

The recreational fishing amnesty in NSW Marine Parks:

A CONTINGENT BEHAVIOUR VALUATION
E HEAGNEY & RICH ALLMAN – SEPTEMBER 2013

EXECUTIVE SUMMARY

This economic study has been undertaken to assess the marginal cost of restricting shore-based recreational line fishing at beach and headland sites that are the subject of the current amnesty in NSW Marine Parks. We interviewed 80 recreational fishers in 3 NSW Marine Parks (Cape Byron, Solitary Islands and Batemans Bay) to gain a better understanding of their site preferences and their most likely behavioural response to restricting access to amnesty sites.

Fishers were asked about the relevance of 8 site attributes for their site selection processes (proximity, accessibility, facilities, safety, seclusion, amenity and expected catch). These were combined with site proxy variables to rate the quality (or utility or desirability) of all beach and rocky headland sites within the selected MPAs for shore-based fishing – including both amnesty and alternate fishing sites. Multivariate testing identified regional differences in fisher site preferences, and these have been accounted for in site quality ratings.

Fishers were asked about their usual travel patterns and their most likely behavioural response to restricted access at any of their usual or preferred fishing locations. Fisher responses were used to estimate the marginal cost of restricted access to individual amnesty sites as follows:

- Where a site of comparable quality to the amnesty site exists within fishers' normal walking distance from the access point (0.5 km) we assume that site switching does not impose any additional cost on fishers. The majority of amnesty sites (15 out of 21 sites) fell into this cost category.
- Where fishers could walk to a site that is of comparable quality to the amnesty site, but this entails walking further than they would normally, the additional distance travelled was considered a loss of consumer surplus, and is calculated using the travel cost method at a rate of 75c per km for every km over 0.5 km travelled. Two out of 21 amnesty sites fell into this cost category.
- Where fishers cannot walk to a site of comparable quality to the amnesty site – i.e. no site of comparable quality exists within their walking limit (1.3 km) - we assume that fishers drive to the closest alternate access point that allows fishing at a site of comparable quality. This is assumed to impose an additional travel cost at a rate of 75c per km for the driving distance between access points. Four out of 21 amnesty sites fell into this category.

Costs associated with individual amnesty sites and individual fishing events were scaled up to estimate the total cost of the amnesty to the broader NSW recreational fishing community. This was achieved by calculating the relative demand for each amnesty site as a function of its quality (relative to other local fishing opportunities) and the size of surrounding resident and tourist populations. We estimate the total cost of the amnesty at ~\$24,500 p.a. comprising costs of ~\$14,500 p.a. at Cape Byron Marine Park, ~\$1,000 p.a. Marine Park and ~\$9,000 p.a. at Batemans Bay Marine Park. Note, however, that the costs to recreational fishers presented in this report are maximum cost estimates, given that most surveyed fishers reported fairly flexible travel patterns and considered site-switching to be a part of fishing rather than a considerable additional cost.

The costs to shore-based recreational line fishers of restricting access to amnesty sites, as reported above, are notably low. This probably arises from the fact that NSW has implemented a multiple-use marine park model and undertaken extensive community consultation to ensure that viable alternatives to sanctuary zone sites remain available to all user groups, thereby minimising costs to this group of recreational fishers. In addition, direct cost to fishers of restricting access to amnesty zones needs to be weighed against any positive value they might hold for restricted access to amnesty sites (e.g. option and existence values). In this context it is important to note that 96% of fishers surveyed for this study supported the use of sanctuary zones for biodiversity conservation purposes.

Although this report only estimates the cost of restricting shore-based recreational fishing at amnesty sites, any change in the distribution of fishers along the coastline may represent a cost or benefit to other recreational users. This is especially likely for swimmers, snorkelers, divers and kayakers, which have been identified by a range of sources as potential conflict groups. The contingent valuation framework used in this study could be applied to the other recreational users so that the costs of restricting access to specific sites to be properly costed and balanced for all user groups in a cost-benefit framework.

The results of this study also highlight 2 more general points. First, on-ground intercept surveys can provide important information about the common opinion, or the diversity of opinion in society, rather than the opinion of a vocal minority that might otherwise be over-represented in public consultation processes. They could make a valuable addition to Marine Park consultation processes. Second, our multivariate analysis suggests that a diverse range of fisher types exists within the NSW recreational fishing community. Deepening our understanding of the site preferences, values and behaviours of these different fisher groups is likely to improve management of values in the NSW Marine Estate.

1. BACKGROUND

In March 2013 the NSW government announced an amnesty on shore-based recreational line fishing in NSW Marine Park sanctuary zones that contain areas of ocean beach or rocky shore habitat. The amnesty was introduced for a period of 6 months to allow for data collection and analysis so that any longer-term decision about recreational fishing access to these areas can be made with a better understanding of socio-economic values and potential economic impacts.

A number of studies have estimated the total economic value of Australian beaches and coastal ecosystems. Recent studies have estimated values as high as \$25M - \$215M for individual beaches (in 2012 dollars for Manly and Mooloolaba beaches respectively), and ~\$60M – \$2.2 billion for coastal regions (in 2012 dollars for the Gold Coast and the Victorian coastline respectively). Several Australian and international studies have also estimated the economic value of beaches and other ecosystems to specific user groups, including snorkelers, divers and recreational fishers. A review of these and other coastal valuation studies is provided in Kirkpatrick (2011).

In valuing the NSW Marine Park amnesty on shore-based fishing, or other Marine Park zoning arrangements, it is necessary to move beyond the total economic value of either an ecosystem or total value to user groups to focus on marginal values – i.e. the change in value that might result from new or different zoning and access regulations. Within this policy context it is necessary to understand how and why different user groups apportion value to different sites, and their likely behavioural responses to changing access or management conditions.

The way in which different site attributes can impart and impact value to recreational user groups has been studied in a range of settings. A small number of studies has investigated site preferences of snorkelers and divers and found elevated values associated with environmental quality and fish size (Rudd and Tupper 2002, Uyarra et al. 2009). A larger number of studies has investigated the site attributes that determine value to recreational fishers. These have found a significant effect of site proximity and travel costs, fishing quality, provision of facilities, encounters with other anglers and regulation (as reviewed by Hunt 2005). However, many of these studies also warn against an ‘average angler’ approach (Siikamäki and Layton 2007, Ward et al. 2013), and identify different ‘types’ or groups of fishers that have very different value sets - e.g. local vs. tourist fishers, catch-oriented vs. experience-oriented fishers, committed vs. occasional fishers. A summary of studies into recreational fisher site preferences and attributes is provided in Table 1.

Table 1: Recent studies that investigate fisher site preferences and the fisher characteristics that might influence them.

| Authors | Context | Significant site attributes | Significant fisher attributes | Comment | Source |
|--|---|---|---|--|---------------------------|
| Hunt | Review | Travel cost (proximity) Fishing quality Provision of facilities Encounters with other anglers Regulations | Individual preferences Knowledge of alternatives Habit | Complex site substitution patterns may exist | (Hunt 2005) |
| Cox | Lake fishing / modelled lakes | Fish density & expected catch | | | (Cox 2004) |
| Newbold & Massey | Modelling demand for fishing or hunting sites | Connectivity for transient or migratory target species | | Actual fish abundances may be the best indicator of site value; use of proxies may over-estimate value; site may not be interchangeable due to temporal differences in value | (Newbold and Massey 2010) |
| Sutton | Measuring satisfaction of recreation fishers and boaters on GBR | Environmental quality Weather quality Fishing quality | | No impact of marine life quality, facilities, encounters with other people or boats | (Sutton 2005) |
| Cervantes, Espejel, Arellano & Delhuneau | Beachgoers in California & Mexico | Infrastructure & services | | | (Cervantes et al. 2008) |
| Ward, Quinn & Post | Lake fishing, Canada | | Spatial behaviour Harvest behaviour Catch efficiency | Multivariate clustering identified 4 different fisher types whose relative distribution varied by region | (Ward et al. 2013) |
| Beardmore, Haider, Hunt & Arlinghaus | Discrete choice modelling experiment | | Centrality to lifestyle Importance of catch Use of specialised gear | Used latent class modelling to identify different fisher types | (Beardmore et al. 2013) |
| Oh & Ditton | | | Skill & knowledge Commitment | Multivariate clustering to identify different fisher types | (Oh and Ditton 2006) |

In this study we investigate the site attributes that drive preferences of shore-based recreational fishers in NSW. We characterise the spatial distribution of site values across 3 NSW Marine Parks (Cape Byron, Solitary Islands and Batemans Bay) and investigate how restricting access to amnesty sites is likely to impact this user group. We recognise the potential for impacts of changed access conditions at amnesty sites on other user groups (e.g. divers and snorkelers who might avoid areas where fishers are present), and on the local or regional economy more broadly. Although these impacts have not been assessed in this study, they are discussed further in Section 6.

