY

2.1 Identification of the site

With the assistance of a FISHCARE WA grant, the Carnarvon Senior High School (CSHS) undertook a survey of the eastern shallows of Shark Bay to identify which areas are most utilised by fish. This work (see Section 3 of the document) quickly demonstrated the Miaboolya ecosystem is regionally the most important nursery area for a number of coastal finfish, including tailor, mulloway, threadfin salmon, kingfish, whiting, and bream.

A total of 130 species were identified within the Miaboolya ecosystem. In addition, it supports an important recreational mud crab fishery.

In an attempt to identify reasons for the importance of this area to fish, a conceptual model of the ecosystem (see Section 3) was developed by Department of Fisheries staff after a field investigation and consideration of research into the fish stocks undertaken by Murdoch University, Carnarvon Senior High School and the Department of Fisheries. Consideration was also given to current texts relating to mangrove systems in Western Australia.

2.2 Consultation

The draft management plan for Miaboolya Beach was developed through a process of data gathering and consultation with the local community. The Carnarvon Senior High School had collected a large body of research data, which was used in the draft plan.

There is limited published information on the specific environmental, social or cultural values of the area, so much use was made of anecdotal information from key individuals with good local knowledge. Discussions on these values were also carried out with staff from the Carnarvon Shire, Department of Land Administration, Conservation and Land Management and other key bodies and groups.

Initial community input to the Miaboolya Beach FHPA proposal was obtained through a series of public meetings, radio interviews and discussions with interest groups and individuals. A public meeting was held in Carnarvon on 2 May 2000, to inform people about the proposal to establish a FHPA. Details were advertised in the *Northern Guardian* newspaper and local radio stations Radio 6LN and ABC Radio. Main user group representatives were also approached to attend the meeting.

The initial meeting was used to determine the issues and concerns that the public had regarding Miaboolya Beach. It also provided a gauge of the attitude of the community towards conservation of the area. The meeting was well attended, by the general

public and representatives of special interest groups, such as angling clubs and conservation groups.

Following the initial meeting, the local radio stations were further utilised to obtain feedback and additional comments from the community. Several media releases were placed in the *Northern Guardian* as the plan progressed, to keep user groups informed as to the progress of the proposal.

Individual interviews were also conducted with some of the interest groups. A variety of opinions was provided by local clubs, individuals, government and non-government organisations.

This final management plan has been prepared following a six-week public review period of the draft management plan. Five submissions were received during this time. This final plan reflects, where possible, the views expressed within these submissions.

3.0 DESCRIPTION OF SITE

3.1 Miaboolya System

Miaboolya Creek is unusual in that it is the only creek system in the Gascoyne that is separated periodically from the open ocean by a sandbar for several months at a time. This process creates an unusual estuarine ecosystem that at times is a coastal lagoon.

The fish and crab stocks use this environment for breeding, growth and development. Some community members have indicated that they believe breeding cycles are stimulated when there is flooding in the Gascoyne River system.

The Miaboolya area sits between the exposed rocky shoreline, with coral reefs surrounding Quobba, and the wide tidal flats and offshore sand banks of the Shark Bay region, as shown on Figure 1.

The Miaboolya ecosystem can be described as consisting of five major components - namely nearshore waters, mangroves, salt marshes algal mats and dune ridges, as described in Section 3 of this document. These components can be seen in Figure 4.

The nearshore waters environment at Miaboolya Beach consists of a number of gutters, separated by shallow sandbars, running parallel to the shore. The gutters vary between 30cm and 1.5m deep.

The sandbars are formed when the heavy silt load in the water flowing from the nearby Gascoyne River is carried north by ocean currents. The silt settles out of the water column and is deposited into these mobile sand bars, which are maintained by the wave action. The gutters shift seasonally and bars are usually formed across the mouths of Miaboolya Creek. High tides or run-off from rainfall in the catchment causes the creek to only open periodically.

Miaboolya Beach is fully exposed to the ocean, which has a maximum tidal range of 1.5 metres. Salinity in the estuary fluctuates, in response to river flow, rainfall and evaporation. Data suggests that it can vary from almost fresh to a very saline 42 parts per thousand (ppt) - note that normal seawater is 33 ppt.

Water conditions at the beach are often turbid and it is common for the water to be muddy-brown. Turbidity increases when the Gascoyne River and Miaboolya Creek are flowing.

The offshore gutters support a variety of juvenile fish species including tailor (*Pomatomus saltatrix*), mulloway (*Argyrosomus spp.*), sand whiting (*Sillago ciliata*), dart (*Trachinotus baillonii*), northern threadfin salmon (*Polydactylus spp.*), tarwhine (*Rhabdosargus sarba*), and various species of crabs, such as blue swimmer and green mud crabs (family Portunidae).

Mangroves dominate the inshore environment. The mangrove system surrounds the mouth of Miaboolya Creek and extends along the entrance road to the car park. The mangrove creeks support adults and juveniles of the species outlined above. It also provides the mud crab population with an ideal habitat, supplying food and shelter. Turtles also occur in the creek system. (Stewart *et al* 1998).

3.1.1 Mangroves

Mangroves usually grow in the area between where high spring tides reach and mean sea level. The term 'mangrove' refers to individual tree or bush species, while a community of mangrove plants is called a mangal.

Mangroves belong to a variety of plant families having common features such as pneumatophores, which are root outgrowths that assist in aeration, and seeds that germinate while attached to the parent plant. These features are adaptations that assist the plants to survive in a harsh environment. (Semeniuk *et al* 1978).

Mangroves grow best in areas with warm climates, salt water along protected shorelines, muddy substrates and a high tidal range. All of these attributes are found around the mouth of the Gascoyne River.

Mangroves are typically 'zoned' (i.e. different species occur in various locations, determined by the frequency of flooding by tidal waters, soil type, soil salinity, drainage, slope, plant interactions and animal interactions). However, at Miaboolya there are only stands of white mangrove (*Avicennia marina)*.

There is now a considerable body of evidence that mangroves play an important role in supporting a wide range of marine life in near-shore waters, and in sustaining coastal fisheries (see Figure 2).

Life in the mangrove community involves interaction between plants, marine animals and terrestrial fauna. Mangroves provide the basis for food chains involving various marine and terrestrial organisms (in the form of leaf litter and other plant detritus on the ground), and for insect, bird and bat populations (in the form of leaves, flowers and fruits).

Mangroves also provide the habitat for many other organisms such as algae and diatoms, which are primary links in food chains as shown in Figure 2 (Semeniuk *et al*. 1978).

