Marine Biodiversity Hub

National Environmental Science Programme

Social and economic benchmarks of the Australian Marine Parks

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Australian Marine Parks

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Important Disclaimer

EXECUTIVE SUMMARY

Management plans for 44 newly established Australian Marine Parks (formerly Commonwealth Marine Reserves) came into effect on 1 July 2018, adding to the 14 marine parks already established in Commonwealth waters. Together the 58 Australian Marine Parks (AMPs) cover 36% of Australian waters. In this report we present a national social and economic benchmark for the AMPs focussing on four key groups: the general public, recreational fishers, non-extractive recreational users, and charter operators.

To construct this benchmark, we conducted four integrated surveys. The general public were targeted through a general public survey of the Australian population distributed online. Boat-based recreational fishers and boat-based non-extractive recreational users (e.g., divers and snorkelers) were sampled through the general public survey, a boat ramp survey at 12 locations across Australia, and a targeted survey (targeting fishing/boating/yacht clubs). Charter operators were surveyed separately through a charter operator survey. Nationally, 4,000 respondents were surveyed. This included 3,026 respondents in the general public survey, 857 in the boat ramp survey, 20 in the targeted survey and 55 in the charter operator survey.

The survey results show that most members of these groups are supportive of the AMPs. Key findings include:

- 75% of the general public, 80% of recreational fishers, 86% of non-extractive recreational users and 57% of charter operators support the National Park Zones in the AMPs.

- Support for other zone types was broadly comparable to support for National Park Zones. Some exceptions included higher levels of support for Recreational Use Zones in the boat ramp survey (94% of recreational fishers and 91% of non-extractive recreational users) and lower levels of support for Special Purpose Zones in the boat ramp survey (57% of recreational fishers and 59% of non-extractive recreational users).

- Most recreational fishers perceived that the zoning in the AMPs would have minimal impact on their fishing. Just 2% indicated that these zones would decrease the quality of their fishing.

- Charter operators for the most part indicated minimal impacts of Commonwealth National Park Zones on their charter businesses. 28% indicated that the zones decreased the profitability of their business, 28% indicated a reduction in their ability to access quality sites, and 7% indicated increases in costs.

- 64% of the general public reported that the zoning is well balanced between conservation and sustainable use, 28% reported that there is not enough protection in the AMPs.

Awareness of the AMPs varied somewhat across user groups, and in general was lower than awareness of adjacent state marine parks. Key findings include:

- 44% of the general public stated being aware of the AMPs. This proportion differed significantly across the six networks, being highest in the Coral Sea Marine Park (48%), and the North (52%) and North-west (52%) networks.

- 22% of recreational fishers in the boat ramp survey reported being aware of an AMP in the survey area. Highest awareness was found in Cairns (43%) and Karratha (40%) and the lowest in Two Rocks (9%), Capes (12%), Nhulunbuy (13%), Victor Harbor (13%) and Jervis Bay (13%). In comparison 86% of recreational fishers in the boat ramp survey were aware of adjacent state marine parks.

- 26% of non-extractive recreational users in the boat ramp survey reported being aware of an AMP in the survey location, but no significant differences were detected across locations. In comparison, 92% of non-extractive recreational users in the boat ramp survey reported knowing about state marine parks in the area.

- 80% of charter operators indicated being aware of the AMPs. 38% indicated being very or extremely familiar with the location of National Park Zones.

Use of the AMPs by recreational fishers and non-fishing recreational users was generally limited. In contrast, the surveys suggested high levels of use amongst charter operators, though this may be due to sample selection bias (those affected by the AMPs being more likely to respond to the survey). Key points on use include:

- On average across the 12 boat ramp locations, 22% of recreational fishing trips occurred inside the AMPs. This proportion differed significantly across locations and was greatest in Ningaloo (44%) and Jurien Bay (36%). Lowest trip proportions in the AMPs were recorded in Cairns (1%) and Nhulunbuy (3%).

- Charter operators on average reported that 25% of their fishing trips and 23% of their non-extractive trips occurred inside the AMPs. No significant differences were detected across networks.

To complement the surveys, a national model of recreational fishing was created. This model attempted to estimate the number of boat-based line fishing trips in each of the AMPs around Australia. Nationally the model estimated that between 11 and 25 thousand trips occur within the AMPs each year, roughly 0.3% of all boat-based line fishing trips. The greatest numbers of these trips occurred in the Temperate East (4,200 CI: 2,800 – 6,000), South-west networks (5,500 CI: 4,200 – 7,000) and South-east network (4,900 CI: 2,200 – 8000). Very few trips were predicted to occur in the Coral Sea Marine Park (0) or North Network (360 CI: 200 – 550, Figure 33).

