# *Allocation in the Houtman Abrolhos*

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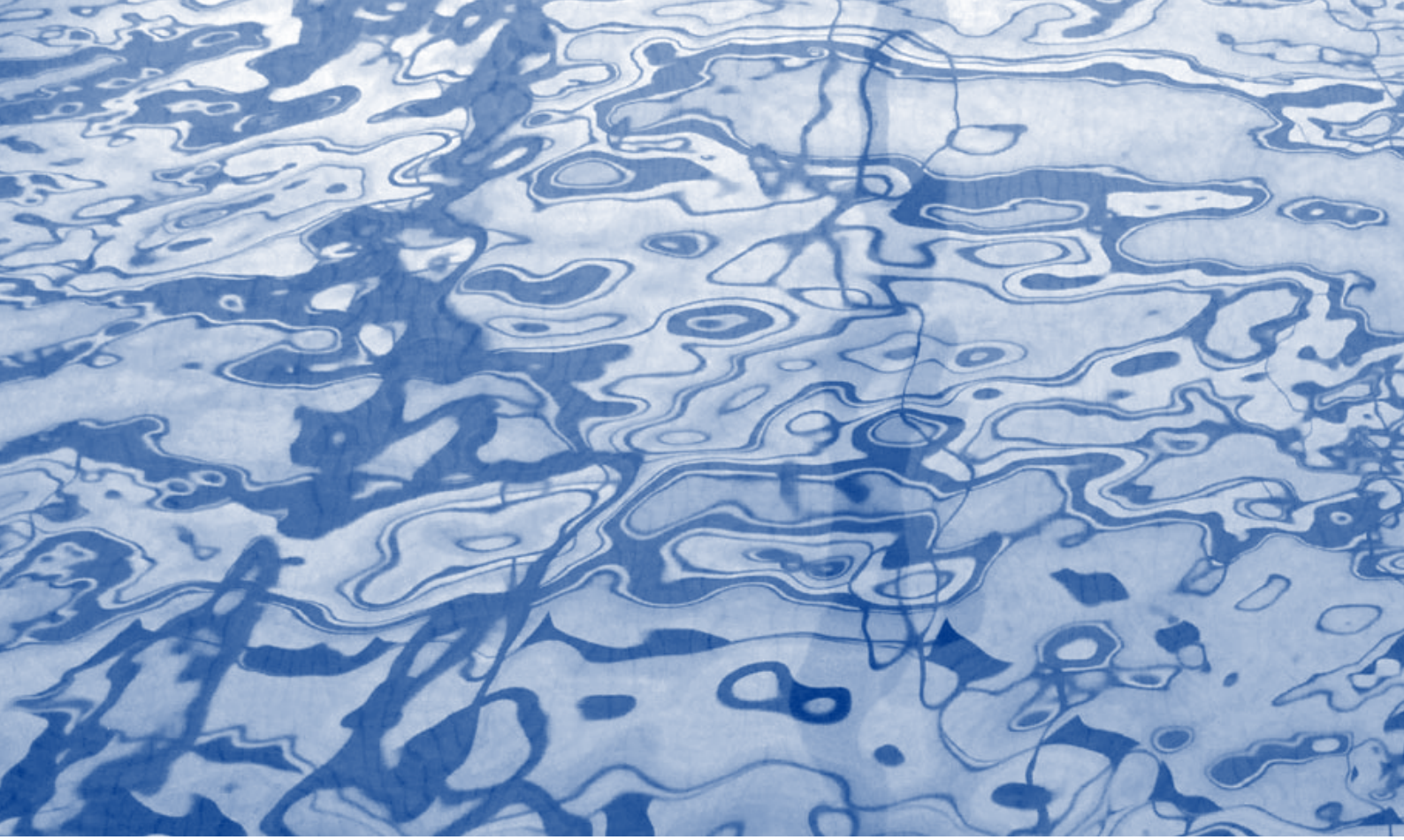

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# Abstract

The Houtman Abrolhos Islands are on the edge of the continental shelf between 28°15'S and 29°S, approximately 60km off the midwest coast of Western Australia. The area is important for commercial fisheries and conservation. This paper presents a strategy for developing integrated fisheries management (IFM) in the Abrolhos. Commercial catch and charter boat data were analysed. Recreational and potential recreational latent fishing effort were estimated. The Abrolhos supports three commercial fisheries: western rock lobsters, scallops and scalefish, which largely targets five demersal species. Recreational fishers concentrate on the same scalefish. Because of their offshore location, high conservation and fishery value, and limited accessibility to recreational fishers, it is suggested that the Abrolhos be subject to separate IFM arrangements. There is no indigenous fishing. Except for rock lobster, four existing Reef Observation Areas (essentially marine protected areas) (ROAs) provide an informal environmental quota. Rock lobster and scallops are commercial fisheries; overlap between commercial and recreational fishers is only in demersal scalefish. Better data on existing catches are required before IFM can be undertaken; a creel census has recently been conducted to determine the recreational scalefish catch.