The animals that are associated with mangroves span a wide range of invertebrate and vertebrate groups. This fauna is often distributed in distinct zones related to frequency of tidal flooding, soil types, salinity, and the type of surrounding plant community. Many of the animals exploit the mangal as a habitat, nursery ground or a source of food.

Fauna in mangroves may be distinguished as either 'resident' or 'temporary'. Resident fauna includes ground-dwelling surface animals such as crabs, shrimps and

worms; tree teredo (also known as "ship worm"), and a host of insects, birds and bats, which use mangrove foliage as habitat and derive food from leaves, flowers and fruit.

Mangroves provide vital feeding grounds for temporary fauna made up of free-swimming animals such as fish and crustaceans that invade the mangal environment at high tide, and of terrestrial animals such as birds, reptiles and mammals that invade the areas at low tide. Additionally, numerous fish and crustacean species (notably banana prawns) use the mangrove environment as a nursery.

Thus, in terms of plant primary production, feeding grounds and nursery beds, mangroves are a vital resource.

It has been shown that the destruction of mangroves can lead to a major change in near-shore ecology, with a subsequent decline in recreational and commercial fishing. Studies have shown that in some coastal waters, most fish caught commercially were linked to food chains that depended on mangroves - as demonstrated in the Carnarvon Senior High School study.

Consequently, mangrove loss is accompanied by a dislocation of the food chain, accompanied by the loss or severe depletion of organisms within the chain. Destruction of mangroves also results in a loss of habitat for a large range of terrestrial organisms such as insects, birds and bats.

Mangroves also help to stabilise coastlines and protect them from storm attack by absorbing wave energy, slowing down currents and protecting the substrate against erosion. Where mangroves have been removed, coastlines that once experienced moderate shore erosion have undergone greater erosion (Semeniuk *et al*. 1978).

For preservation of natural habitats, protection from coastal erosion, and the sustenance of offshore fisheries, careful management of mangrove habitats is essential. It must be recognised that tidal flats in front of mangrove systems and the supra-tidal flats behind them are important to the system concerned.

3.1.2 Salt Marshes

Salt marshes exist in low energy environments around the mangrove system and the upper reaches of tidal influence. These areas support low shrubby glass worts (popularly known as brown samphires) and in some places there are wide expanses of bare mud. In addition, these flats support algal mats, which are an important component of the mangrove system.

Sediments are introduced onto the salt marshes during normal tidal inundations and storms, and are deposited from suspension and trapped by plants. (Graig 1983).

The salt marsh system - which includes bare mud flats - supports a system of algal mats. Above this are samphire communities, which are a low herbland dominated by *Holasarcia, Salacornia, Frankenia* and *Atriplex.* Saltwater couch (*Sporobolus*

virgincus) is present in the transition zone between the samphire and sand dune plant communities.

3.1.3 Dune Ridges

The dunes in this area have generally been formed by wind-blown sand, which has accumulated by sand-trapping vegetation. They include incipient fore-dunes, established fore-dunes and hind-dunes.

Fore-dunes are the foremost vegetated sand dune occurring immediately landward of an unvegetated beach. They are initially colonised by beach spinifex (*Spinifex longifolius*) soft roly-poly (*Salsola kali*) and beach morning glory (*Ipomoea brasiliensis*) (Graig 1983).

Hind-dunes are behind the fore-dunes and separated from them by swales. They support a more diverse vegetation than fore-dunes including buffel grass (*Cenchrus ciliaris*) and occasional shrubs.

The sand dunes support an open low shrubland with *Spinifex longifolia, Baeckia* sp, and sand dune vegetation communities.

The Miaboolya system is also important for terrestrial animals and is home to a number of wetland bird species. Migratory species can be seen in high numbers seasonally. Studies of birds have been conducted to the north at Lake MacLeod and south at Shark Bay, but little work has been conducted at Miaboolya specifically.

3.2 Importance of the Miaboolya Ecosystem

As outlined above, the Miaboolya system has regional importance as a fish nursery and general fish habitat. However, there are hundreds of kilometres of tidal mangrove creeks and extensive areas of salt marsh in the Gascoyne region. The question is: "Why is the Miaboolya area measurably more productive than the neighbouring systems?"

Unlike other creeks in the region, the Miaboolya system is extensively influenced by the Gascoyne River. As shown in Figure 3, the river has a catchment that extends over 600 kilometres inland and covers an area of 79,000 square kilometres (Allan Bradley, pers. com.). The catchment is generally covered by pastoral leases, but also includes areas of the State Conservation Estate, small areas of horticultural development and townsites.

When the Gascoyne River floods, large volumes of water are discharged through the its associated delta. The Miaboolya Creek system is an anabranch of this delta.

The floodwaters include fresh water, sediments and nutrients that are uncommon in the waters of Shark Bay. It is probable that the influxes of fresh water and nutrients elevate the primary production of the mangroves, algal mats and salt marshes that make up the system. The sediments - kept mobile by the near-shore wave climate - generate the system of offshore banks and troughs that shelter juvenile fish.

In addition, the sediments limit water clarity in the near-shore waters, protecting young fish from predators. These attributes can be seen in the conceptual model of the Miaboolya ecosystem (see Figure 5).

The Miaboolya Beach FHPA is located within Reserve No. 27137 (Recreation, Camping and Recreation) which is vested in and managed by the Shire of Carnarvon. The Reserve is zoned 'rural' in the Shire of Carnarvon District Planning Scheme No 11, reserved for recreation under the Scheme and is covered by a Coastal Policy Area. It is also recognised in the Carnarvon Coastal Policy.

The reserve environment is being degraded through unrestricted vehicular access through the salt marsh, rubbish dumping, fire and inappropriate fishing methods.

4.0 DESCRIPTION OF USERS

The Miaboolya Beach FHPA is located within Reserve No. 27137 (Recreation, Camping and Recreation). There has been no formal survey of the public use of the reserve, but observation by Fisheries Officers indicates most of the overnight visitors to Miaboolya Beach are tourists who are passing through Carnarvon.

Tourists are attracted to the area by various publications that advertise Miaboolya Beach as a free camping ground. Also, the Carnarvon Tourist Bureau and local fishers recommend the area as a good fishing spot.

Access to Miaboolya Beach for vehicles is via beach tracks, which lead to a small open area used for camping and car parking.

The Carnarvon community also uses the Miaboolya area for fishing and mud crabbing. Other recreational activities include off-road driving, trail bike riding, horse riding, family picnics, daytrips, beachcombing and swimming. Nude bathing is permitted on the beach north of the car park.