2. VALUATION FRAMEWORK

2.1 Contingent behaviour valuation

This analysis uses a contingent behaviour valuation to determine the most likely (and lowest cost) substitute for fishing access at amnesty sites.

Our valuation framework combines information about recreational fishers' site preferences and their usual site selection or site switching behaviours:

- Fishers site preferences are used to rate the quality (or utility or desirability) of all beach and rocky headland sites within the selected MPAs for shore-based fishing – including both amnesty and alternate fishing sites.
- Information on site selection and switching behaviours are used to establish fishers' usual travel patterns, and their most likely behavioural response to restricting access to amnesty sites.

The closure of amnesty sites would be considered to impose a cost to recreational fishers if sites of equivalent or comparable quality do not exist within usual or reasonable search or travel distances. Depending on fisher behaviours, these costs may be measured in terms of increased travel costs, diminished fishing experience (loss of consumer surplus), or loss of fishing days.

We recognise the possibility that limiting recreational fishing access may sometimes result in reduced participation in local fishing opportunities, which may impose secondary costs on the local community via a reduction of spending in local businesses. However, as none of the fishers interviewed in this study reported that they would fish less if access to specific beach and headland sites was restricted (see Section 2.5), we have not included any secondary economic effects analysis in this study.

2.2 Survey methodology

We undertook face-to-face surveys with 80 shore-based fishers in 3 NSW Marine Parks: 23 in Cape Byron Marine Park, 37 in Solitary Islands Marine Park, and 20 at Batemans Bay Marine Park.

Interviews were undertaken over 3 consecutive weekend periods (Friday evening – Saturday – Sunday) from 2nd to 18th August 2013.

Within each of the selected Marine Parks we aimed to focus survey effort in those areas that are most frequently used by shore-based fishers (as identified from a range of historical user-group studies undertaken in each of the Marine Parks and by consultation with regional staff) in order to obtain site preference information that was representative of general use patterns. We also visited each of the sanctuary zones that are the subject of the current amnesty at least once during the survey period in order to capture the preferences and opinions of those fishers most likely to be affected by any management changes, although fishers were not always present at these sites.

Fisher interviews were focussed on 4 key information areas:

- Fisher characteristics – including information about home postcode, annual fishing effort, frequency of fishing in the Marine Park, fishing specialisation (gears and habitat), and species vs. site orientation
- Site preferences – where fishers were asked to rank 8 site attributes (proximity, accessibility, facilities, safety, seclusion, amenity, expected catch and conflict with other user groups) on a scale of 1-5 representing degree of relevance for selecting a fishing site (“not relevant” to “most relevant”)
- Travel patterns – including fishers’ usual travel between different access points and fishing sites within the region, and their most likely response to any regulation that limited access to favoured fishing sites
- Knowledge and attitudes towards Marine Park regulation – including whether or not fishers were aware of the amnesty and whether or not they supported to use of sanctuary zones for conservation purposes.

A copy of the full interview content is provided in Appendix 1.

2.3 Fisher types and site preferences

Statistical clustering of fisher site preference data clustered fishers into several ‘types’ that assign different levels of importance different site attributes. Multivariate testing identified significant links between fisher characteristics like catch orientation and species vs. site specialisation (RELATE test in PRIMER-E, $\rho = 0.157$, $p = 0.005$) These results are consistent with the economic literature presented in Table 1, and represent a promising first step towards understanding the diversity of motivations, values and behaviours of recreational fishers in NSW. The potential to build on these findings so that angler fisher diversity can be accounted for in future management of Marine Parks is discussed further in Section 6.3.

In the context of valuing access to recreational fishing at amnesty sites, however, we are limited to differentiating fisher ‘types’ on the basis of characteristics with known prevalence within the NSW recreational fishing community, as this enables us to scale up the values of different fisher ‘types’ and estimate value to all NSW recreational fishers. The 2000 National Recreational Fishing Survey provided estimates of the relative distribution of recreational fishers across broad coastal regions, and with respect to average annual effort (i.e. those that fish less than 5 days, 5-24 days, or more than 25 days per year (Henry & Lyle 2003). We investigated differences in fisher site preferences on the basis of these characteristics using a 2-factor (crossed) ANOSIM in PRIMER-E.

ANOSIM identified significant differences in fishers’ site preferences between Marine Parks ($\rho = 0.347$, $p = 0.001$) but not their level of annual fishing effort ($\rho = 0.026$, $p = 0.3$). Post-hoc testing revealed that site preferences of fishers at Cape Byron Marine Park were significantly different to those at either Solitary Islands or Batemans Bay, so site preference data was collated separately for that park, as presented in Table 2.

Table 2: Mean value weighting for site attributes as reported by fishers interviewed in Cape Byron, Solitary Islands and Batemans Bay Marine Parks. S.E. are standard errors.

| | | Proximity | Accessibility | Facilities | Safety | Seclusion | Amenity | Exp. catch | Other users^^ |
|---------------------|-------------|-----------|---------------|------------|----------|-----------|----------|------------|---------------|
| Cape Byron | Mean | 2.77 | 2.51 | 2.71 | 2.63 | 3.26 | 3.48 | 3.23 | 3.04 |
| | S.E. | 0.29 | 0.22 | 0.21 | 0.16 | 0.19 | 0.20 | 0.23 | 0.19 |
| | Rank | 5 | 8 | 6 | 7 | 2 | 1 | 3 | 4 |
| Other parks^ | Mean | 4.51 | 4.51 | 2.14 | 3.74 | 1.70 | 2.89 | 2.65 | 1.40 |
| | S.E. | 0.09 | 0.08 | 0.10 | 0.09 | 0.07 | 0.11 | 0.12 | 0.11 |
| | Rank | =1 | =1 | 6 | 3 | 7 | 4 | 5 | 8 |

^ other parks refers to Solitary Islands and Batemans Bay Marine Parks only; given the regional differences in fisher preferences observed in our study weightings may not be transferable to other NSW Marine Parks.

2.4 Calculating site value scores

We used fisher site preference information in combination with proxy variables for each of the site attributes identified in our survey to estimate a site value score for both amnesty sites and alternate beach and headland sites within the selected Marine Parks. Proxy variables that were used to represent site attributes, and their data sources, are provided in Table 3 (over page).

GIS software was used to create a 500m gridded raster extending from the northern to the southern boundary of each of the selected Marine Parks, and the proxy variables shown in Table 3 were rated within each 500m grid square. An overall site score for each 500m grid square was calculated by weighting proxy variables according to the fisher preferences shown in Table 3. An example of how fisher preferences were used to weight proxy ratings and provide overall site scores is provided in Table 4.

Table 4: Site preference weightings and sample proxy variable data for a hypothetical site in Cape Byron Marine Park. In order to calculate the overall site score site preference weightings and proxy variable ratings are multiplied; multiplied values are summed across all 6 site attributes and the resultant total is expressed as a percent of the maximum possible score – i.e. (sum of weightings)*5.

| Cape Byron | Accessibility | Facilities | Safety | Seclusion ^^ | Amenity | Other users |
|-------------------------------|---------------|------------|--------|-----------------|---------|-------------|
| Rank [^] | 6 | 4 | 5 | 2 | 1 | 3 |
| Site preference weighting | 2.51 | 2.71 | 2.63 | 3.26 | 3.48 | 3.04 |
| Proxy variable rating | 3.00 | 2.00 | 1.50 | 4.50 | 3.00 | 2.00 |
| Site pref x proxy rating | 7.52 | 5.42 | 3.94 | 14.66 | 10.45 | 6.09 |
| Overall site score (%) | | | | | | 55 |

[^] site attributes have been re-ranked within a reduced attribute set (cv Table 2) that excludes ‘proximity’ and ‘expected catch’ (see below for rationale)

^{^^} ‘seclusion’ and ‘other users’ proxies were not available for Solitary Islands and Cape Byron Marine Parks. This is unlikely to affect our site score assessments given that these were the attributes that fishers in these Marine Parks rated as ‘least relevant’ for site selection.

‘Proximity’ has been excluded from overall site score calculations because it is not a ‘fixed’ site attribute, rather it varies depending on the location of a fisher’s home or holiday accommodation. ‘Proximity’ to dwellings or tourist accommodation has been used to estimate the demand for individual amnesty sites as described in Section 2.6.

‘Expected catch’ has been excluded from overall site score calculations because there is limited data about recreational fishing catch rates available at the relevant spatial scale. Creel surveys could be incorporated into future site preference survey work to assist in future site valuation studies.