## Acknowledgements

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# Introduction

Fisheries in Western Australia are dominated by benthic species that produce relatively small tonnages but are of high dollar value. The dominant fishery in the state is the western rock lobster, *Panulirus cygnus*. The catch in 2002/03 was 11,387 tonnes worth Australian $ 278 million. The other major fisheries were prawns (3766 tonnes; $ 45.4 million), scallops (6707 tonnes; $ 22.5 million), and abalone (307 tonnes; $ 12.3 million) (Penn *et al.* 2005). The West Coast Demersal Scalefish Fishery, which includes the Abrolhos Islands, is the largest fishery for scalefish. In 2002/03 the catch was 1,154 tonnes worth $ 5.6 million. The fishery is dominated by Westralian dhufish and pink snapper (St John and King 2005).

Oceanic waters off the west coast of Western Australia are depauperate in nutrients, and fish productivity is therefore relatively low (Lenanton *et al.*, 1991. This increases the risk of overfishing, accentuated by the growth of the human population. In recent decades, Western Australian fisheries management has moved to limited entry for commercial fisheries. Licences are transferable, and have a financial value in their own right. Detailed information is collected on the catches of the commercial fishermen, and there are datasets on the commercial catches which now date back 30 to 40 years. Most of the fisheries are considered to be fully exploited, with no room for growth in wild caught stocks (Penn *et al.* 2005).

In contrast to the considerable amount of information available on commercial fisheries, there is relatively little knowledge of recreational fisheries. Estimates are that one-third of the population of two million people in the state fish at least once a year (Penn *et al.* 2005). The population of the state is increasing rapidly. It doubled in the last 30 years, and is expected to double again in the next 30 years. The population increase is putting pressure on fish stocks, and there will be increasing competition between various sectors for the available fish in the future.

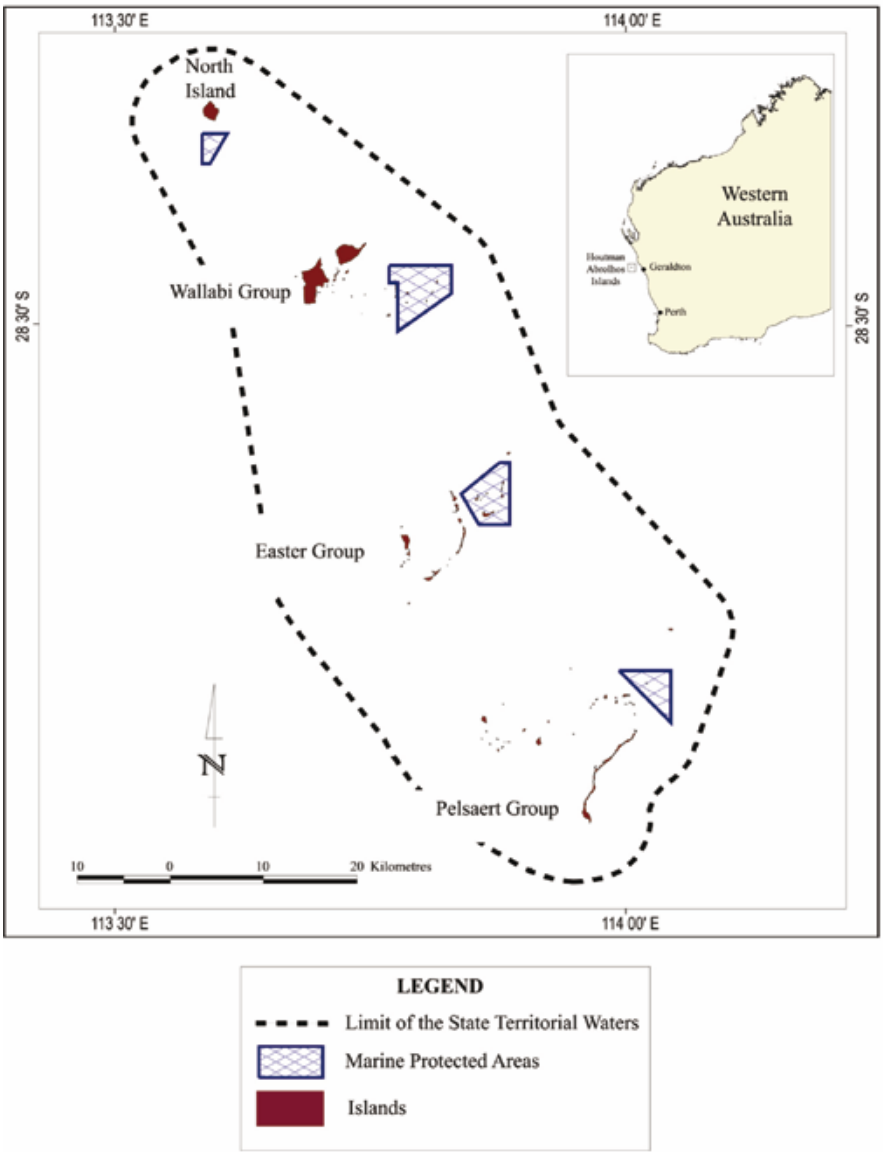
In recognition of the increasing importance of recreational fishing and the potential conflict between recreational and commercial fishers, the Department of Fisheries is now moving to integrated fisheries management to formally allocate resources between the various fishery sectors: commercial, recreational and customary (Fisheries Western Australia 2000a). There is no specific allocation for the environment apart from a target to fish stocks at sustainable levels, but there is a system of marine protected areas in the state, some of which have sanctuary zones in which no fishing is allowed.