An estimate was also made using a choice experiment of the wellbeing value that the AMPs provides to the Australian public. Using conservative assumptions, we estimated that the AMPs provides between $6.2 billion and $8.7 billion in Net Present Value. This is an estimate of the Australian publics' willingness to pay for the AMPs. This figure suggests that the AMPs provide substantial value. For example, displaced catches from the 2018 implementation of AMPs were estimated at $4.2 million in Gross-Value Product, several orders of magnitude below the value of the AMPs.

Overall, the benchmark surveys highlight the substantial value associated with the AMPs, and generally positive perceptions and attitudes towards the parks. It also highlights potential areas for improvement and collects data to help address these. In particular, awareness levels of the AMPs were relatively low, and the surveys suggests that different groups should be contacted in different ways. For example, the general public most wanted to know about the ecosystems in the parks, preferring to get this information through social media and the AMPs website. Recreational fishers preferred information to be provided through state fisheries/marine park websites whilst charter operators preferred to be contacted directly by email.

Repeats of the benchmark survey would provide an obvious means of tracking progress and provide further insights for the adaptive management of the AMPs. We have provided some recommendations for improving engagement and reach of survey repeats including removal of some areas from the boat ramp survey (due to low responses and low use of the AMPs), focusing on core areas, and use of regional contacts provided through marine park network managers to help increase engagement with the targeted and charter operator surveys.

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1. INTRODUCTION

Management plans for 44 newly established Australian Marine Parks (formerly Commonwealth Marine Reserves) came into effect on 1 July 2018, adding to the 14 marine parks already established in Commonwealth waters.[1] Together the 58 Australian Marine Parks (AMPs) cover 36% of Australian waters. These AMPs are grouped into the North, North-west, South-west, South-east and Temperate East networks, and the Coral Sea Marine Park (Figure 1). The marine parks are managed by Parks Australia under the *Environmental Protection and Biodiversity Conservation Act 1999*. The overarching objectives for the Australian Marine Parks are to provide for:

a) the protection and conservation of biodiversity and other natural, cultural and heritage values of marine parks; and

b) ecologically sustainable use and enjoyment of the natural resources within marine parks, where this is consistent with objective (a).