5.0 VALUES OF THE AREA

During the public consultation process undertaken by Department of Fisheries during preparation of the draft management plan, a large number of user groups with an interest in the Miaboolya Beach area were identified. Each of these groups holds the area as being of significant value, for different reasons. These groups were invited to comment on the final draft management plan, prior to the preparation of this final plan.

5.1 Environmental Values

The area is a habitat for an abundance of native fauna. These include juvenile finfish species such as tailor (*Pomatomus saltatrix*), mulloway (*Argyrosomus spp*.) and sand whiting (*Sillago ciliata*), and various crab species including mud crabs, blue swimmer and green mud crabs (family Portunidae). All these species are important to the Carnarvon region and are part of the ecological balance that exists within the Miaboolya Beach ecosystem.

The mangals found within Miaboolya Creek are of environmental importance.

Publications and research shows that Miaboolya Creek is south of the general southern distribution of the mud crab. Anecdotal evidence suggests that Carnarvon populations of mud crabs have existed solely due to the mangrove environment afforded by Miaboolya Creek, which provides recruitment and breeding sites. Miaboolya is the major primary habitat, with smaller satellite mud crab populations within the surrounding creek systems.

Resident and migratory populations of birds, marine turtles and dolphins also exist within the area and contribute to its environmental value.

5.2 Cultural Values

Consultation with the Gnulli native title group has shown that the Miaboolya area is of important cultural and historical value to the local Aboriginal people. The area was - and still is - a place for food collection and gathering for social occasions. The Gnulli group is committed to the conservation of this area for these reasons.

5.3 Research and Education Values

Miaboolya Creek has a high value for research and education purposes. The Carnarvon Senior High School has been conducting biological and ecological studies in the area for several years.

The work by CSHS students on finfish has been instrumental in alerting Department of Fisheries to the significance of the area to juvenile finfish. The school's more recent work on mud crabs has also contributed to an understanding of the area.

The CSHS initially proposed that Miaboolya Beach become a Fish Habitat Protection Area. Research on this proposal was undertaken by the CSHS, with the help of a FISHCARE WA grant.

The Department of Fisheries is also currently conducting research to identify the breeding grounds of mud crabs and develop an understanding of their population dynamics. The project will lead to improved management of human impacts in the area.

5.4 Recreational Values

The Miaboolya area is heavily used for recreation by the local community and visitors. The creek and adjoining beach play host to a wide range of leisure activities as previously discussed.

6.0 THREATS

Human activities are impacting on the Miaboolya Beach ecosystem. Table 1 lists the main threats to the area.

TABLE 1: THREATS TO THE ENVIRONMENT AT MIABOOLYA BEACH

THREAT	COMMENT
Mangrove system degradation	Already widespread loss of mangroves observed. Changes in hydrology, e.g. creek mouth blocking more frequently and silting.
Fishing	Adverse fishing techniques being used by some. Fishing activity possibly affecting juvenile fish stocks.
Vehicles	General destruction caused through reckless 4WD activity. Degradation of dunes and mud flats.
Digging for mud crabs	Can cause habitat degradation and mangrove destruction.
Camping	Lighting of camp fires
Possible engineering works	Possible future works - for example river training, port development, pipeline construction etc. - would require assessment by the Environmental Protection Authority.
Littering	Littering is an ongoing issue at Miaboolya.

7.0 MANAGEMENT PLAN

7.1 Aim

The aim of this management plan is to protect and rehabilitate the aquatic habitat of Miaboolya Beach and the associated mangrove ecosystem; and to actively involve the community in its management.

The establishment of the area as a FHPA provides a framework to enable better management of human activities, minimise their impacts, and encourage community stewardship for the conservation of Miaboolya Beach and its surrounds.

7.2 Boundary

The Miaboolya Beach FHPA includes the area shown on Figure 1 and described as:

- all Western Australian coastal waters north of a line drawn due west from Point Whitmore and between a line drawn due south from Bejaling Hill and the Western Australian coastline;

- all waters within the boundaries of reserve number 27137 which is vested in the Shire of Carnarvon for the purposes of recreation, camping and picnicking; and

- all waters on the vacant Crown land which is south and east of reserve A 27137 and separates reserve A 28220 (One Tree Nature Reserve) from the sea.

7.3 Purpose of Fish Habitat Protection Area

The Minister for Fisheries may set aside an area of State waters as a Fish Habitat Protection Area (FHPA) pursuant to Section 114 of the *Fish Resource Management Act (FRMA) 1994*

FHPAs are gazetted by the Minister for Fisheries under Section 115 of the *FRMA 1994*. The Minister may gazette a FHPA for the following purposes:

1. The conservation and protection of fish, fish breeding areas, fish fossils or the aquatic ecosystem.
2. The culture and propagation of fish and experimental purposes related to that culture or propagation.
3. The management of fish and activities relating to the appreciation or observation of fish.

The Miaboolya Beach FHPA has been set aside for purposes 1 and 3 above.

7.4 State and National Context

The policy "New Horizons in Marine Park Management" outlines the WA Government's approach to the development of a system of marine protected areas in Western Australia. The New Horizons policy states FHPAs may be established to protect fish and their habitats.

In 1999 the WA Government released the "State of the Environment Report", which was prepared under the auspices of the Environmental Protection Authority. This provides an overview of the key environmental issues facing WA, including a synopsis of issues associated with the marine environment.

In December 1999, the WA Government then released "Environmental Action: the State Government's Response to the State of the Environment Report". This report states that the Department of Fisheries will continue to establish a system of FHPAs, to provide for effective management of fish and their habitats.

The priorities for establishing these protected areas are drawn up by the Department of Fisheries during the process of preparing a Fisheries Environmental Management Strategy for each region of the State. In addition, there is a process that enables community groups to nominate areas for protection, which is outlined in the Department of Fisheries' "Guidelines for the Establishment of Fish Habitat Protection Areas" (Fisheries Management Paper No. 152).

The Fisheries Environmental Management Review for the Gascoyne Region was released in May 2001, which identified the Miaboolya area as being an area in need of special protection.

In February 2001 the Environmental Protection Authority of Western Australia released its "Guidelines for the Protection of Mangroves".

In June 1998 the Australian and New Zealand Environment and Conservation Council released the "Interim Marine and Coastal Regionalisation for Australia Version 3.3" (IMCRA). IMCRA provides the first layer in a broad planning framework in which more detailed information on ecosystems must be used to assist decision-making within Australian and New Zealand. Furthermore, IMCRA will be used as a planning framework for the development of the National Representative System of Marine Protected Areas.