Table 3: Proxy variables used in overall site score calculations

| Attribute | Description | Proxy | Source |
|---|---|--|--------------------|
| Proximity* | Proximity to the fisher's home (if resident) or accommodation (if tourist) | Population density in adjoining statistical area | ABS 3235.0 |
| | | Number of tourist nights in adjoining statistical area (over previous 12 months) | ABS 8635.1.55.001 |
| Accessibility | Ease of access to the site, including both car-based travel to the access point, and foot-based travel between the carpark and the fishing site | Grade of road to closest parking point | |
| | | Availability of parking | Google Earth |
| | | Distance from access point to site | (DPI, Rich Allman) |
| | | Grade of access track to site | |
| Provision of facilities | | Nearest shop (food, water, coffee) | Google Earth |
| | | Nearest toilets / tap | (DPI, Rich Allman) |
| | | Fish cleaning tables | |
| Safety | Rating from 1-5 to encompass exposure to wind and swell, unsafe walking tracks or other hazards | Rank provided by, or confirmed by, MPA regional staff | |
| Seclusion^ | | Intensity of other users (shore-based, all groups) | MPA / DPI surveys |
| Amenity | | Adjoining land-use | Google earth |
| Expected catch | | Data unavailable | |
| * this was omitted from overall site score calculations but used to estimate relative demand of amnesty sites (see Section 2.4) | | | |
| ^ included for Cape Byron only as seclusion was ranked highly at this park, and data was unavailable for other parks | | | |

2.5 Estimating costs

Our fisher survey used targeted questioning to identify fishers' most likely behavioural responses to changing access regulations at a (hypothetical) preferred beach or headland fishing site. All fishers reported that they would either move sites - travelling further up or down the coastline within a specified distance, or, if the walking distance to an alternate fishing site was beyond a specified limit, they would drive to an alternate access point and select a new fishing site.

Costs to fishers of restricting access to amnesty sites were therefore estimate as follows:

- Where fishers can walk to a site that is of comparable quality to the amnesty site (based on overall site scores) within their normal walking distance from the access point (0.5 km; based on mean 0.46 km and S.E. ± 0.02 km determined from fisher surveys) we assume that site switching does not impose any additional cost to fishers.
- Where fishers could walk to a site that is of comparable quality to the amnesty site, but this would entail walking further than they would normally, the additional distance travelled is considered a loss of consumer surplus, and is calculated using the travel cost method. We assume a cost of 75c per km (equivalent car travel rate as published by NSW government) for every km over 0.5 km travelled.
- Where fishers cannot walk to a site of comparable quality to the amnesty site – i.e. no site of comparable quality exists within their walking limit (1.3 km; based on mean 1.3 km and S.E. ± 0.15 km determined from fisher surveys) we assume that fishers drive to the closest alternate access point that allows fishing at a site of comparable quality. This is assumed to impose an additional travel cost at a rate of 75c per km (as above) for the driving distance between access points (as calculated from Google Earth).

The costs estimated using the above method should be considered the maximum cost of restricting access to amnesty sites because, based on our fisher interviews:

- most fishers (62% of those surveyed) drive to their selected fishing access point, so driving to an alternate access point will not necessarily represent an additional travel cost, particularly when fishers are aware that fishing is not allowed at a site prior to commencing travel – for example, the alternate access point may be equidistant from the fisher's house, but in a different direction.
- some fishers (12% of those surveyed) usually drive between multiple access points when selecting a fishing site, so switching between access points in response to limiting access to amnesty sites does not impose any additional cost on top of normal travel patterns for this group.

- all surveyed fishers indicated that they did not consider additional travel to select a new fishing site (within reasonable limits) to impose any cost; rather they saw site-switching as a normal part of the fishing experience.

It is important to note that most fishers (96% of those surveyed) supported the use of sanctuary zones for biodiversity conservation purposes, so it is likely that fishers hold additional positive value for restricted access to amnesty sites (e.g. option and existence values). Contingent valuation techniques could be used to quantify these types of values in future recreational fishing surveys.

2.6 Scaling up

Estimated costs to individual fishers of restricted access to amnesty sites have been scaled up to the broader NSW recreational fishing community as follows:

- We assume 6.879 M fishing events per annum. This figure is taken from the National Recreational Fisher Survey undertaken in 2000 (Henry & Lyle 2003). We recognise that this figure is somewhat dated, and an updated estimate of total fishing effort across the state will be available on completion of a repeat survey that is currently underway. However, it is not possible to 'scale up' the total effort estimate from 2000 ahead of the repeat survey data release without encountering serious confounding effects. For example, scaling up based on the increase in NSW recreational fishing licences sales over the past decade is likely to be confounded by increasing awareness and compliance with the new requirement for recreational licencing over the same period.
- The authors of the 2000 study also provide a proportional breakdown of recreational fishing by region, and gear type. These have been used to estimate the total number of ocean beach and headland line fishing events in the 3 broad regions that encompass the selected NSW Marine Parks: the North Coast, Solitary Islands and South Coast fishing regions.
- We estimated the proportion of regional fishing effort occurring inside the selected Marine Parks. For the Solitary Islands fishing region we assumed that 100% of fishing effort occurred within the Solitary Islands Marine Park. For the North Coast and South Coast fishing regions we note the high value ranking that surveyed recreational fishers placed on the proximity of fishing sites (especially in Batemans Bay Marine Park - see Table 2) and estimate demand for fishing in Marine Parks based on their proximity to coastal dwellings (for residents) and tourist accommodation (for tourists). We apportion regional fishing effort to the selected Marine Parks using:

$$\text{Proportion of regional effort in MP} = \frac{\left[\frac{\text{pop}_{mp}}{\text{pop}_{region}} + \frac{\text{tourists}_{mp}}{\text{tourists}_{region}} \right]}{2}$$

where pop_{mp} is the population in coastal census divisions adjacent to Marine Park waters (using ABS SA2 divisions and 2011 Census data— see Appendix 2,3)

pop_{region} is the population in all coastal census divisions (SA2) in the relevant region

tourists_{mp} is the number of tourist nights in coastal census divisions adjacent to Marine Park waters as recorded from ABS Tourist Accommodation Survey (using ABS SA2 divisions and cat no. 8635.1.55.001)

pop_{region} is the population in all coastal census divisions (SA2) in the relevant region.

This equation assumes an equal distribution of residents and tourist in the local fishing population. The true distribution of residents vs. tourists in the broader fishing population is unknown, but tourist numbers are often correlated with local population size in regional areas, so the final proportion of fishing effort calculated this way is likely to be robust to this assumption. Plots of relative demand in each Marine Park are provided in Appendix 2.

- We also used ‘proximity’ to estimate the demand for shore-based recreational line fishing at individual amnesty sites. We generated a demand estimate for each amnesty site using:

$$\left[\frac{\text{site val}_{amn,x}}{\text{site val}_{SA2,x}} * \text{pop}_{SA2,x} \right] \frac{1}{\sum_{SA2=a} \text{pop}_{SA2}} + \left[\frac{\text{site val}_{amn,x}}{\text{site val}_{SA2,x}} * \text{tourists}_{SA2,x} \right] \frac{1}{\sum_{SA2=a} 1}$$

Where $\text{site val}_{amn,x}$ is the sum of overall site scores for all GIS raster squares that contain amnesty site x

$\text{site val}_{SA2,x}$ is the sum of overall site scores for all GIS raster squares within the statistical division containing amnesty site x

SA2 a = z are all SA2 statistical divisions adjacent to the Marine Park

pop_{SA2} is the SA2 population as reported in the 2011 Census

tourists_{SA2} is the number of tourist nights reported for the SA2 (using ABS cat no. 8635.1.55.001).

This methodology essentially predicts demand at an individual amnesty site as a function of surrounding tourist and residential density and local site quality relative to other sites in the SA2. A similar technique has recently been proposed for use in economic benefits transfer (Cullinan et al. 2011). Tables showing demand estimate calculations for each amnesty site in the selected Marine Parks are provided in Appendix 3.

3. VALUING THE AMNESTY AT CAPE BYRON MARINE PARK

3.1 Cape Byron Marine Park in context

Byron Bay is one of Australia's most visited regional tourism destinations– it is home to world renowned surf breaks and steadily growing kayaking, snorkelling and diving industries. Early research undertaken to inform the Cape Byron Marine Park zoning plan identified a broad range of recreational users in the MP – recreational fishers ranked as the 6th most prevalent user group, after swimmers, walkers & runners, beach-goers, whale & dolphin watchers and surfers. Pre-zoning surveys of user groups identified that recreational fishing was mainly concentrated in the Brunswick Heads Estuary, the adjoining Brunswick Beach, Tallow Beach, Broken Head, Seven Mile Beach and Lennox Head. Only 2 of these preferred recreational fishing areas have been affected by sanctuary zoning.