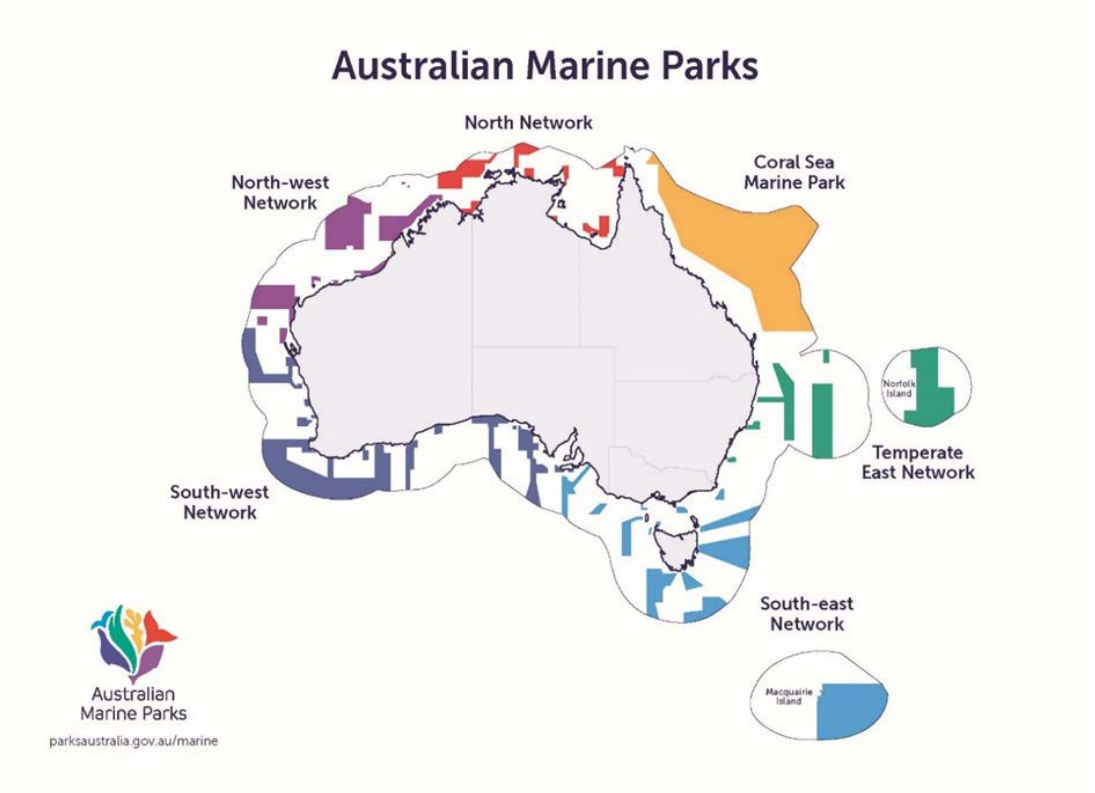

Figure 1. Australian Marine Parks networks.

To compliment implementation of the AMPs, Parks Australia have also committed to the delivery of seven management programs summarised in Table 1.

[1] Commonwealth waters includes all waters in the Australian Economic Exclusive Zone more than 5.5 km from shore or offshore reefs and islands.

Parks Australia is developing a Monitoring, Evaluation, Reporting, Improvement (MERI) system to support adaptive management of the Commonwealth Parks (including the AMPs) and Gardens. The MERI system will establish a nationally consistent process to:

- Assess achievement against the objectives in management plans;
- Enable continuous improvement; and
- Report progress to the Australian community.

The MERI system will support Parks Australia to assess performance against measures that align with their stated objectives. The MERI system requires that Parks Australia track their performance using measures that align with their stated objectives.

Table 1. Seven management programs for the Australian Marine Parks.

Management program	Description
Communication, education, and awareness program	Actions that improve awareness, understanding and support for marine parks and park management.
Tourism and visitor experience program	Actions that provide for and promote a range of environmentally appropriate, high-quality recreation and tourism experiences and contribute to Australia's visitor economy.
Indigenous engagement program	Actions that recognise and respect the ongoing cultural responsibilities of Indigenous people to care for sea country and support multiple benefits for traditional owners.
Marine science program	Actions to provide necessary scientific knowledge and understanding of marine park values, pressures, and adequacy of responses for effective management.
Assessments and authorisations program	Actions that provide for efficient, effective, transparent and accountable assessment, authorisation and monitoring processes to support sustainable use and protection of marine park values.
Park protection and management program	Timely and appropriate preventative and restorative actions to protect natural, cultural and heritage values from impacts.
Compliance program	Actions that ensure appropriate and high levels of compliance by marine parks users with the rules set out in this plan.

Social and economic values are an important part of the AMPs. Provision for sustainable use is explicitly stated as a core objective of the AMPs. Similarly, social, and economic values are specifically targeted in several of the management programs in Table 1, including conducting activities to improve awareness and support for marine parks and activities to promote recreation and tourism experiences. Given the importance of social and economic values to the AMPs, and the recent expansion of the AMPs, there is a time-critical need to identify and collect benchmark data on social and economic measures to allow Parks Australia to evaluate and track its performance.

In this report we present the results from benchmark surveys and analysis to assess the social and economic values of the AMPs from the perspective of four groups:

- The Australian public
- Boat-based recreational fishers
- Boat-based non-extractive recreational users (e.g., divers, snorkellers, sailors)
- Charter operators

2. METHODS

2.1 Surveys

Four surveys were used to characterise the social and economic values of the AMPs (Figure 2). The general public were targeted through a general public survey of the Australian population distributed online. Boat-based recreational fishers and boat-based non-extractive recreational users (e.g., divers, snorkelers) were sampled through the general public survey, a boat ramp survey, and a targeted survey (targeting fishing/boating/yacht clubs). Individuals were classified as recreational fishers or non-extractive recreational users based on the activities they reported conducting in the last 12 months. Note that these categories are not mutually exclusive: an individual can simultaneously be a member of the general public, a boat-based recreational fisher, and a boat-based non-extractive recreational user. With a few exceptions, the responses from such individuals are reported under all three sections in this report. Charter operators were surveyed separately through a charter operator survey.