The IMCRA divides the Australian Marine Environment into 60 bioregions. Miaboolya Beach is in the Shark Bay bioregion, which is represented by Shark Bay Marine Reserve and Shark Bay Marine Park in the Nations System of Marine Protected Areas. However, as outlined in Section 3 of this document, the Miaboolya ecosystem is unlike the remainder of Shark Bay and warrants special consideration.

7.5 Selection Criteria Justification

Miaboolya Beach has been declared a FHPA on the basis of the selection criteria outlined in the "Guidelines for the Establishment of FHPAs" (Fisheries Management Paper No. 152). The selection criteria are outlined in more detail in Table 2 below.

TABLE 2: MIABOOLYA BEACH FHPA SELECTION CRITERIA

Purpose of FHPA	Selection Criteria (need for protection)
Fish Protection	❖ Miaboolya Beach is a major nursery site for juvenile fish species and the only known breeding area for tailor in the Gascoyne Region. ❖ It is a popular recreational fishing/crabbing spot and there is evidence that netting and crabbing may be impacting on the fish stocks and their habitats.
Habitat Protection	❖ Miaboolya Creek is an important fish breeding and nursery area. ❖ The mangrove habitat is of great local importance for mud crabs. ❖ Miaboolya Creek is distinctive and unlike any other creek system within the Gascoyne region.
Research	❖ The research work commenced by Carnarvon Senior High School and the Department of Fisheries provides a valuable basis for further study. ❖ Opportunities for further studies include mud crab population dynamics, mangrove ecology, nutrient flows, and monitoring of hydrology within the creek. ❖ Establishment of a FHPA could help coordinate research efforts, with a focus on resolving particular management problems.
Resource Protection	❖ The mangrove areas are important for mud crabs and other fish, birdlife and other aquatic organisms. ❖ The current existence of disruptive fishing practices is detrimental to the fishing resource. This includes the damage caused by digging mud crabs from their burrows. ❖ Dramatic death of mangroves already noticed within the site is probably due to changing hydrology. ❖ Future management of the Gascoyne River could impact upon the Miaboolya Creek system. ❖ Near-shore engineering works could damage the breeding and nursery areas, unless proposals undergo appropriate environmental assessment.

Human Use and Resource Sharing	❖ A FHPA will provide a focus for improved management of the area including control of off-road driving and promotion of sustainable fishing practices. ❖ A FHPA will encourage responsible behaviour through increased community awareness and possible restrictions. ❖ Future engineering works and development may impact upon the aquatic environment of the Miaboolya system if habitat issues are not considered during the planning process.
Education and Observation	❖ A FHPA will provide a focus for community education and ecotourism. ❖ More people may visit the area to observe birds or nature once the value of the area has become more widely known.

8.0 OBJECTIVES AND MANAGEMENT STRATEGIES

The waters outlined in Section 7.2 of this plan have been set aside as a Fish Habitat Protection Area (FHPA), vested with the Minister of Fisheries under the *Fish Resources Management Act 1994*. The establishment of a FHPA formally recognises and promotes the Miaboolya area as one of high conservation value. The waters within Reserve A 27137 will be jointly vested in the Shire of Carnarvon and the Minister for Fisheries.

The public consultation process preceding the preparation of this final management plan identified a number of key issues that the plan should address, including education, community involvement, recreational fishing and commercial fishing.

Objectives have been set and strategies developed to achieve these objectives. These are discussed in greater detail below.

The following abbreviations are used in this section:
DoF Department of Fisheries
SoC Shire of Carnarvon
CSHS Carnarvon Senior High School
Gnulli Gnulli Native Title Group

8.1 Education

Objective: To educate the community, state government agencies, local government and visitors to the area about the Miaboolya Beach environment.

Protection of Miaboolya area will be enhanced if the public become involved in its management. In order to maintain the level of protection required, the public must be aware of Miaboolya Beach, the nearby mangrove ecosystem, and the activities that may jeopardise its habitats.

Issues will be included in the community awareness program such as native species protection within the area, mangrove ecosystem conservation, and the development of responsible fishing practices.

8.1.1 Strategies

1. Continue current and proposed research projects undertaken in the area in association with Carnarvon Senior High School (CSHS) and Department of Fisheries (DoF) to develop a better understanding of the Miaboolya system and involve students in the management of the area. (CSHS/DoF)

2. Extend the lifetime of projects so that students are involved for a number of years. Introducing students to the area through a school project will help to promote awareness and engender an understanding and appreciation of the ecological value of Miaboolya in the next generation of those who will care for it. (CSHS)
3. Erect multi-lingual signs in the area to educate visitors about local native species, habitats, mangrove ecosystems, responsible fishing methods etc. (DoF)
4. Develop a series of information packages about the Miaboolya site including maps and codes of conduct for visitors. (DoF)

8.2 Community Involvement

Objective: To encourage the community to be involved in the management of the Miaboolya system and take an active role in its conservation and rehabilitation.

The long-term protection of the Miaboolya system will depend on a strong sense of community ownership of the area and effective community involvement in its management.

8.2.1 Strategies

1. Encourage and develop a series of community-based conservation and education projects. Funding for the work may be available from FISHCARE WA or other funding bodies. (DoF)
2. Use Miaboolya Beach as the venue for national projects such as 'Clean Up Australia Day' and 'Coast Care Day'. (DoF/SoC)
3. Encourage the wider community to take part in the decision-making and management behind the management of the site and the introduction of a FHPA. (DoF)

8.3 Recreational Fishing

Objective: Ensure that the people of Western Australia and visitors have a quality recreational fishing experience within the Miaboolya system while protecting its important environmental values in the long term.

There is potential for significant over-fishing to occur at Miaboolya. Many finfish species use the area as a nursery, and a high abundance of juvenile fish can be observed within the site of the FHPA.

In addition, some unacceptable fishing methods are used in the area at present, including the destruction of mud crab burrows. Establishment of an FHPA will assist in reducing the use of adverse fishing techniques.

Currently, the waters of all creeks within a distance of 10 kilometres north of Point Whitmore and the waters of all creeks within a distance of five kilometres south of Mangrove Point (including all waters within a radius of 400 metres of their mouths) are closed to recreational netting at all times.

During the consultation process, people expressed the view that the existing daily bag limit of 10 mud crabs is too high in view of the small area of the mangal and the high fishing pressure. A lower limit of 5 was suggested instead. This lowering of the bag limit for mud crabs is also recommended in the draft report of the Gascoyne Recreational Fishing Working Group.

In addition, it was recommended that the area of the existing recreational netting closure be extended. Discussions with the major stakeholders resulted in a recommendation that recreational netting be prohibited between the One Mile Jetty and the Miaboolya Beach car park.

This prohibition would include some waters that are outside the Miaboolya Beach FHPA.