High visitation rates by a broad range of recreational user groups may go some way to explaining the unique site preferences held by recreational fishers surveyed in the Cape Byron Marine Park (see section 2.3). Fishers at Cape Byron rated amenity, seclusion and conflict with other user groups amongst the top 4 (out of 8) site attributes affecting their site selection. In contrast, fishers in other Marine Parks generally rated these in the bottom 4 (see Table 2). At-site conflict with surfers, kayakers and boat-users was noted by 25% of survey respondents from Cape Byron. However, during face-to-face interviews many recreational fishers commented that their avoidance of crowded sites related as much to issues of traffic and competition for parking than any direct conflict with other user groups at the fishing site itself. Fishers reported that it was difficult to park in high demand areas, and that they often experienced extensive traffic and parking delays, and that demand for parking had led to the introduction of paid parking at some sites (and most fishers avoided using those areas). This issue is most relevant for the Cape Byron and Lennox Head amnesty sites, and has been incorporated into overall site scores for the Cape Byron Marine Park by assigning low values to heavily used sites, as consistent with fisher preference weightings (Table 2).

3.2 Valuing Cape Byron Marine Park amnesty sites

We present the cost associated with restricting shore-based recreational line fishing at each of the amnesty sites in Cape Byron Marine Park below. Costs estimates are for a single fishing event. Costs are scaled up to be representative of the overall impact on the NSW recreational fishing community in Section 3.3.

A) Tyagarah Beach

| | |
|---|-----------|
| Amnesty site score (max) | 35 |
| Maximum site score within 0.5 km | 35 |
| Maximum site score within 1 km | |
| Distance to nearest site of comparable quality | |
| Cost per event: walk <0.5 km to south | none |

B) Belongil Beach

| | |
|---|-----------|
| Amnesty site score (max) | 27 |
| Maximum site score within 0.5 km | 27 |
| Maximum site score within 1 km | |
| Distance to nearest site of comparable quality | |
| Cost per event: walk <0.5 km to south | none |

C) Wategos

| | |
|--|----------------|
| Amnesty site score | 42 |
| Maximum site score within 0.5 km | |
| Maximum site score within 1 km | 39* |
| Distance to nearest site of comparable quality | 1 / 8 km* |
| Cost per event: walk <1 km to L. Wategos / Clarkes | \$ 0.38 |
| Cost per event: drive 1 km to Cosy Corner | \$ 0.75 |
| Cost per event: drive 8 km to Broken head (north) | \$ 6.00 |
| Average cost per event: | \$ 2.38 |

* we assume different fishers may behave differently in this situation – some may move walk a short distance to Little Wategos, Clarke’s Beach or Cosy Corner and accept a minor loss of site quality (<10%), others may drive to an alternate high quality fishing site. We assume both responses are equally likely and take the average impact value.

D) Tallow Beach

| | |
|---|-----------|
| Amnesty site score | 32 |
| Maximum site score within 0.5 km | 32 |
| Maximum site score within 1 km | |
| Distance to nearest site of comparable quality | |
| Cost per event: walk <0.5 km to south | none |

E) Broken Head

| | |
|---|-----------|
| Amnesty site score | 21 |
| Maximum site score within 0.5 km | 26 |
| Maximum site score within 1 km | |
| Distance to nearest site of comparable quality | |
| Cost per event: walk <0.5 km to north | none |

F) Lennox Head

| | |
|---|-----------|
| Amnesty site score | 33 |
| Maximum site score within 0.5 km | 41 |
| Maximum site score within 1 km | |
| Distance to nearest site of comparable quality | |
| Cost per event: walk <0.5 km to north | none |

G) Lennox Head 2

| | |
|--|-----------|
| Amnesty site score | 20 |
| Maximum site score within 0.5 km | |
| Maximum site score within 1 km | 41 |
| Distance to nearest site of comparable quality | |
| Cost per event: walk <1 km to north | \$0.38* |

* an alternate no-cost fishing site may exist to the south, outside the Marine Park boundary

3.3 Valuing the amnesty at Cape Byron Marine Park– scaling up

Costs of restricting shore-based recreational line fishing in Cape Byron Marine Park have been scaled up from a site-specific cost per event to a total cost for all amnesty sites in the Marine Park and all NSW recreational fishers using the method outlined in Section 2.6. The total cost of the amnesty at this Marine Park was \$14,467. Costs were primarily incurred at the Wategos Beach amnesty site as a result of the high relative demand for fishing access in that region (see Appendix 2). Results are provided in Table 5.

Table 5: Cost of the fishing amnesty at Cape Byron Marine Park to all recreational fishers in NSW

| Recreational Fishing | Proportion (%) | Number | Source | |
|--|----------------|--------------|----------------------------|-----------------------|
| Number of recreational fishing events in NSW per year | | 6,789,000 | Henry & Lyle 2003 | |
| % that is shore-based line fishing in north coast NSW fishing region | 14.6 | 991,194 | Henry & Lyle 2003 | |
| % north coast fishing effort inside Cape Byron Marine Park | 11.2 | 111,014 | ABS data (see Section 2.6) | |
| | | | | |
| Relative value of amnesty sites: | Rel. demand* | No. affected | Cost per event (\$) | Total cost^ (\$ p.a.) |
| Tyagarah Beach | 9.1 | 10,102 | 0 | |
| Benongil Beach | 4.5 | 4,996 | 0 | |
| Wategos Beach | 5.3 | 5,884 | 2.38 | 14,003 |
| Tallow Beach | 2 | 2,220 | 0 | |
| Broken Head | 3.9 | 4,330 | 0 | |
| Lennox Head (north) | 0.9 | 999 | 0 | |
| Lennox head (south) | 1.1 | 1,221 | 0.38 | 464 |
| | | | | |
| Total cost to all NSW recreational fishers | | | | 14,467 |

4. VALUING THE AMNESTY AT SOLITARY ISLANDS MARINE PARK

4.1 Solitary Islands Marine Park in context

The Solitary Islands Marine Park spans 75 km of the NSW mid-north coast. At its southern end the Marine Park is adjacent to Coffs Harbour – one of the largest regional cities in NSW which is home to around 70,000 people and experiences 85% of total tourism activity in the mid-north coast region. To the north the Marine Park is adjacent to the Yuraygir National Park – which abuts 38 km, or roughly half, of the Marine Park coastline and extends an average of 10 km inland. With the exception of a few small coastal towns that are located between Yuraygir and the Marine Park (Wooli, Diggers Camp and Minnie Water, with combined resident population of ~3,000), the accessibility of this section of the Marine Park is limited – there are many unsealed dirt roads, some of which are suitable for 4WD only, and some coastal sites are only accessible by walking a considerable distance along low-grade foot tracks.

Given the extremes in population, tourism and accessibility from southern to northern parts of the Solitary Islands Marine Park, it is unsurprising that recreational fishers surveyed within the park reported that proximity and accessibility were of highest relevance to their fishing site selection (ranked equal 1st of the 8 site attributes surveyed – see Table 2). Because we have estimated demand for fishing at individual amnesty and alternate site as a function of both site quality and proximity to population and tourists, the stark differences in northern vs. southern sections of the Marine Park have been accounted for in our site-specific estimates of recreational fishing value.

4.2 Valuing Solitary Islands Marine Park amnesty sites

We present the cost associated with restricting shore-based recreational line fishing at each of the amnesty sites in Solitary Islands Marine Park below. Costs estimates are for a single fishing event. Costs are scaled up to be representative of the overall impact on the NSW recreational fishing community in Section 4.3.

A) Minnie Water Beach

| | |
|--|-----------|
| Amnesty site score | 33 |
| Maximum site score within 0.5 km | 35 |
| Maximum site score within 1 km | |
| Distance to nearest site of comparable quality | |
| Cost per event: walk <0.5 km to north | none |

B) Jones Beach

| | |
|--|-----------|
| Amnesty site score | 29 |
| Maximum site score within 0.5 km | 44 |
| Maximum site score within 1 km | |
| Distance to nearest site of comparable quality | |
| Cost per event: walk <0.5 km to north or south | none |

C) Barcoongere Rocks / Freshwater Beach

| | |
|--|-----------|
| Amnesty site score | 28 |
| Maximum site score within 0.5 km | |
| Maximum site score within 1 km | |
| Distance to nearest site of comparable quality | 7km* |
| Cost per event: drive further south to 4WD access | \$ 5.25 |
| Cost per event: use Wooli sites | none |
| Cost per event: use Diggers Camp sites | none |
| Average cost per event: | \$ 1.75 |

* a number of alternatives exist within this range. Wooli and Diggers camp sites represent no additional cost because they are no further from Wooli town (the access point) than the amnesty site

D) Flat Top Point

| | |
|--|-----------|
| Amnesty site score | 39 |
| Maximum site score within 0.5 km | 36 |
| Maximum site score within 1 km | |
| Distance to nearest site of comparable quality | 3 km |
| Cost per event: walk <1 km to north | \$ 0.38 |
| Cost per event: drive 3 km to Sandy beach | \$ 3.00 |
| Average cost per event: | \$ 1.70 |

* we assume different fishers may behave differently in this situation – some may move walk a short distance to the north and accept a minor loss of site quality (<10%), others may drive to an alternate high quality fishing site. We assume both responses are equally likely and take the average impact value.