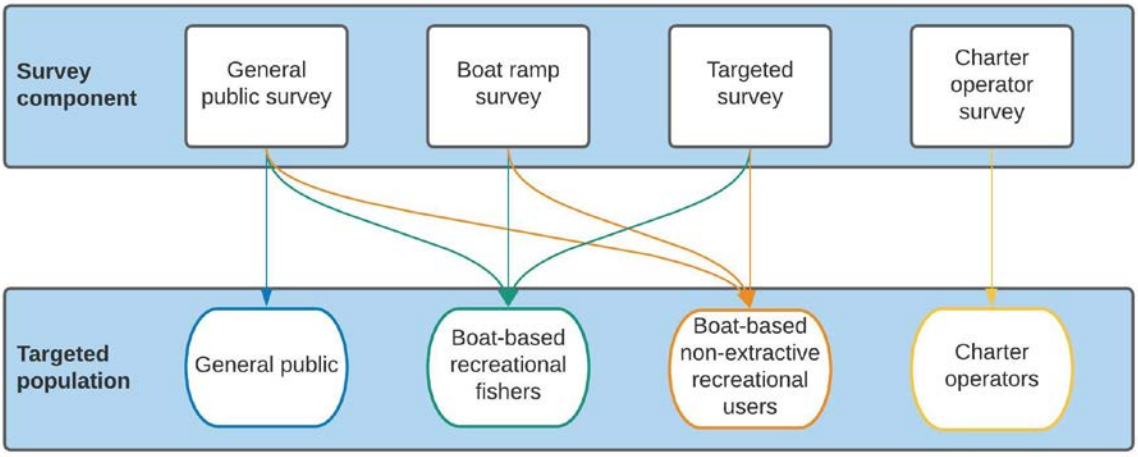

Figure 2. Sampling design illustrating how the general public, boat based-recreational fishers, boat-based non-extractive recreational users and charter operators were targeted through four integrated surveys.

Given the national nature of the AMPs, data were collected and reported at a range of different spatial scales:

- National: referring to the entire extent of the AMPs nationally.
- Network: referring to the six networks within the AMPs (Figure 1).
- Sub-network: referring to 12 regions nested within the six AMP networks (Figure 3).
- Location: referring to 39 areas nested within the sub-network and network scales. 12 of these locations were the subject of boat ramp surveys. All 39 locations were also used to collect fine-scale information on use patterns in the general public and targeted surveys (Figure 3).

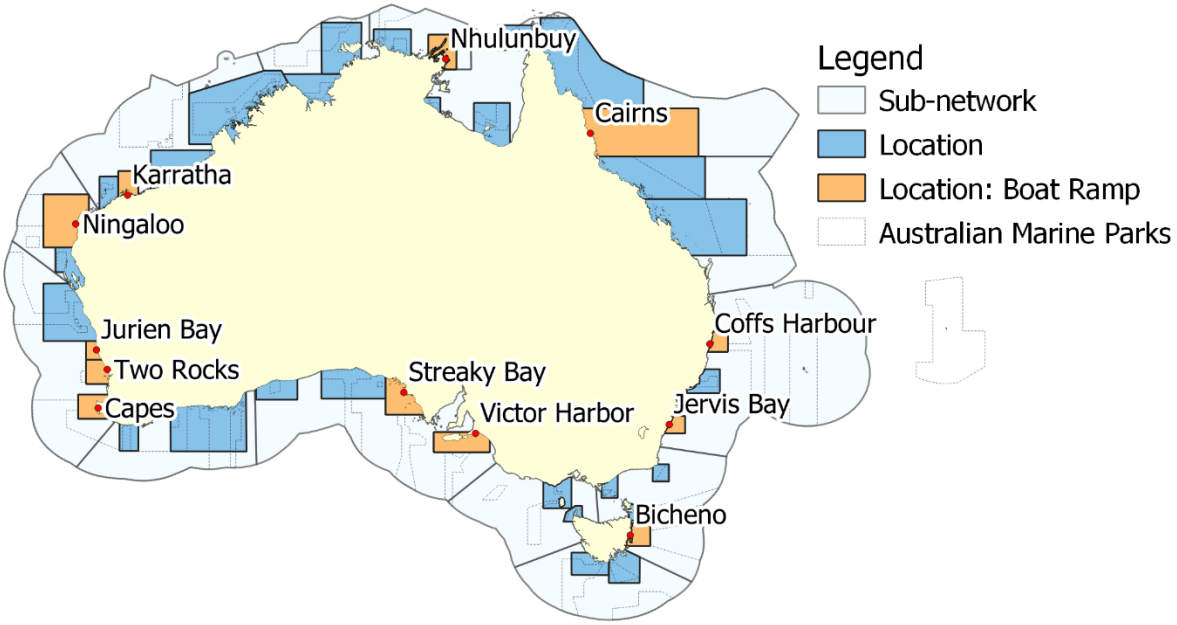

Figure 3. Spatial scales relevant to data collection and reporting. The sub-network scale is nested within the six networks of the Australian Marine Parks and the locations are nested within the sub-networks. Note: due to Victor Harbor being on the boundary of the South-west and South-east networks the Murray Marine Park has been included in the South-west Network in the boat ramp, general public and targeted surveys, but was correctly included in the South-east Network in the charter operator survey.