Subtropical areas in Western Australia are likely to be particularly sensitive to overfishing because they contain many species with restricted geographic ranges (Morgan & Wells 1991; Jones & Kaly 1995). The Houtman Abrolhos Islands is an area of particular interest for fisheries management and the conservation of marine biodiversity. It is one of the few areas in Australia where tropical coral reefs are found alongside kelp beds typical of temperate rocky reef habitats. Large temperate species including pink snapper, *Pagrus auratus*, and Westralian dhufish, *Glaucosoma hebraicum*, and large tropical lethrinids occur on deepwater limestone reefs and can often be seen in shallow coral areas and on isolated patch reefs within the Abrolhos lagoonal areas. Depletion of these species could also have trophic cascade effects on biodiversity and community structure. The Abrolhos is recognised as having substantial environmental values, and is considered one of the most important areas for marine conservation in Western Australia (CALM 1994). In 1994 a series of four Reef Observation Areas was established in the islands, which include about 17% of the lagoons. All fishing is banned in the reef observation areas except for rock lobster. In 1999, the Abrolhos became the first Fish Habitat Protection Area in Western Australia. The present paper examines the implications of integrated fisheries management in the Abrolhos.

## The Houtman Abrolhos Islands

The Houtman Abrolhos is a complex of 122 islands and reefs located at the edge of the continental shelf between 28°15'S and 29°S, approximately 60km offshore from the midwest coast of Western Australia (Fig. 1). The islands are low lying, with a maximum height of 15m above sea level. There are three major platforms, North Island-Wallabi Group, Easter Group and the Pelsaert (or Southern) Group, separated by Middle and Zeewijk channels respectively, both approximately 40m deep. Each group has an extensive, shallow reef system to the southwest, in the direction of the prevailing swell. To the east is a series of islands and a shallow lagoon. The islands are an A class reserve which puts a high value on the preservation of their environmental values. Some islands are inhabited by about 900 commercial rock lobster fishers and their families during the rock lobster season, which extends from 15 March to 30 June.

Figure 1. Map of the Houtman Abrolhos Islands, Western Australia.




The Abrolhos is a critical area for Western Australian fisheries. It is an area of major importance to the western rock lobster fishery. Catches are generally about 15% of the total for the industry, with a value to the fishers of approximately $ 45 million annually. Even more important, the islands contribute an estimated 40-50% of the production of larvae for the total fishery (Chubb pers. comm.). Additionally, there is a saucer scallop and a small wetline fishery. Recently seven licences have been issued for production of black pearls (*Pinctada margaritifera*). Pearl production is now approaching commercial levels.