E) Bare Bluff / Diggers Point

| | |
|--|-----------|
| Amnesty site score | 31 |
| Maximum site score within 0.5 km | 42 |
| Maximum site score within 1 km | |
| Distance to nearest site of comparable quality | |
| Cost per event: walk <0.5 km to north or south | none |

F) Moonee Beach

| | |
|---|-----------|
| Amnesty site score | 31 |
| Maximum site score within 0.5 km | 44 |
| Maximum site score within 1 km | |
| Distance to nearest site of comparable quality | |
| Cost per event: walk <0.5 km to north | none |

4.3 Valuing the amnesty at Solitary Islands Marine Park– scaling up

Costs of restricting shore-based recreational line fishing in Solitary Islands Marine Park have been scaled up from a site-specific cost per event to a total cost for all amnesty sites in the Marine Park and all NSW recreational fishers using the method outlined in Section 2.6. The total cost of the amnesty at this Marine Park was \$1,046. Costs are minimal because the amnesty sites that impose a travel cost on affected fishers occur in areas of the park that have very low relative demand (only ~600 fishing events are affected; see Appendix 2). Results are provided in Table 6.

Table 6: Cost of the fishing amnesty at Solitary Islands Marine Park to all recreational fishers in NSW

| Recreational Fishing | Proportion (%) | Number | Source | |
|--|----------------|--------------|----------------------------|-----------------------|
| Number of recreational fishing events in NSW per year | | 6,789,000 | Henry & Lyle 2003 | |
| % that is shore-based line fishing inside Solitary Islands Marine Park | 1.38 | 93,688.20 | ABS data (see Section 2.6) | |
| Relative value of amnesty sites: | Rel. demand* | No. affected | Cost per event (\$) | Total cost^ (\$ p.a.) |
| Minnie Water | 0.2 | 187 | 0 | |
| Jones Beach | 0.04 | 37 | 0 | |
| Barcoongere Rocks | 0.22 | 206 | 1.75 | 361 |
| Flat Top Point | 0.43 | 403 | 1.70 | 685 |
| Bare Bluff / Diggers Point | 0.68 | 637 | 0 | |
| Moonee Beach | 1.72 | 1,611 | 0 | |
| Total cost to all NSW recreational fishers | | | | 1,046 |

5. VALUING THE AMNESTY AT BATEMANS BAY MARINE PARK

5.1 Batemans Bay Marine Park in context

The Batemans Bay Marine Park spans 130km of the NSW south coast. The south coast has lower population densities and less tourism than the north of the state, but the area that encompasses the Marine Park is well known for fishing, and the total demand for shore-based recreational line fishing is higher here than in the other Marine Parks surveyed (see Table 7).

Multivariate analysis of fisher site preferences, characteristics and behaviours suggested that resident and tourist recreational fishers in the Batemans Bay Marine Park may have different site preferences. However, this was a marginally significant ($p=0.1$) result based on a small sample size from this Marine Park ($n= 20$ with interview success limited by strong winds that deterred fishers) and additional research would be required to gain a deeper understanding of different fisher ‘types’, their relative distribution, and implications for managing recreational fishing in this Marine Park (see Section 6.3).

5.2 Valuing Batemans Bay Marine Park amnesty sites

We present the cost associated with restricting shore-based recreational line fishing at each of the amnesty sites in Batemans Bay Marine Park below. Costs estimates are for a single fishing event. Costs are scaled up to be representative of the overall impact on the NSW recreational fishing community in Section 4.3.

A) North Head

| | |
|--|---------------|
| Amnesty site score | 32 |
| Maximum site score within 0.5 km | |
| Maximum site score within 1 km | 32 |
| Distance to nearest site of comparable quality | |
| Cost per event: walk <1 km to north | \$0.38 |

B) Guerilla Bay to Longnose Point

| | |
|---------------------------|-----------|
| Amnesty site score | 51 |
|---------------------------|-----------|

| | |
|---|--------|
| Maximum site score within 0.5 km | |
| Maximum site score within 1 km | |
| Distance to nearest site of comparable quality | 2.5 km |
| Cost per event: drive 2.5 km to Rosedale or Tomakin Hd | \$1.88 |

C) Broulee Island

| | |
|---------------------------|-----------|
| Amnesty site score | 41 |
|---------------------------|-----------|

| | |
|--|------|
| Maximum site score within 0.5 km | 41 |
| Maximum site score within 1 km | |
| Distance to nearest site of comparable quality | |
| Cost per event: fish from neighbouring headland | none |

D) Congo

| | |
|---------------------------|-----------|
| Amnesty site score | 53 |
|---------------------------|-----------|

| | |
|--|------|
| Maximum site score within 0.5 km | 53 |
| Maximum site score within 1 km | |
| Distance to nearest site of comparable quality | |
| Cost per event: | none |

E) Meringo / Bingie

| | |
|---------------------------|-----------|
| Amnesty site score | 49 |
|---------------------------|-----------|

| | |
|--|------|
| Maximum site score within 0.5 km | 47 |
| Maximum site score within 1 km | |
| Distance to nearest site of comparable quality | |
| Cost per event: walk <0.5 km to north | none |

F) Brou Beach

| | |
|---|-----------|
| Amnesty site score | 34 |
| Maximum site score within 0.5 km | 41 |
| Maximum site score within 1 km | |
| Distance to nearest site of comparable quality | |
| Cost per event: walk <0.5 km to north | none |

G) Handkerchief Beach / Fullers Beach north

| | |
|---|-----------|
| Amnesty site score | 34 |
| Maximum site score within 0.5 km | 44 |
| Maximum site score within 1 km | |
| Distance to nearest site of comparable quality | |
| Cost per event: walk <0.5 km to north | none |

H) Fullers Beach south

| | |
|---|-----------|
| Amnesty site score | 49 |
| Maximum site score within 0.5 km | 51 |
| Maximum site score within 1 km | |
| Distance to nearest site of comparable quality | |
| Cost per event: walk <0.5 km to north | none |

5.3 Valuing the amnesty at Batemans Bay Marine Park– scaling up

Costs of restricting shore-based recreational line fishing in Solitary Islands Marine Park have been scaled up from a site-specific cost per event to a total cost for all amnesty sites in the Marine Park and all NSW recreational fishers using the method outlined in Section 2.6. The total cost of the amnesty at this Marine Park was \$9,191. Costs were primarily incurred at the Guerilla Bay to Longnose Point amnesty site as a result of the high relative demand for fishing access in the south Batemans Bay region (see Appendix 2). Results are provided in Table 7.

Table 7: Cost of the fishing amnesty at Batemans Bay Marine Park to all recreational fishers in NSW

| Recreational Fishing | Proportion (%) | Number | Source | |
|--|----------------|--------------|----------------------------|------------------------|
| Number of recreational fishing events in NSW per year | | 6,789,000 | Henry & Lyle 2003 | |
| % that is shore-based line fishing in south coast NSW fishing region | 5.14 | 348,955 | Henry & Lyle 2003 | |
| % south coast fishing effort inside Batemans Bay Marine Park | 51 | 177,967 | ABS data (see Section 2.6) | |
| | | | | |
| Relative value of amnesty sites: | Rel. demand* | No. affected | Cost per event (\$) | Total cost^ (\$ p. a.) |
| North Head | 1.42 | 2,527 | 0.38 | 960 |
| Guerilla Bay to Longnose Point | 2.46 | 4,378 | 1.88 | 8,231 |
| Broulee Island | 0.4 | 712 | 0 | - |
| Congo | 1.51 | 2,687 | 0 | - |
| Meringo / Bingie | 2.11 | 3,755 | 0 | - |
| Brou Beach | 0.53 | 943 | 0 | - |
| Handkerchief Beach / Fullers Beach north | 0.69 | 1,228 | 0 | - |
| Fullers Beach south | 3.39 | 6,033 | 0 | - |
| | | | | |
| Total cost to all NSW recreational fishers | | | | 9,191 |

6. GENERAL DISCUSSION

6.1 Value of amnesty sites to shore-based recreational line fishers

We estimate the cost of restricting access of shore-based recreational line fishers to all amnesty sites in NSW Marine Parks at a total of \$24,704 p.a. This total comprises a range of different costs, depending on fishers' likely behavioural responses to restricting access at different amnesty sites:

- 15 amnesty sites were not associated with any cost to fishers, as an alternate fishing site of comparable quality existed within fishers' usual travel pattern
- 2 entailed a small loss of consumer surplus, whereby fishers could walk to an alternate site of comparable quality, but doing so involved working further than they normally would so fishers experienced some loss of satisfaction or enjoyment.
- 4 entailed an increased travel cost, whereby fishers were required to drive up to 20 km to an alternate access point to find a fishing site of comparable quality to the amnesty site (although this site had an alternate fishing site that involved only a minor loss of quality within easy walking distance).