8.3.1 Strategies

1. Regulate to prohibit netting within the FHPA from the northern end of the Miaboolya Beach car park to the One Mile Jetty in the south, to protect juvenile tailor stocks. (DoF)
2. Regulate to prohibit the destruction of mud crab burrows. (DoF)
3. Regulate to decrease daily bag limits of mud crabs to five to conserve stocks. (DoF)
4. Regulate so that mud crabs can only be taken only by means of drop nets. (DoF)

8.4 Commercial Fishing

Objective: Encourage the commercial fishers to contribute to the conservation of the Miaboolya system.

There is an experimental fishery targeting blue swimmer crabs (*Portunus pelagicus*). The commercial fishers provide valuable crab biological data through their catch records. They can record the population numbers of crabs, as well as their migratory movements. Mud crabs (*Scylla spp*.) are caught as part of the by-catch, but are returned to the water alive.

This is an valuable opportunity for Department of Fisheries to record data regarding mud crabs and the commercial fishers. This data could be to gain a better understanding about the mud crab population at Miaboolya, and appropriate management strategies to ensure that it is managed in an environmentally sustainable manner.

8.4.1 Strategies

1. Utilise the information provided by the commercial (experimental) fishers in the area to establish a monitoring program, to develop a database for commercial fishing at Miaboolya. The results of this monitoring should be reviewed periodically to assess whether the fishery is being appropriately managed. (DoF, CSHS)

8.5 Gascoyne River Management

Objective: Minimise the effects of changes to the Miaboolya ecosystem resulting from the implementation of management strategies for the Gascoyne River.

Recent deaths of fish and turtles in large areas of the Miaboolya mangal may have resulted from changes to the natural river flooding patterns. Some observers believe the changes to the course of the Gascoyne River have lead to increased levels of silt being deposited in the estuary. It is also believed that this has lead to the estuary mouth being closed more frequently.

During these periods of separation of the Miaboolya estuary mouth from the sea, increased water temperature and evaporation results in elevated salinity levels in the estuary. This has resulted in the widespread death of fish and turtles and may have contributed to the loss of mangals.

It is believed the risk of undesirable change in the aquatic environment in the Miaboolya area could be minimised if the Department of Fisheries was permitted to contribute to the Gascoyne River catchment planning and management process.

8.5.1 Strategies

1. Monitor water quality within the creek such as flow patterns, general water parameters and salinity levels to assist in protecting the mangal. (DoF, CSHS)
2. Maintain records of observations such as dead fauna (turtles, fish, crabs) that may occur as a result of the creek being blocked or other seasonal conditions (DoF, CSHS)

3. Monitor water conditions in the mangal and open the Miaboolya estuary mouth if high salinity levels threaten fish stocks and the mangals. (DoF, CSHS)
4. Investigate the cause of previous mangrove deaths and prepare a mangrove monitoring and rehabilitation plan. (DoF)
5. Seek representation for the Department of Fisheries on the Gascoyne River Catchment Management Advisory Group. (DoF)

8.6 Land Use Planning

Objective: Ensure that planning documents relevant to the area reflect the need to protect the Miaboolya aquatic system.

From time-to-time, planning documents are prepared on behalf of State Government authorities and the Shire of Carnarvon that may result in land-use changes, which could effect the health of the Miaboolya system. Advice will be provided to ensure these documents reflect the need to protect the system.

8.6.1 Strategies

- Provide advice about the need to protect the Miaboolya system during the development, management plans and planning schemes relevant to the area. (DoF)

8.7 Nature-Based Tourism

Objective: To manage nature-based tourism within the Miaboolya system.

Properly managed nature-based tourism is consistent with the education objective and the conservation of the Miaboolya system. Recreational activities such as bird-watching, wetland and mangrove tours, as well as informational presentations on traditional Aboriginal fishing methods, were raised as possible activities which could occur at Miaboolya during the consultation process.

8.7.1 Strategies

1. Provide local tourism operators with information produced for visitors about the need to protect the system. (DoF)
2. Impose appropriate conditions, to protect the environment, upon any approval to undertake nature-based tourism in the Miaboolya area. (DoF)

8.8 Mining and Exploration

Currently, no mining activity occurs within the area and is not currently the subject of any mining exploration activity. The environmental impacts associated with mining are managed pursuant to Part IV of the *Environmental Protection Act 1986*.

8.8.1 Strategies

Refer any proposal to undertake mining exploration or development within the Miaboolya Beach FHPA to the Environmental Protection Authority for assessment and to ensure habitat protection issues are considered. (DoF)

8.9 Resourcing, Surveillance and Enforcement

Objective: To provide the resources required to effectively protect the values of the Miaboolya Beach FHPA.

The protection of the values of the Miaboolya Beach FHPA will require the allocation of resources to it. The Department of Fisheries and Carnarvon Shire Council staff have responsibilities that relate to the resources of the area.

8.9.1 Strategies

1. Ensure that state and local government officers have appropriate authority and training to undertake enforcement activities in the Miaboolya area. (DoF, SoC)
2. Develop and maintain good working relationships between the external agencies or groups carrying out information programs or research that can help preserve the terrestrial and aquatic environments of the Miaboolya ecosystems. These include CALM, Waters and Rivers Commission, Agriculture WA and local community groups. (DoF)
3. Seek funding to help in the employment of local Aboriginal people to assist in the management, enforcement and research associated with Department of Fisheries within the FHPA. (DoF, Gnulli)
4. Ensure there are sufficient funds made available to state and local government agencies or community groups to conduct the required patrols, education and maintenance necessary for the Miaboolya Beach FHPA. (DoF)

9. IMPLEMENTATION PLAN

9.1 Reservation

The offshore and inland waters, as described in section 7.2 of this document, will be set aside as a FHPA, in accordance with s.115 of the *Fish Resources Management Act 1994*.

In view of the fact that Reserve 27137 is already vested in the Shire of Carnarvon, it is necessary to initiate joint vesting of this reserve with the Shire and the Minister for Fisheries. This process has the potential to take some time. Accordingly, it is proposed to proclaim the FHPA in two stages, as follows:

- Stage 1: Proclamation of the offshore waters.
- Stage 2: Proclamation of the inland waters. This will be carried out once the issues associated with joint vesting of Reserve 27137 have been addressed to the satisfaction of the Shire of Carnarvon, the Department of Land Administration and the Department of Fisheries.

9.2 Implementation Strategy

This Plan of Management contains management strategies that reflect the views expressed in public submission and the Minister's priorities.

It is the responsibility of Department of Fisheries to coordinate the implementation of management strategies contained within this management plan, and report to the community on progress each year.