2.1.1 General public survey

The general public survey aimed to collect data from a representative sample of the Australian public. A draft survey was initially developed in consultation with Parks Australia. Due to restrictions on gatherings in response to SARS-CoV-2 (COVID-19), the survey was tested remotely (via phone). Ten survey testers were recruited from the Australian public through a market research agency. The survey testers were asked to complete the survey online and prompted throughout for responses about various aspects of the survey including their interpretation of questions, and any points they found confusing, difficult, or ambiguous. The survey testers were then called via phone to discuss the survey one-on-one with a researcher to elaborate on the comments provided. The responses were used to refine the survey.

The survey instrument involved questions on demographics, awareness of the AMPs, attitudes/perceptions towards the AMPs, and use of the AMPs. Awareness and attitudes/perceptions in the general public survey were measured at the national scale, with respondents reflecting on the AMPs overall.

Use of the Australian Marine Parks

Use was measured at a relatively fine scale in the survey. To do this, respondents were cascaded through a series of questions about their use of Australian waters in the last 12 months at the national, network and location scales (Figure 3). For locations they visited, they were then asked to provide details of the on-the-water locations of their trips using a gridded map for each location they visited (e.g., Figure 4). This sequence of questions allowed an estimate of the number of trips conducted by each person in the AMPs in the last 12 months.

Note that fine-scale use patterns were only recorded for one activity per respondent. Recreational fishing was prioritised, with respondents that had been recreational fishing answering the fine-scale use questions from the perspective of their fishing activities. Respondents that had not been fishing, but had conducted non-extractive recreational activities, were asked to indicate fine-scale use patterns for the activity they had conducted most frequently (e.g., diving/snorkelling, sailing etc.).

Figure 4. Gridded map used to record on-the-water use locations in the general public and targeted surveys. Grids incorporate the shape of the zones in the Australian Marine Parks.

Choice experiment

The general public survey also included a choice experiment to measure the value the AMPs provide to the Australian population in monetary terms. At this stage of the survey respondents had been provided with a range of information about the AMPs, including where they were, their purpose, the different types of zones and when they were implemented. The choice experiment task asked respondents to choose amongst alternative arrangements of the AMPs in terms of the make-up of zone types, combined with a monetary attribute in terms of a cost (respondent pays money) or payout (respondent received money). The payment vehicle was a 10-year annual cost/payout through changes in the respondent's income taxes. An example of the choice task is presented in Figure 5.

Each respondent was randomly assigned to one of seven blocks containing six unique choice tasks. Attribute levels were constructed using the s-efficiency approach described by Scarpa and Rose (2008). As the AMPs were already implemented at the time of the survey, the current arrangement of zoning was used as the baseline. As we were interested in measuring the total value of the AMPs, all zone types included attribute levels at 0% (i.e., complete removal of that zone type). We also allowed for increases in zoning beyond the current level (e.g., the increase in Multiple Use Zone from 32% to 60% in Figure 5). All alternatives were constrained such that the total across the three zone types and the area without zoning added up to 100%.

Analysis was conducted using the conditional logit formula where the likelihood of a respondent selecting a particular option (status quo or an alternative) is modelled as a function of the attribute levels. Protest responses were identified as those that selected the status quo across all six choice tasks and in a follow up question asking why they had selected the status quo every time, selected "I do not like the idea of paying or receiving money for environmental policies", "The choices were too confusing" or "I do not have sufficient information or knowledge to make such choices". Protest responses were discarded before analysis.

Assuming these are the only options available to you, which one would you choose?

	Current arrangements	Alternative 1	Alternative 2
Area in green no-take National Park Zones	22%	22%	30%
Area in yellow Habitat Protection Zones	46%	10%	0%
Area in blue Multiple Use Zones	32%	60%	0%
Area without zoning	0%	8%	70%
Change in costs/payout to you (annual for 10 years)	**None**	You **receive $40** annually	You **pay $150** annually
Your preferred option:	☐	☐	☐

Figure 5. Example of choice experiment task in the general public survey.