Costs were distributed unevenly at broad regional spatial scales, with a total cost of ~\$14,500 p.a. in the Cape Byron Marine Park, ~\$1,000 p.a. in the Solitary Islands Marine Park and ~\$9,000 p.a. in the Batemans Bay Marine Park. Costs are notably low. This probably arises from the fact that NSW has implemented a multiple-use marine park model, and undertaken extensive community consultation to ensure that viable alternatives to sanctuary zone sites remain available to all user groups, thereby minimising costs to recreational fishers and other users.

Costs were also variable at the scale of the individual amnesty site. Costs were also variable at the scale of the individual amnesty site:

- More than 95% of total cost in Cape Byron Marine Park relates to a single site (Wategos Beach) where overall scores for local alternative sites are lowered because of competition with other users, including competition for parking.
- Costs of the amnesty at the Solitary Islands Marine Park were incurred at two sites - Barcoongere Rocks and Flat Top Rock – but associated costs were low due to low relative demand at the affected sites (0.22% and 0.43% of total fishing demand within the Marine Park respectively – see Appendices 2 & 3). In the case of Barcoongere rocks low relative demand stems from the site being located in a remote area of the adjoining Yuraygir National Park where access tracks to the coast are limited and may be separated by several

kilometres. It should be noted that in most cases, 'travelling' to an alternate site (Wooli or Diggers camp) is likely to reduce overall travel costs as the road to Barcoongere Rocks passes through Wooli. Costs at this site are likely to be incurred by a small number of dedicated specialist fishers.

- Around 95% of the cost in Batemans Bay Marine Park was associated with restricted access to the Guerilla Bay to Longnose Point amnesty site, based on a high relative demand for that site from the surrounding south Batemans Bay region (see Appendices 2 & 3).

The costs to recreational fishers presented above are maximum cost estimates, given that most surveyed fishers reported fairly flexible travel patterns and considered site-switching to be a part of fishing rather than a considerable additional cost. In addition, 96% of surveyed fishers supported the use of sanctuary zones for biodiversity conservation purposes, so any direct cost associated with amnesty site closures reported in this study should be weighed against these option and existence values.

6.2 Value of amnesty sites to other recreational users

Although this report only estimates the cost of restricting shore-based recreational fishing at amnesty sites, any change in the distribution of fishers along the coastline may represent a cost or benefit to other recreational users. Fishers, regional Marine Park staff and the economic literature identify a range of recreational activities that sometimes conflict with shore-based recreational fishing, including swimming, snorkelling, diving, surfing and kayaking. Any costs to recreational fishers of restricted access to amnesty sites should be weighed against any benefits that accrue to these other user groups.

In some NSW Marine Parks the prevalence and value of other user groups far outweighs the value of recreational fishing (e.g. see Section 3.1). However, we emphasise that it is only the marginal value of these activities (i.e. the change in value associated with restricted fishing access at amnesty sites or any resultant change in the spatial distribution of recreational fishers within the Marine Park) that is relevant for valuing amnesty sites. For example, swimmers, snorkelers or divers may report a loss of consumer surplus if their experience is diminished by the presence of recreational fishers. If they are displaced from amnesty sites because recreational fishers are present, this may impose an increased travel cost, or result in reduced participation in local recreational opportunities. A recent study in Western Australia reported that snorkelers are more common in Marine Park sanctuary zones relative to surrounding areas (Smallwood et al. 2012), but it is unclear whether this relates to

a preference for areas where fishers are absent, or whether it relates to a perceived or real improvement in fish size, diversity or abundance, as have been reported as diver and snorkeler preferences in other studies (Rudd and Tupper 2002, Uyarra et al. 2009).

The contingent valuation framework used in this study is suitable for valuing site preferences of any recreational user group. It could be applied to the other recreational users listed above to identify patterns of resource use and value across the coast, and allow the likely costs of management actions that restrict access to specific sites to be properly costed and balanced for all user groups in a cost-benefit framework. It is also important to ensure that non-use values of other recreational users (and non-users) are also considered (as for recreational fishers above), but this will require a better understanding of the scale of any ecological benefit that might arise from Marine Parks sanctuary zones and improve biodiversity values.

6.3 General comments

The contingent valuation / site preference valuation undertaken in this study has raised a range of important points:

- The implementation of multiple use Marine Parks in NSW, which proceeded via extensive public consultation, appears to have minimised its impact on shore-based recreational line fishers by ensuring that sanctuary zones are accompanied by alternate high quality fishing sites within reasonable travel distances.
- There is broad support for the use of sanctuary zones amongst this fisher group, with 96% of surveyed fishers supporting the use of sanctuary zones for biodiversity conservation. This highlights a key benefit of on-ground intercept surveys: they tend to represent the common opinion, or the diversity of opinion in society, rather than the opinion of a vocal minority that might otherwise be over-represented in public consultation processes. We recommend that this style of intercept survey should be included as part of future Marine Park consultation processes.
- Under our contingent behaviour valuation framework the cost of restricting access to amnesty sites is a function of site quality at both the amnesty and the alternate fishing site. It follows that it is possible to retain amnesty closures while still reducing their impact on recreational fishers by improving fishing opportunities at alternate sites. Given the importance interviewed fisher assigned to 'accessibility' (see Table 2) this could be achieved

by improving parking and access tracks at alternate fishing locations. Improving site accessibility has been recommended to increase and manage coastline values in an Irish Marine Protected Area (Barry et al. 2011).

- Our multivariate analysis identified statistically significant links between fisher site preferences and their fishing motivations and behaviours. This type of analysis hold great promise for by improving future Marine Park impact assessment studies through a deeper understanding of the diversity and values of recreational fishers in NSW. However, the number of fishers sampled, the spatial coverage of fisher surveys, and proxy data used to rate site attributes would need to be improved to ensure robust assessment.

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Appendix 1 – Fisher interviews

ASSESSMENT OF ECONOMIC VALUES OF BEACHES AND HEADLANDS OF THE NSW COAST

The NSW Government recently introduced an amnesty allowing line fishing from ocean beaches and headlands in sanctuary zones.

This survey is being undertaken to capture your views on beaches and headlands in marine parks, particularly information about economic values. Your feedback will help us to gain a better understanding of the value of beaches and headlands to recreational fishers and how people access and use these areas.

At no time will your answers be used to identify you and any information remains confidential. The consultant running the survey use answers to identify patterns in responses, they will not focus on individuals.

A. PARK USER CHARACTERISTICS

Are you a local or a tourist? _____

What is your home postcode? _____

How often do you fish? _____ (days in past year)

How often do you fish in the _____ Marine Park? _____ (days in past year)

What type of recreational licence do you hold? 3 days / 1 month / 1 year / 3 years

Could you provide a rough breakdown of your participation in different recreational fishing activities (in general over the past year):

Beach fishing _____

Bait collecting _____

Rock / headland fishing _____

Spear fishing _____

Boat-based fishing (independent) _____

Boat-based fishing (charter) _____

C. SITE SELECTION

Do you generally come down to fish from this access point (i.e. coming in from a particular road or carpark) or use a range of access points in the region? *Single / multiple*

If multiple access points, where are they, how far away?

1. _____

2. _____

3. _____

Is there any difference between them in terms of preferences / travel costs?

When you come on to the beach or headland, do you have a fixed site in mind, or look at conditions and select a site within the general vicinity?

Do you select a fishing site on the basis of targeting a particular species at known or likely locations, or selecting a site for general fishing purposes? *Target species / site only*

A. For fishers targeting a particular species at known or likely locations

Which species? (in what preference order / at what times of year / other qualifiers)

Sp 1. _____

Sp 2. _____

Sp 3. _____

Do you target them at known sites / or assess likely distribution in the basis of other characteristics?

Sp 1. _____

Sp 2. _____

Sp 3. _____

Which other sites in the region (Marine Park and surrounds) are suitable for targeting those species?

Important sites: _____

Secondary sites: _____

Occasional sites: _____

Mark in groups on map if possible

Does moving to alternate sites impose any additional cost to you (e.g. reduced catch, increased travel cost, access) or just a part of normal site selection / switching in response to different conditions and the likely distribution / abundance of the target species?