This management plan will be subject to review in 2010.

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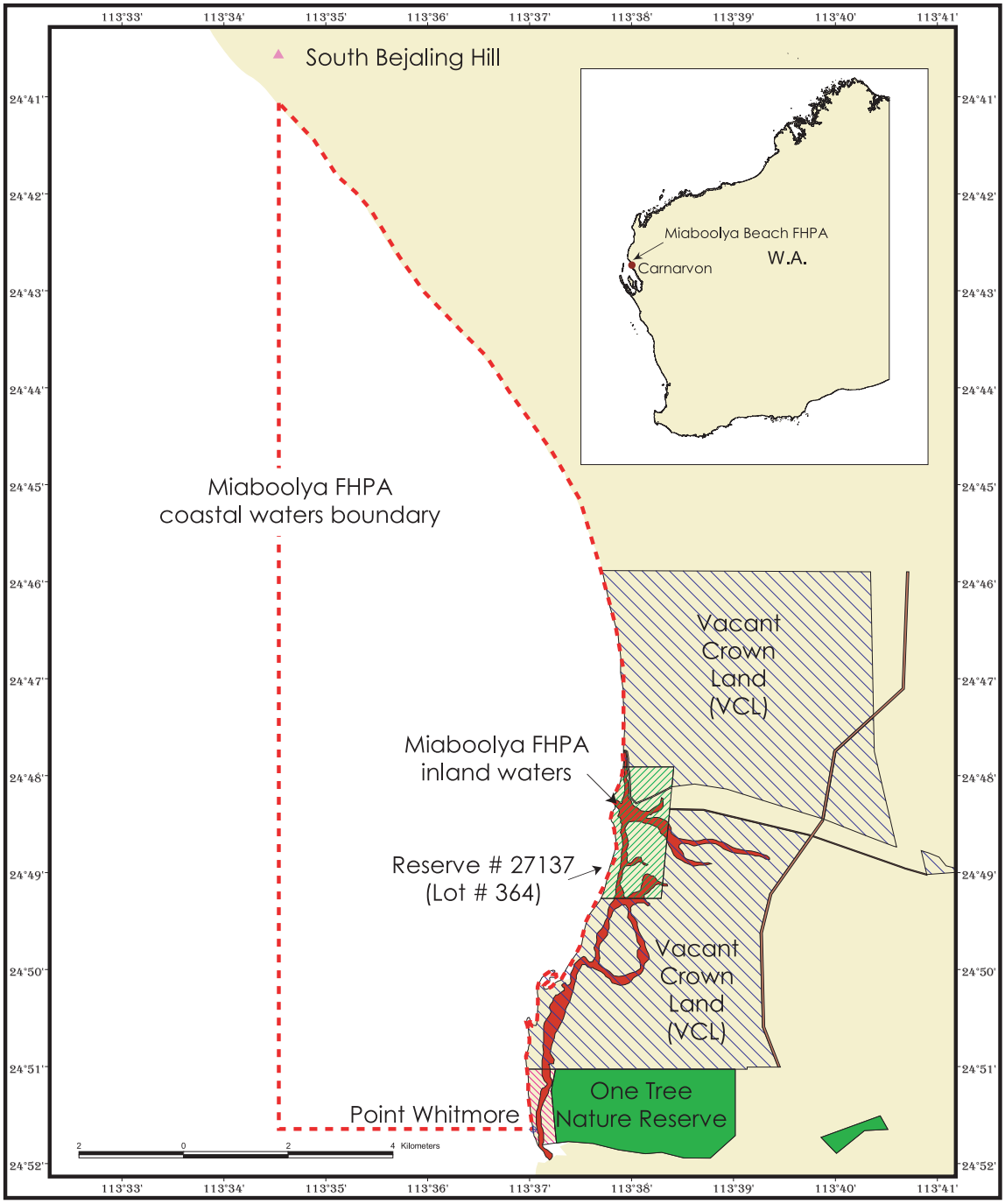