Distribution

The finalised survey was distributed through a market research agency to the Australian general public. Overall, a target sample size was set at 3,000 individuals. As we aimed to report data at the network scale, the sample was stratified by network based on place of residence (allocating postcodes to their nearest network). Ideally, equal sample sizes would have been obtained for each network (i.e., 500 respondents from each of the six networks), but due to a lack of available respondents, targets had to be adjusted to reflect attainable sample sizes within each network. To ensure a representative sample within each network, targets were set based on combinations of age, gender, and whether the respondent resided in a capital city. Target sample sizes within each network were set for each criteria combination (age, gender, capital city) to match proportions in the 2016 Australian census place of usual residence. The general public survey was distributed through October and November 2020.

As the survey was distributed using a stratified sample by network, results are reported at the network level. Where results are scaled up to the national scale, averages across networks are used rather than sample averages. Tests were performed to detect differences across networks. For proportion metrics chi-squared tests were used (X^2) and for scale metrics (e.g., scale of 1 to 5) Kruskal Wallis tests were used (*KW*).

2.1.2 Boat ramp surveys

The boat ramp survey was designed in close consultation with Parks Australia and aimed to measure boat-based fishers' and non-extractive recreational users' awareness, use and attitudes/perceptions towards the AMPs in the survey location. The survey also asked for

similar information on any adjacent state marine parks in the location, providing a point-of-comparison. Spatial patterns of recreational use were recorded on a gridded map using pen and paper. As in the general public survey, use patterns for recreational fishing was prioritised, with anyone who had been fishing in the location in the last 12 months filling in use patterns from the perspective of their fishing activities.

Boat ramp surveys were conducted in 12 locations around Australia, selected for their proximity to the AMPs and frequency of use (Figure 3). Within each location, between 1 and 4 major boat ramps were selected for sampling. Seven and a half -hour survey shifts were conducted over nine days during school holiday periods. The survey timing was selected to maximise likely boating use, with locations in tropical areas sampled in the austral Winter and Spring, and locations in the South surveyed in the austral Summer and Autumn. By targeting peak periods we likely under-represent more frequent boat users who may avoid peak periods. The boat ramp surveys were conducted between July 2019 and January 2021.

The surveys were conducted face-to-face, with survey staff approaching boat users before/after launching or retrieving their boat. Survey questions were read aloud by the survey staff member and responses for all questions, with the exception of the spatial use questions, recorded using a tablet device.

As the survey was distributed at the location scale, results are reported at the location level. Where results are scaled up to the network and national scale, averages across locations are used rather than sample averages. Tests were performed to detect differences across locations. For proportion metrics chi-squared tests were used and for scale metrics Kruskal Wallis tests were used.

2.1.3 Targeted survey

The targeted survey combined elements from the boat ramp and general public surveys. This included questions about awareness, use and attitudes/perceptions towards the AMPs. Use was measured using the same nested question structure as in the general public survey, providing fine-scale details of use patterns (Figure 4). Individuals were then asked about awareness and attitudes/perceptions of the AMPs. For the targeted survey, awareness and perception questions were customised to the sub-network which respondents accessed most frequently in the last 12 months. This included providing zoning maps at the sub-network scale.

The survey was distributed through fishing, yacht, dive, and aquatic clubs around Australia. A list of 175 clubs with publicly available email addresses were identified through searches on google. These clubs were emailed with a request to distribute the survey amongst their club members. The survey was distributed during December 2020 through January 2021.

Due to a relatively small sample size, results from the targeted survey are reported at the national scale.

2.1.4 Charter operator survey

The charter operator survey combined elements of the boat ramp, general public and targeted survey, but also additional questions relevant specifically to charter operators. A draft survey was first developed with Parks Australia and tested on three charter operators identified from the researcher's own networks. The refined survey was then distributed to charter operators nationally.

The survey included questions about the charter business, attitudes/perceptions towards the AMPs (at the sub-network scale), the consultation process used to establish the AMPs, and use of the AMPs (recorded at the sub-network scale). Fine-scale use patterns were not recorded from charter operators in the survey. As the COVID-19 epidemic likely had a large impact on charter businesses, use was recorded for the 2020 and 2019 calendar years.

The survey aimed to collect revenue information from charter operators. To minimise survey burden, we did this by collecting information on the numbers of client's operators took on different types of trips and aligning this with average charter prices. Average charter prices were estimates from web searches. For each charter type the average of at least 10 publicly listed charter prices was used. The average charter prices and their standard deviations are shown in Table 2.