In general, individual fisheries in the Abrolhos Islands are subject to the same requirements as in other parts of Western Australia. In addition, fishing for

baldchin groper is banned in the Abrolhos from 1 November to 31 January to protect spawning aggregations in the shallow lagoonal waters (Nardi *et al.* 2006). Only limited commercial fishing of pelagic species is allowed in the Abrolhos Fish Habitat Protection Area. Over the years commercial fishers living on the islands fed samson fish (*Seriola hippos*) and yellowtail kingfish (*S. lalandi*), which now congregate in the commercial anchorages; fishing of these species in the anchorages is now prohibited (a much better word than banned- to heavy and in some cases closures are for small time periods etc, then open again) under fisheries legislation. Fishing for western rock lobster in the islands is subject to the same restrictions as elsewhere in the state. In addition, rock lobsters in the islands can only be collected by pots.

All of the major recreational scalefish species caught in the Abrolhos are classified as reef fish, for which there is a combined daily bag limit of a total of seven fish per day for recreational fishers. The possession limit, other than at a person's place of permanent residence, is one of the three options: 20 kg of fillets or pieces of fish; or 10 kg of fillets or pieces of fish plus one day's bag limit of whole fish; or two day's bag limit of whole fish. This regulation does not apply to commercial fishers if they can show intent to catch fish commercially.

## Material and methods

Commercial data presented are from two sources: Penn *et al.* (2005) for western rock lobsters and saucer scallops and returns from commercial fishers for the scalefish. Fishers are required to submit monthly catch returns specifying the species caught, weight and location. The latter data are in blocks of one degree of latitude and longitude (squares of 60 nautical miles on a side). Three blocks (97012-97014) include the Abrolhos Islands, but they also include adjacent areas of the open sea. Catch data for 2003/04 were obtained for these three blocks. The blocks include areas both in the Abrolhos Fish Habitat Protection Area and locations outside the FHPA. As the present paper deals only with the FHPA, a number of corrections were made to the data. Firstly, mackerel and tuna are caught commercially in the FHPA in relatively small numbers, and these have been ignored in the analysis. Secondly, there is an experimental fishery for the clupeid *Sardinella lemuri* in the region. The fishery caught 915,990 kg in 2003/04 using purse seines; some of this may have been caught in the FHPA. As this is a pelagic species caught by purse seines, it is not targeted by recreational fishers, and the species has been not included in the catch data. Also not included are a number of species caught incidentally in small quantities (usually <100 kg). It should be remembered that while most of the catch of species discussed in this paper comes from the FHPA, some does not.

Recreational catches were estimated from the number of visitors to the islands, their length of stay (Stoddart unpublished) and the number of times fish are consumed weekly. As there are no data on the numbers of meals of fish consumed weekly, we have used a range of values to indicate the potential effect of this consumption. Potential latent fishing effort was estimated by multiplying the number of visitors times the possession limit.

# Results

## Western rock lobster

The 150 commercial fishers have a total allocation of 17,654 pots. The fishery operates from 15 March to 30 June each year. Weather permitting, pots are pulled every day during the early part of the season, then at two to three day intervals later in the season when catches have declined. Legal sized rock lobsters are put into holding tanks on the boat and taken to holding areas near the fishers' island base where they are placed in holding containers in water until a carrier boat takes them live back to Geraldton. In some cases fishers transport the rock lobsters to the mainland at the end of the day and return the next morning to pull pots.

The commercial fishery relies on input controls: number and size of pots, seasonal controls and size limits. Recreational fishers must comply with the same seasonal and size limits as the commercial fishers, and are limited to two pots in the islands. They must have a current Western Australian recreational rock lobster licence. There is a daily bag limit of 8 per person per day, with a boat limit of 16. The number of pots used by recreational fishers in the islands is very small (about 100 pots).

In 2002/03 the total catch of western rock lobster was 12,277 tonnes worth $ 278 million; the Abrolhos catch was 1,722 tonnes. Recreational fishers take an estimated 0.9% of the catch of western rock lobsters in the northern zone (IFAAC 2005). As this zone includes both the Abrolhos and the continental coastline where recreational fishing is concentrated, the proportion of the recreational catch at the Abrolhos is likely to be significantly smaller.

## Scallops

The scallop industry in the Abrolhos targets *Amusium balloti*, which are caught by otter trawls, primarily in the sandy areas east of the islands.