How far from an access point do you generally or are you willing to travel to find a suitable location for targeting your preferred species

Usual range (no impact on experience) - site range on map or ____ km

Extreme range (impact on travel cost or enjoyment) - site range on map or ____ km

Limit of range (would not fish if travel beyond): - site range on map or ____km

B. For fishers selecting a fishing site for general fishing purposes

How would you rate the following site considerations when you are selecting a site to fish:

| | Not relevant | —————→ | | | | Most relevant |
|-------------------------|--------------|--------|---|---|---|---------------|
| Proximity | 1 | 2 | 3 | 4 | 5 | |
| Accessibility | 1 | 2 | 3 | 4 | 5 | |
| Provision of facilities | 1 | 2 | 3 | 4 | 5 | |
| Safety | 1 | 2 | 3 | 4 | 5 | |
| Seclusion | 1 | 2 | 3 | 4 | 5 | |
| Amenity | 1 | 2 | 3 | 4 | 5 | |
| Expected catch | 1 | 2 | 3 | 4 | 5 | |
| Other user group | 1 | 2 | 3 | 4 | 5 | |

(which one?)

Which other sites in the region (Marine Park and surrounds) do you consider to be:

Important sites: _____

Secondary sites: _____

Occasional sites: _____

Mark in groups on map if possible

Does moving to alternate sites impose any additional cost to you (e.g. reduced catch, increased travel cost, access) or just a part of normal site selection / switching in response to different site conditions?

How far from an access point do you generally or are you willing to travel to find a suitable fishing site?

Usual range (no impact on experience) - site range on map or ____km

Extreme range (impact on travel cost or enjoyment) - site range on map or ____km

Limit of range (would not fish or travel beyond): - site range on map or ____km

E. AMNESTY SITES

Are you aware that these sites were previously closed to fishing and are currently the subject of a government amnesty that has allowed access to land-based fishers? Yes / No

Do any of the amnesty sites on the map rate as

Best sites: _____

Secondary sites: _____

Occasional sites: _____

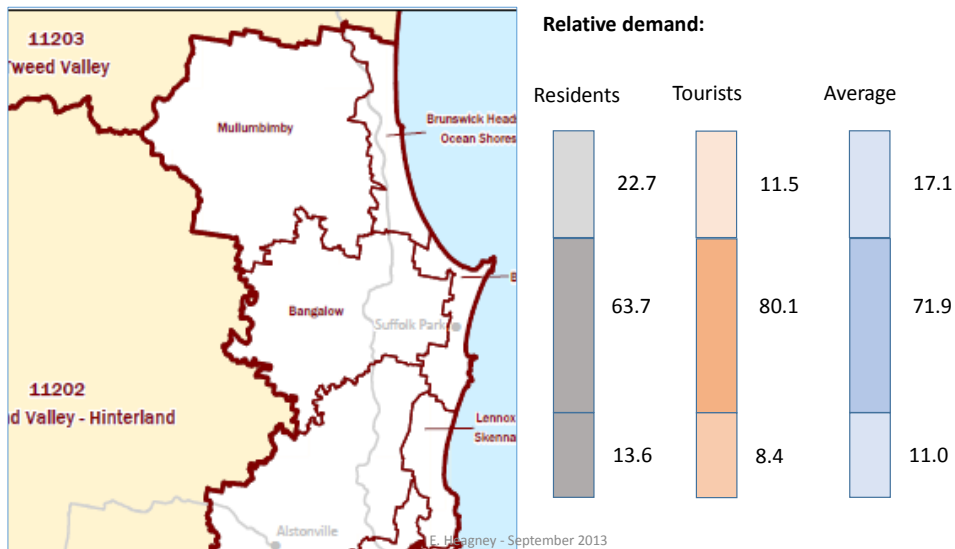
Do you support the use of sanctuary zones that exclude beach fishing in selected areas of the marine park for biodiversity and conservation purposes?

Yes / No

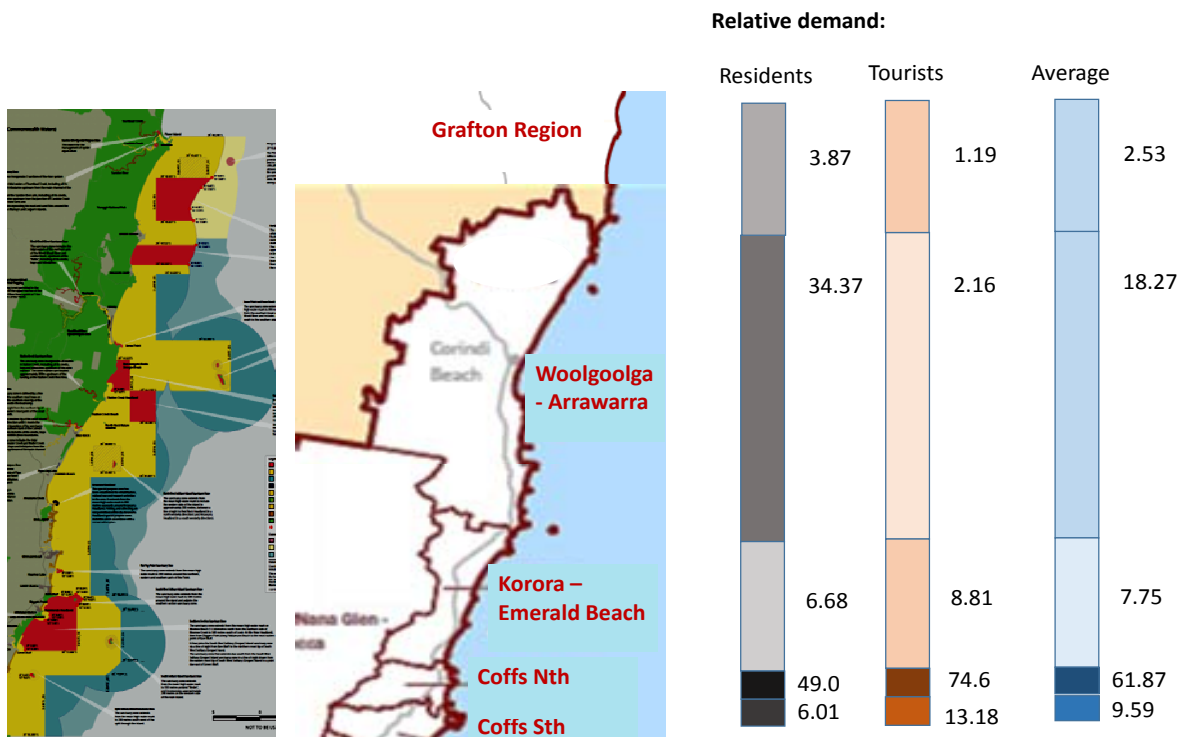
Qualifiers:

Appendix 2 – Relative demand in selected Marine Parks by SA2 region. Maps are from ABS statistical geography catalogues (SA2)

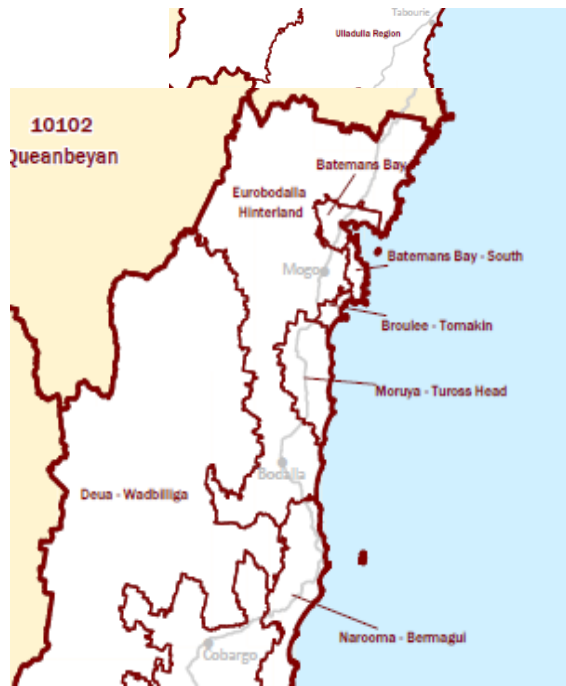
Cape Byron Marine Park – percent of total demand by SA2 unit



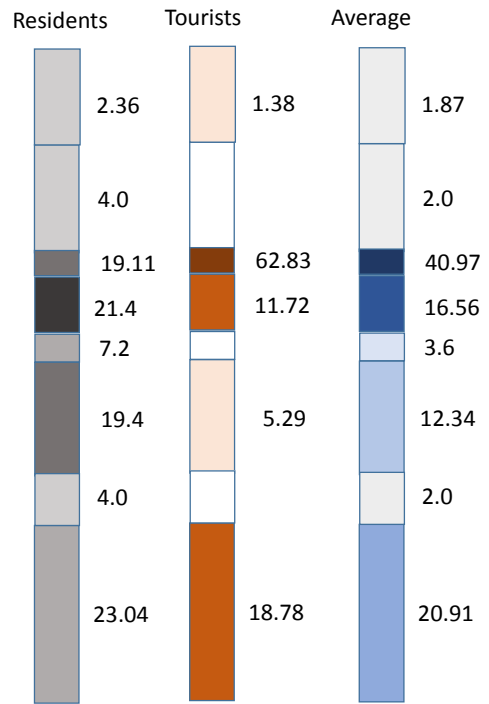
Solitary Islands Marine Park – percent of total demand by SA2 unit