Figure 1 Location of Miaboolya Beach FHPA

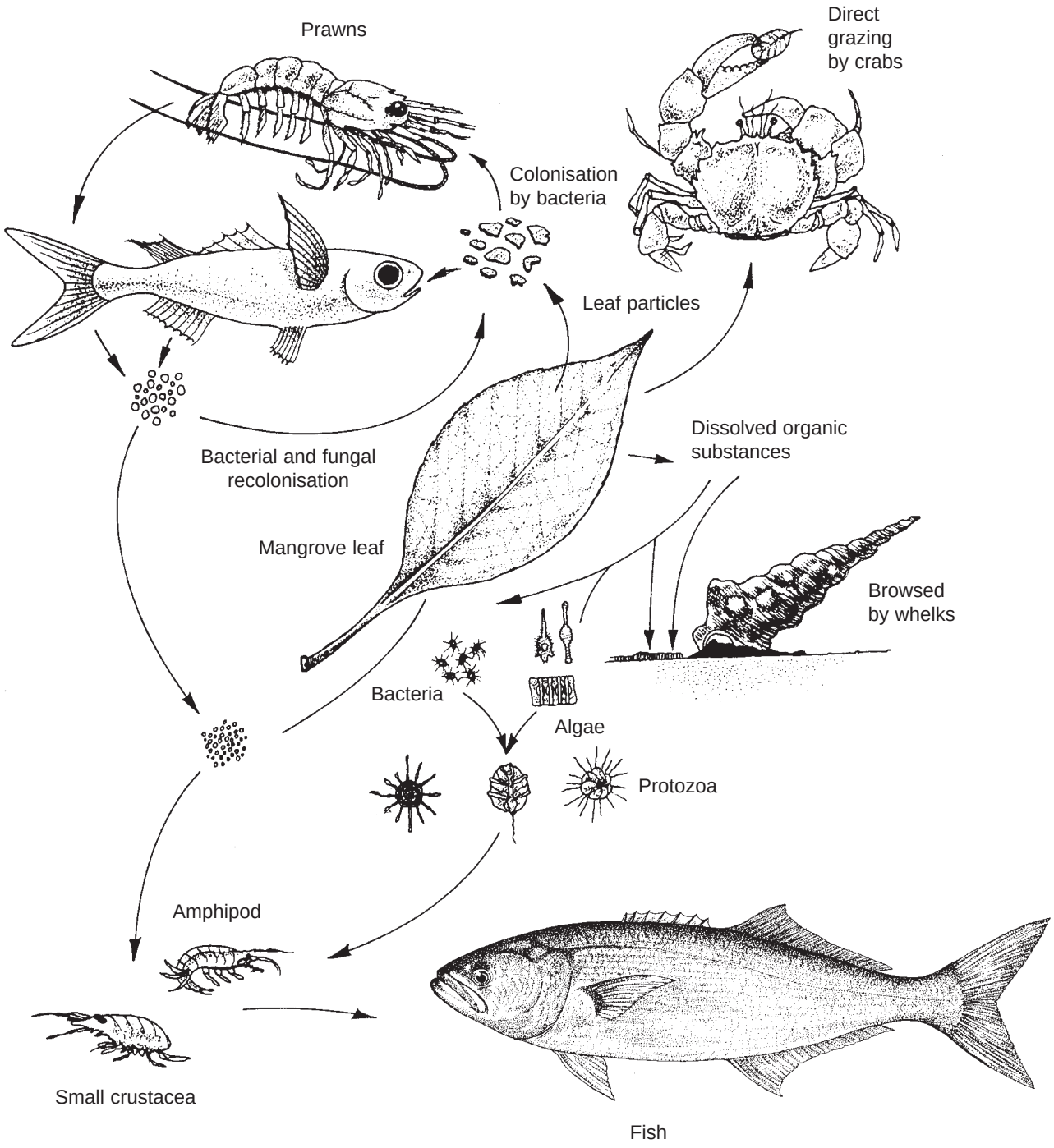

Figure 2 Supply of mangrove material to the food chain (adapted from Semenuik 1972)