The fishery became limited entry in 1986; there are 16 licensed boats in the fishery. The season is nominally open from 1 April until 30 June, but the actual length of the season is determined based on the results of an annual preseason survey. Recruitment varies considerably between years as a result of fluctuations in the Leeuwin Current (Harris *et al.* 1999). Recent improvements in predicting catch levels have allowed the seasons to be closed early in years when low catches are predicted. A total of 5840 tonnes (whole weight) worth $ 19.6 million was caught in 2003. This was a record due to an outstanding settlement. In the previous year the catch was 195 tonnes whole weight, a more normal catch level. As the scallops are caught in depths of 30+ m, there is no recreational catch.

## Scalefish

The commercial catch of scalefish is overwhelmingly (98.6%) dominated by six families of fish (Table 1), five of which are carnivorous demersal species. The pelagic carangids comprise only 4.8% of the catch. Lethrinids dominate with 36.9% of the total catch. Redthroat emperor (*Lethrinus miniatus*) and spangled emperor (*L. nebulosus*) are the primary species caught in this family. A single member of the family Sparidae, the pink snapper *Pagrus auratus*, constitutes 29.6% of the catch. As its name implies, the Westralian dhufish (*Glaucosoma hebraicum*) is a species endemic to Western Australia. This species constitutes 16.2% of the catch. Two species of labrids constitute 8.1% of the catch; almost all of this is the baldchin groper (*Choerodon rubescens*), another endemic Western Australian species. Small quantities of the Western blue groper (*Achoerodus gouldii*) are also caught. Several species of serranids together constitute 3.0% of the catch. The most important of these is the tropical coral trout, *Plectropomus leopardus*, which comprised 41% of the catch of this family. Five species (*Lethrinus miniatus*, *L. nebulosus*, *P. auratus*, *G. hebraicum*, and *C. rubescens*) comprised 95.2% of the demersal fish taken by commercial fishers in 2003/04.

Table 1. Dominant families in the commercial catches in the Houtman Abrolhos Islands during 2003-04.

| Family | Common name | Catch (kg) | Percentage of commercial catch |
|---|---|---|---|
| Lethrinidae | Emperors | 73,371 | 36.9 |
| Sparidae | Pink snapper | 58,798 | 29.6 |
| Glaucosomatidae | Westralian dhufish | 32,145 | 16.2 |
| Labridae | Baldchin groper | 16,146 | 8.1 |
| Carangidae | Kingfish, trevally | 9,619 | 4.8 |
| Serranidae | Cods, coral trout | 6,049 | 3.0 |
| | | 196,128 | 98.6 |

All of the demersal families and species listed above are prized fish that attract a high commercial price. As prized species they are also important to recreational fishers in the Abrolhos, and are the key target species. Most of the recreational fishing in the Abrolhos is for demersal species, with a small seasonal recreational take of Spanish and shark mackerel and small tuna species As would be expected, recreational fishers on charter boats also targeted the same demersal species; 22.4 of the 27.0 tonnes reported in 2003/04 was from the same five species (Table 2).

Table 2. Charter catches in the Houtman Abrolhos Islands during 2003-04.

| Family | Species | | Estimated Catch (Tonnes) |
|---|---|---|---|
| | Scientific name | Common name | |
| Serranidae | Epinephelides armatus | Cod, Breaksea | 0.1 |
| | Epinephelus rivulatus | Cod, Chinaman | 0.3 |
| | Plectropomus leopardus | Trout, Coral | 0.7 |
| Glaucosomatidae | Glaucosoma hebraicum | West Australian dhufish | 5.0 |
| Carangidae | Pseudocaranx dentex | Trevally, Skipjack | 0.1 |
| Lutjanidae | Lutjanus sebae | Emperor, Red | 0.1 |
| Lethrinidae | Lethrinus miniatus | Emperor, Redthroat | 3.0 |
| | Lethrinus nebulosus | Emperor, Spangled | 1.0 |
| | Lethrinidae spp | Snapper, North West | 0.4 |
| Sparidae | Pagrus auratus | Snapper, Pink | 5.0 |
| Labridae | Choerodon rubescens | Groper, Baldchin | 9.0 |
| Other | | | 2.3 |
| Total | | | 27.0 |