Batemans Bay Marine Park – percent of total demand by SA2 unit



Relative demand:



Appendix 3 – Relative demand calculations for individual amnesty sites

A) Cape Byron Marine Park

| Amnesty site / non-amnesty | SA2 | Total SA2 value (sum all site scores) | Amnesty site value (sum amnesty site) | Amnesty site value (proportion of SA2) | SA2 tourist nights (no)^ | Weighted tourist nights (no) | Relative tourist demand | SA2 population (no)^ | Weighted population (no) | Relative local demand (%) | Average relative demand (%) |
|----------------------------|------------------------------|---------------------------------------|---------------------------------------|--|--------------------------|------------------------------|-------------------------|----------------------|--------------------------|---------------------------|-----------------------------|
| Tyagarah | Brunswick Heads - Ocean Shor | 517 | 229 | 24.36 | 9998 | 243,556 | 6.1 | 3866 | 94,182 | 12.1 | 9.1 |
| Belongil | Byron Bay | 853 | 72 | 3.60 | 55,626 | 200,254 | 5.0 | 8,655 | 31,158 | 4.0 | 4.5 |
| Wategos | Byron Bay | 853 | 84 | 4.20 | 55,626 | 233,629 | 5.9 | 8,655 | 36,351 | 4.7 | 5.3 |
| Tallow | Byron Bay | 853 | 32 | 1.60 | 55,626 | 89,002 | 2.2 | 8,655 | 13,848 | 1.8 | 2.0 |
| Broken Head | Byron Bay | 853 | 62 | 3.10 | 55,626 | 172,441 | 4.3 | 8,655 | 26,831 | 3.4 | 3.9 |
| Lennox 1 | Lennox Head - Skennars Head | 387 | 33 | 2.46 | 11558 | 28,464 | 0.7 | 3670 | 9,038 | 1.2 | 0.9 |
| Lennox 2 | Lennox Head - Skennars Head | 387 | 39 | 2.91 | 11558 | 33,639 | 0.8 | 3670 | 10,681 | 1.4 | 1.1 |
| Non-amnesty | Brunswick Heads - Ocean Shor | 517 | 288 | 21.49 | 9998 | 214,872 | 5.4 | 3866 | 83,090 | 10.6 | 8.0 |
| Non-amnesty | Byron Bay | 853 | 603 | 45.00 | 55,626 | 2,503,170 | 62.7 | 8,655 | 389,475 | 49.9 | 56.3 |
| Non-amnesty | Lennox Head - Skennars Head | 387 | 315 | 23.51 | 11558 | 271,699 | 6.8 | 3670 | 86,272 | 11.0 | 8.9 |

B) Solitary Islands Marine Park

| Amnesty site / non-amnesty | SA2 | Total SA2 value (sum all site scores) | Amnesty site value (sum amnesty site) | Amnesty site value (proportion of SA2) | SA2 tourist nights (no)^ | Weighted tourist nights (no) | Relative tourist demand | SA2 population (no)^ | Weighted population (no) | Relative local demand (%) | Average relative demand (%) |
|----------------------------|------------------------|---------------------------------------|---------------------------------------|--|--------------------------|------------------------------|-------------------------|----------------------|--------------------------|---------------------------|-----------------------------|
| Minnie Water | Grafton Region | 1944 | 151 | 0.08 | 5,367 | 417 | 0.09 | 1290 | 100 | 0.30 | 0.20 |
| Jones Beach | Grafton Region | 1944 | 29 | 0.01 | 5,367 | 80 | 0.02 | 1290 | 19 | 0.06 | 0.04 |
| Barcoongere Rock | Grafton Region | 1944 | 166 | 0.09 | 5,367 | 458 | 0.10 | 1290 | 110 | 0.33 | 0.22 |
| Flat Top Point | Woolgoolga - Arrawarra | 1673 | 39 | 0.02 | 9,788 | 228 | 0.05 | 11446 | 267 | 0.80 | 0.43 |
| Bare Bluff / Digger | Woolgoolga - Arrawarra | 1673 | 62 | 0.04 | 9,788 | 363 | 0.08 | 11446 | 424 | 1.27 | 0.68 |
| Moonee Beach | Korora - Emerald Beach | 697 | 155 | 0.22 | 39,902 | 8,873 | 1.96 | 2225 | 495 | 1.49 | 1.72 |
| Non amnesty | Grafton Region | 1944 | 1598 | 0.82 | 5,367 | 4,412 | 0.97 | 1290 | 1,060 | 3.18 | 2.08 |
| Non amnesty | Woolgoolga - Arrawarra | 1673 | 1572 | 0.94 | 9,788 | 9,197 | 2.03 | 11446 | 10,755 | 32.29 | 17.16 |
| Non amnesty | Korora - Emerald Beach | 697 | 542 | 0.78 | 39,902 | 31,029 | 6.85 | 2225 | 1,730 | 5.20 | 6.02 |
| Non amnesty | Coffs Harbour North | 262 | 262 | 1.00 | 338,090 | 338,090 | 74.66 | 16342 | 16,342 | 49.07 | 61.87 |
| Non amnesty | Coffs harbour South | 119 | 119 | 1.00 | 59,690 | 59,690 | 13.18 | 2000 | 2,000 | 6.01 | 9.59 |

Note – ‘Grafton region’ population has been adjusted to include only resident populations at Sandon, Minnie Water, Diggers Camp and Wooli as the population of the broader SA2 is concentrated away from the coast, and is unlikely to focus access on this stretch of the coast given its relative inaccessibility (associated with access through Yuraygir National Park). Regional tourism estimates were scaled in proportion to the resident population.

C) Batemans Bay Marine Park

| Amnesty site / non-amnesty | SA2 | Total SA2 value (sum all site scores) | Amnesty site value (sum amnesty site scores) | Amnesty site value (proportion of SA2) | SA2 tourist nights (no)^ | Weighted tourist nights (no) | Relative tourist demand (%) | SA2 population (no)^ | Weighted population (no) | Relative local demand (%) | Average relative demand (%) |
|----------------------------|------------------------|---------------------------------------|--|--|--------------------------|------------------------------|-----------------------------|----------------------|--------------------------|---------------------------|-----------------------------|
| North head | Eurobodalla Hinterland | 1975 | 343 | 0.17 | - | | | 3210 | 557 | 1.42 | 1.42 |
| Guerilla to Longn | Batemans Bay South | 981 | 149 | 0.15 | 13243 | 2011 | 1.74 | 8221 | 1249 | 3.18 | 2.46 |
| Broulee island | Broulee-Tomakin | 734 | 41 | 0.06 | - | | | 2828 | 158 | 0.40 | 0.40 |
| Congo | Moruya - Tuross Heads | 1657 | 203 | 0.12 | 6110 | 749 | 0.65 | 7618 | 933 | 2.38 | 1.51 |
| Meringo / Bingie | Moruya - Tuross Heads | 1657 | 283 | 0.17 | 6110 | 1044 | 0.90 | 7618 | 1301 | 3.31 | 2.11 |
| Brou Beach | Eurobodalla Hinterland | 2571 | 166 | 0.06 | - | | | 3210 | 207 | 0.53 | 0.53 |
| Handkerchief | Narooma - Beramgui | 1975 | 68 | 0.03 | 20701 | 713 | 0.62 | 8631 | 297 | 0.76 | 0.69 |
| Fullers south | Narooma - Beramgui | 1975 | 336 | 0.17 | 20701 | 3522 | 3.05 | 8631 | 1468 | 3.74 | 3.39 |
| Non amnesty | Ulladulla Region | 556 | 556 | 1.00 | 1590 | 1590 | 1.38 | 928 | 928 | 2.36 | 1.87 |
| Non amnesty | Eurobodalla Hinterland | 1975 | 1466 | 0.74 | - | | | 3210 | 2383 | 6.07 | 6.07 |
| Non amnesty | Batemans Bay | 1823 | 1823 | 1.00 | 72589 | 72589 | 62.83 | 7503 | 7503 | 19.11 | 40.97 |
| Non amnesty | Batemans Bay South | 1150 | 1001 | 0.87 | 13243 | 11527 | 9.98 | 8221 | 7156 | 18.22 | 14.10 |
| Non amnesty | Broulee-Tomakin | 734 | 693 | 0.94 | - | | | 2828 | 2670 | 6.80 | 6.80 |
| Non amnesty | Moruya - Tuross Heads | 1657 | 1171 | 0.71 | 6110 | 4318 | 3.74 | 7618 | 5384 | 13.71 | 8.72 |
| Non amnesty | Narooma - Beramgui | 2585 | 2181 | 0.84 | 20701 | 17466 | 15.12 | 8631 | 7282 | 18.54 | 16.83 |