The charter operator survey was distributed via email. Names and contact information for charter operators (including fishing, eco-tourism etc.) were compiled using online searches. In total, 646 charter operators were identified with a publicly available email address, and these operators were emailed with details of the survey and a survey link. The survey was distributed throughout January 2021.

Results of the charter operator survey are reported at the network scale. As the sampling technique was not stratified, sample averages are used for the charter operator survey to scale up to the national scale. Tests were performed to detect differences across networks. For proportion metrics chi-squared tests were used and for scale metrics Kruskal Wallis tests were used.

Table 2. Average charter prices (per client) for different charter types.

Charter Type	Average price ($)	Standard deviation ($)
Fishing single day	$262.50	$109.17
Fishing multi-day	$3,031.50	$1,540.81
Eco-tourism single day	$208.42	$122.81
Eco-tourism multi-day	$2,239.69	$1,667.86
Diving trips single day	$215.25	$58.28
Diving trips multi-day	$956.12	$858.18
General Cruises single day	$173.83	$66.12
General cruises multi-day	$890.00	$686.61
Party/Function Hire	$39.33	$10.25

2.2 National random utility model

To provide further information on the use of the AMPs by recreational fishers, a national model of recreational fishing activity was created. The model aimed to measure the number of boat-based recreational fishing trips using line-fishing gear in each of the AMPs around Australia. The model was also based on economic random utility theory meaning that scenarios can be evaluated to determine how the implementation of the AMPs affects enjoyment from the recreational fishing experience. The resulting estimates are expressed in dollar terms and should be interpreted as recreational fishers' willingness to pay to avoid the restrictions imposed by the zoning in the AMPs, and in particular exclusion from National Park Zones (NPZs).

The model consists of two components. The first is an estimate of the number of boat-based line trips in marine waters that launch at each boat ramp in Australia each month. Most Australian states conduct semi-regular surveys (typically phone diary surveys) to estimate recreational catch and effort for fisheries management purposes (e.g., Ryan et al. (2019) and West et al. (2015)). The resulting reports were used to produce monthly estimates of the number of boat-based line fishing trips in marine waters at a regional scale, with the scale being determined by the scale of reporting for that state (typically >3 regions per state). Generating these estimates from available data required a range of assumptions. The three most common assumptions made were that:

- The ratio of freshwater to marine trips was constant across coastal regions and months;
- The ratio of line-fishing versus other gear types was constant across regions and months; and,
- The proportion of trips in each month was constant across regions.

Where published data permitted, these assumptions were avoided. Where multiple years data were available trip numbers were averaged across years.

With estimates of trip number by month and region, trips were then allocated to boat ramps across Australia. This was done by using a human gravity metric (Cinner et al. 2018) and the Australian Population Grid 2019, which provides population estimates across Australia at a 1 km^2 resolution (Australia Bureau of Statistics 2020). Gravity was calculated for each boat ramp (G_r) by first dividing the population in each grid cell (Pop_m) by the squared distance to the boat ramp ($Distance_m{}^2$) and then summing across the set of all cells within 500 km of the ramp (*m*, EQ1). The resulting metric provides a relative measure of the population density in the area surrounding the boat ramp.

EQ1. $$G_r = \sum_M \frac{Pop_m}{Distance_m{}^2}$$

Trips within each region were then allocated to each of the boat ramps in that region using the gravity metric. The general approach was to estimate the number of the trips to each boat ramp ($Trips_r$) by dividing the trips in a region ($Trips_q$) between the boat ramps proportional to the gravity of each boat ramp in the region:

EQ2. $$Trips_r = Trips_q \frac{G_r}{\sum_R G_r}$$

Implicitly this method assumes that there is no competition between boat ramps for trips and possibly results in trips being overly concentrated in areas with lots of boat ramps. To correct for this, gravity calculations were augmented to allow for competition amongst boat ramps within 20 km radius using the formula:

EQ3. $$G_r = \sum_M \frac{Pop_m}{Distance_m{}^2} . NR_r{}^{-\frac{1}{y}}$$

where NR_r is the number of boat ramps within 20 km of boat ramp *r*, and *y* is a customisable variable indicating the effect of nearby boat ramps. When *y* is set to 0, gravity is unaffected

by nearby boat ramps. Alternatively, when *y* is set to 1, boat ramps are in full competition, and gravity is divided between nearby boat ramps. We report on models using *y* set at 0 (no competition between boat ramps) and *y* at 0.5.

The second component of the model involved allocating the trips at each boat ramp to an on-the-water location. To do this we made use of two existing Australian studies in which random utility models are constructed to model boat-based recreational fishers' on-the-water site choices as a function of site variables. The first model is based on trips taken across the South-west of Western Australia (Navarro et al. submitted for publication), and the second is based on trips taken across New South Wales (Navarro et al. 2021).