Because of the long coastline in Western Australia (some 14,000 km) and concentration of the population in Perth, there are few resources to determine the levels of recreational catch in remote areas such as the Abrolhos. Funding was obtained for a recreational fishing creel census that took place in the Abrolhos during the 2005/06season, but data were not available when this paper was written. In the absence of survey data, only broad estimates of the recreational catch can be made. Table 3 shows available data on the number of visitors to the Abrolhos in 2003/04. These data were used to estimate the potential catch consumed in the islands. The assumption was that each person on the islands had fish as a main meal two to four times a week. A 200 gm serve is considered a large serve, and equates to 600 gm of whole fish (Department of Fisheries 2005b). Using these assumptions, two to four meals of fish per person per week on the islands equates to 19.5 to 39.0 tonnes of whole fish caught per annum and consumed in the Abrolhos.

Table 3. Potential recreational catch of Abrolhos Island visitors in 2004/05. (Visitor numbers courtesy of Emily Stoddart; *from Leonie Noble as estimate of stay with fishers during season)

| Season | | | Total days | | Amount of fish consumed (tonnes) | |
|---|---|---|---|---|---|---|
| | | | | | Twice | Four times |
| Out of season | 1 577 | 3.5 | 5 497 | 785 | | |
| Easter school holidays | 121 | 11.8 | 1 522 | 217 | | |
| In season, not school holidays | 2 060 | 5 | 10 300 | 1 470 | | |
| Total recreational | | | | 2 472 | 3.0 | 6.0 |
| Fishers and their families | 900 | 107 (length of season) | 96 300 | 13 760 | 16.5 | 33.0 |
| Total consumption | | | | | 19.5 | 39.0 |

If all the recreational people brought back to the mainland their possession limit of 20 kg of fillets, this would be 75 tonnes, or 225 tonnes whole weight, a significant potential latent catch. The data for the commercial fishers is only for fish sent to the mainland on the carrier boat as consigned catch that goes to the processing factory. There is also a potential catch by the commercial fishers of scalefish that are taken off the carrier boats and used for personal consumption.

# Discussion

Integrated fisheries management is an emerging field in Western Australia, driven by the fact that many of the fisheries are already fully exploited. Commercial fisheries are limited entry, and many have been limited for years. Recreational catches of many species have increased as the population has grown. This trend will continue as the population continues to grow. Equity in the distribution of the catch between the various fishing groups is a key consideration. Wild caught fish are a communal resource, in which there is no individual ownership, but there are increasing expectations in the community. Commercial fishers need allocations from integrated fisheries management that allow them to make a reasonable living with their work and investment. Recreational fishers expect to be able to catch fish for their personal enjoyment and use. Customary fishers expect a portion of the catch in line with their traditional usage of the resource.

As indicated above, the population of Perth is expected to double in the next 30 years. This would be expected to double fishing pressure, even without allowing for increased leisure time and disposable income. The pressure on the Abrolhos may be even greater than this. Geraldton is a small city, with a population of about 40,000 people in the region. The local growth rate is subject to considerable variation as a result of economic conditions. There are a number of potential developments, such as petrochemical exploration, development of a proposed port at Oakajee, enhancement of the Geraldton harbour, increased tourism, movement of a small proportion of people away from capital cities ("sea changes"), etc. which may cause the Geraldton population to expand at a rate higher than that of the state as a whole. Any increase in the population of Geraldton is likely to increase the number of local people going to the Abrolhos. In addition, there is a planned increase in direct tourism to the Abrolhos from Perth, interstate and overseas, and a tourism facility is now being planned for Long Island in the Wallabi Group.

The Houtman Abrolhos Islands are located 60 km off Geraldton on the mid-west coast of Western Australia. The islands have many unique features, and

are of high conservation value. To some extent, the isolated location of the islands has protected them from the high levels of recreational fishing seen along the continental coastline. The unique nature of the Abrolhos makes it imperative that consideration be given to having tighter management of fisheries and a separate system of integrated fisheries management in the islands. As the islands are well offshore, there has been no known Aboriginal occupation since the last ice age, and customary fishing does not occur there. While there is no formal integrated fisheries management allocation for conservation purposes, the four existing reef observation areas provide protection for a considerable proportion of the shallow areas for all species except rock lobsters.