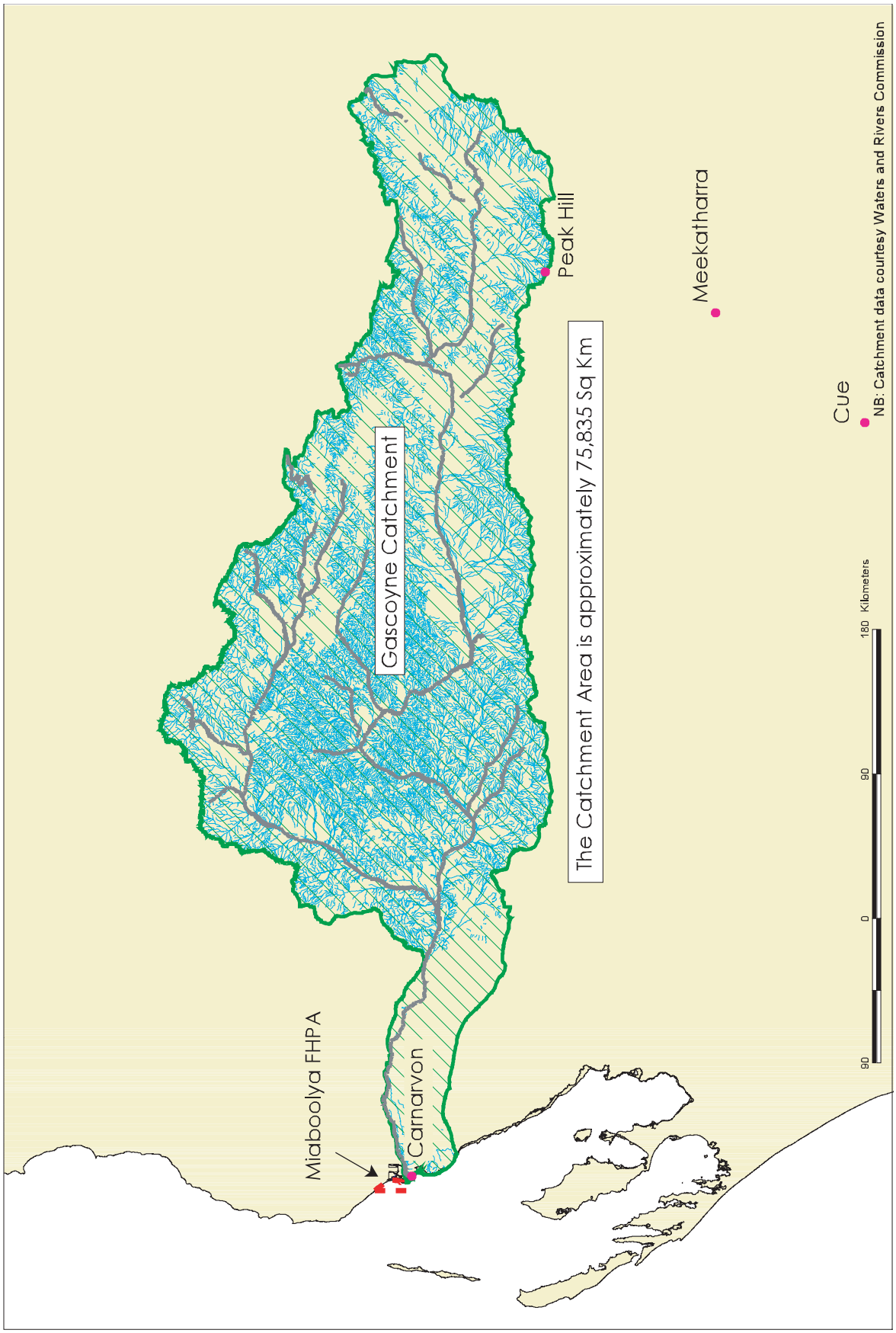

Figure 3 Gascoyne River catchment

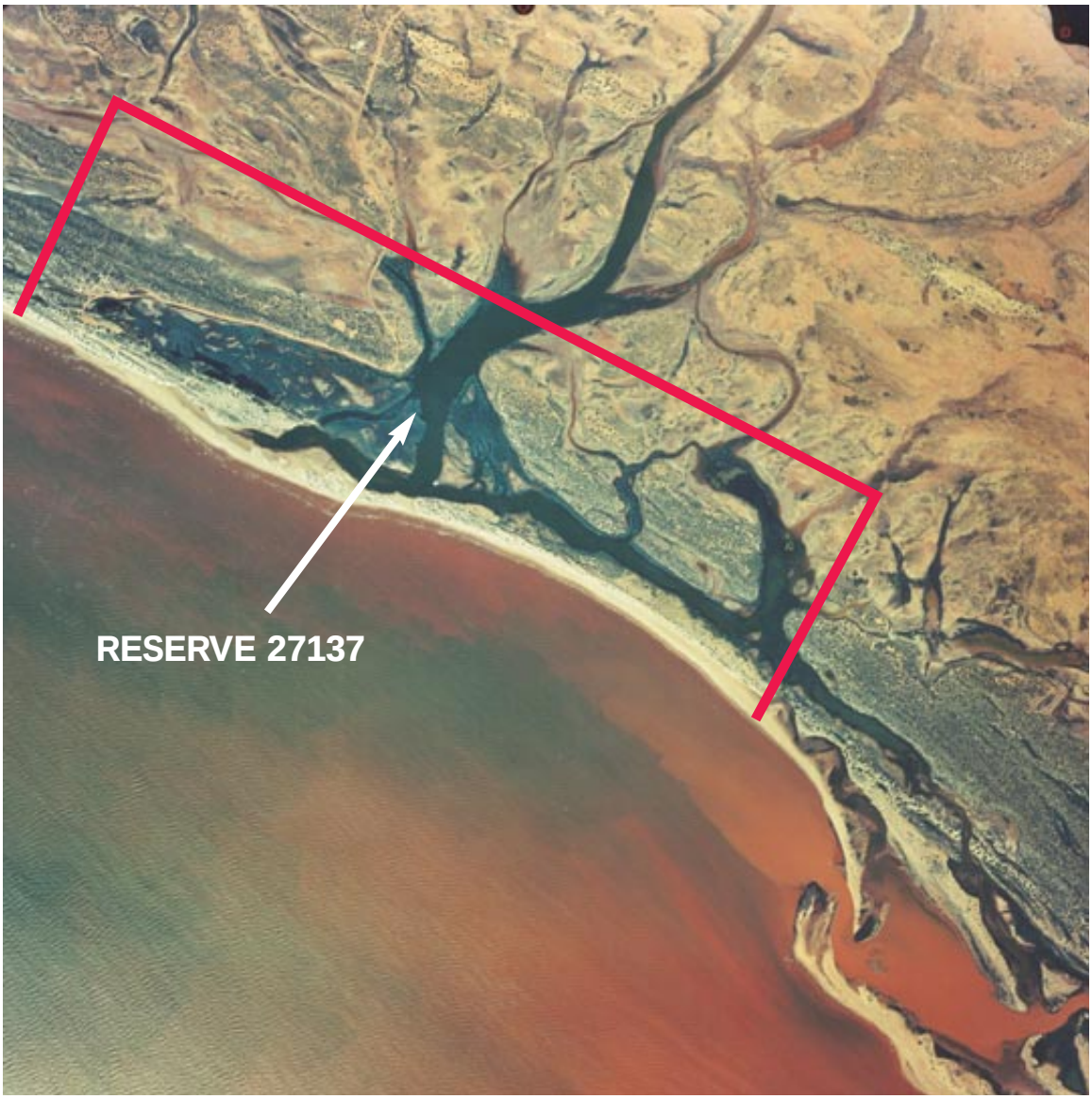

Figure 4 Aerial photograph of Miaboolya Beach FHPA

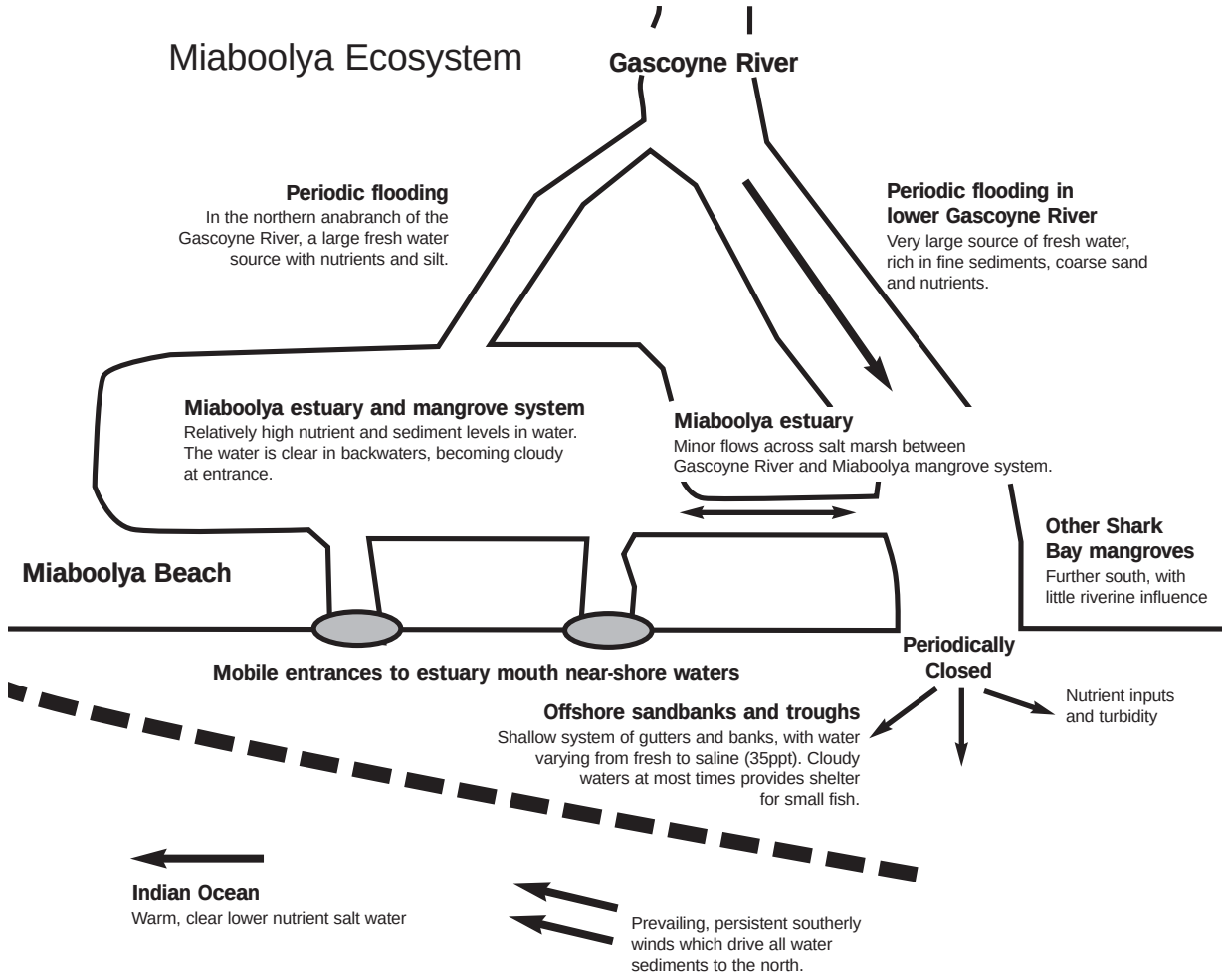

Figure 5 Conceptual model of Miaboolya Ecosystem

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