Before effective integrated fisheries management can be implemented, a critical question must be answered: are fish stocks in the Abrolhos being fished sustainably at present? The rock lobster and scallop fisheries are commercial fisheries that are subject to tight controls. There is no need for special management of these two species. Pelagic species of scalefish are primarily targeted by recreational fisher and this catch is minimal. Demersal scalefish are the only group targeted by both commercial and recreational fishers. Five species comprised the vast majority of the catch in 2003/04 in the Abrolhos; these species are also key to the overall demersal scalefish fishery on the west coast (St. John and King 2005). Additionally, catches of a sixth species, the coral trout *Plectropomus leopardus*, have historically been significant in the Abrolhos.

Anecdotal information from commercial rock lobster fishers is that when they are catching fish recreationally, they leave the shallow lagoonal areas of the Abrolhos and fish in deeper oceanic waters because there are few of the target species in the lagoons. Similarly, diving experiences in the Easter Group in 2004 clearly showed that there were larger numbers of adult individuals of the target species in the Easter Group Reef Observation Area than in areas outside the ROA (Wells unpublished). More substantial information is provided by Nardi *et al.* (2004). They examined densities of C. *rubescens* and *P. leopardus* inside and outside the Easter and Wallabi ROAs before they were established in 1994 and monitored them at two-year intervals until 2002 (a subsequent survey was undertaken in 2004). Three years after the establishment of the ROAs, densities of *P. leopardus* began to rise, peaking in 2002. At that time densities had increased three-fold in the Easter Group and seven-fold in the Wallabi Group. The density of mature fish in the closed area had increased by an order of magnitude. This is particularly important, as the Abrolhos is the only area on the west coast of Western Australia with a substantial population of *P. leopardus*. Densities outside the closed areas remained relatively stable throughout the study. *Plectropomus leopardus* is a territorial fish that lives in shallow water and deep-water reefs. With closed areas totalling 17% of the Abrolhos lagoonal environments, the populations benefited substantially from protection, and across the entire Abrolhos the

population increased by a factor of 2.5. In contrast, the 2004 survey showed a sharp decline in densities of *P. leopardus*, 70% in the Easter Group and 82% in Wallabi Group (Nardi *et al*. 2005). The sharp decreases in the ROAs were attributed to confirmed illegal fishing. The decline in populations of *P. leopardus* in the reserves is matched by an equally sharp decrease in the commercial Abrolhos catch. Catches in the three years from 2000/01 to 2002/03 were 15, 14 and 12 tonnes respectively (St John 2003; 2004; St John & King 2005). These catches dropped suddenly to 2.5 tonnes in 2003/04.

In contrast to *P. leopardus*, C. *rubescens* is a mobile species which also has a refuge in deep water. This combination of biological features means the ROAs in the Abrolhos were less effective in enhancing the density of this species. Populations of C. *rubescens* showed no clear patterns, fluctuating irregularly both inside and outside the protected areas, in the period from 1993 to 2002 (Nardi *et al.*, 2004). This finding is consistent with that of Bohnsack (2000), who suggested that small marine reserves might not be as effective for mobile species as for territorial species. Moreover, Nardi *et al.* (2006) have presented other data that suggest C. *rubescens* is a species that may be susceptible to overfishing at the Abrolhos. For example, indirect estimates of the annual instantaneous rate of natural mortality (M) ranged from 0.05 to 0.58 and total mortality (Z), ranged from 0.21 to 0.56, rendering stock assessment highly uncertain. Moreover, the small geographic range, slow growth, long potential life span, protogynous sex change, aggregative spawning and high discard mortality rates further increase the possibility of overfishing. The finding that the species spawns in spring and early summer (Nardi *et al.*, 2006) has led to an annual three monthly closure (1 November – 31 January) for C. *rubescens* in the Abrolhos.

While the data presented above do not demonstrate conclusively that the key fish species in the Abrolhos are being overfished, they do raise concerns that must be addressed before integrated fisheries management proceeds in the area. The concerns also suggest that the Abrolhos should be treated as a separate area, with tighter limits on fishing than occur near the adjacent mainland.

The first step in establishing integrated fishery management allocations in the Abrolhos is to determine the sustainable catch and what is being caught in the islands. There are already good data on the commercial landed catch of demersal scalefish, but there are no data on the fish caught and consumed in the islands or brought to the mainland by commercial rock lobster fishers for their personal consumption. Data are now being collected on charter boat activity, which primarily targets demersal scalefish. No data are available on fish caught by recreational fishers, and there is a substantial latent fishing effort. Data obtained from the 2006 / 07 recreational creel survey will help to provide the necessary information.

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