The models in these papers provide a useful starting point for assigning fishing trips to on-the-water locations. In particular, these studies provide estimates of the utility function of fishers making on-the-water site choices of the form:

EQ4. $$U_{ij} = \beta' x_{ij} + e_{ij}$$

where x_{ij} is a vector of on-the-water site attributes, β is the vector of coefficients, and e_{ij} is the error term. Assuming the errors are independent and identically distributed extreme values, the utility function is related to the probability of a fisher choosing a specific site from all sites available to them by the conditional logit formula:

EQ5. $$prob_{ij} = \frac{\exp(\beta' x_{ij})}{\sum_{j=1}^{J} \exp(\beta' x_{ij})}$$

The two source studies provide estimates of the coefficients of the utility function (β) that describe fishers' choice of on-the-water site given their choice to launch at a specific boat ramp. The set of site attributes in these studies (x_{ij}) include:

- Travel cost: the fuel cost in AU$s for the return trip from the boat ramp to the on-the-water location
- Wave height: the estimated wave height (m) at the on-the-water location
- Depth: the estimated depth of the on-the-water site (m)
- Area: The size of the site (km^2)

Given estimates of the number of trips launching at each boat ramp, these trips can be allocated to adjacent on-the-water locations by using the utility functions from the source studies and the site attributes for all adjacent sites to estimate the probability of visiting each site (EQ2).

Scenarios were run with and without fisher access to the NPZs in the AMPs.[2] From these scenarios the change in recreational fisher welfare (their willingness-to-pay) due to the restricted site access was estimated using:

[2] Site access can be removed by setting the utility of a site to 0.

EQ6. $$WTP_i = \frac{\ln \sum_{j=1}^{J} \exp({U_{ij}}^0) - \ln \sum_{j=1}^{J} \exp({U_{ij}}^1)}{{\beta'}_{TC}}$$

Where ${U_{ij}}^0$ is the utility of each site available to the fisher under a scenario where fishers have access to NPZs, and ${U_{ij}}^1$is the utility of each site under a scenario where fishers do not have access to NPZs, and ${\beta'}_{TC}$ is the travel cost parameter from the utility function.

To define sites in our national model, a 5 x 5 nm grid was established across Australia. The grid was then modified to capture the shape of the AMPs and its zones. Each location in the modified grid was used as a potential "site" in the model. Following the source studies, fishers launching at a particular boat ramp were assumed to have access to all on-the-water sites within 100 km.

The four site attributes were then estimated for each site, month and ramp combination following procedures in the source studies. Travel cost for each on-the-water site, boat ramp combination was estimates as the round-trip distance multiplied by $0.54 per km which, represented the estimated fuel-based boat costs (Honda Marine 2009; DMIRS 2018). Depth of the site was extracted using standard Australian bathymetry with a 9 arcsecond resolution (~250m at the equator) (Whiteway 2009). Average depth across each site was used.

Weather data for each site month combination was extracted from the Centre for Australian Weather and Climate Research (CAWCR) wave hindcast model (Smith et al. 2020). The hindcast model provides wave height and wind speed for coastal Australia in 4-arcminute grid resolution (approximately 7.4 km at the equator). Monthly averages for each record location were used.

The number of trips to each site was then estimated by multiplying the number of trips launching at a particular boat ramp by the probability of visiting each on-the-water site.

Error estimates were propagated throughout the model construction. This included propagation of errors throughout component 1 (allocation to boat ramp) and component 2 (allocation to on-the-water sites). Errors for component 1 were used as reported in state recreational fishing reports and propagated throughout calculations to ensure that estimates of trip numbers at each boat ramp in each month had associated errors. Where the source reports did not report errors, a conservative 30% mean standard error was assumed. Errors for component 2 were based on the errors reported in the models of the source studies (Navarro et al. 2021, submitted for publication). Errors were also propagated through combining component 1 and component 2 of the model. Note that errors do not capture uncertainties about the assumptions made in the model. Some sensitivity analysis was conducted to test sensitivity to the effect of these assumptions (e.g., using different values of *y* in augmenting gravity calculations).

Initial model testing revealed that the model was under-estimating use of the AMPs. For example, Figure 170 shows the results for the model based on the Western Australian utility function reported in Navarro et al. (2021). The model predicts that just 9,400 (CI: 6,200 – 13,100) boat-based line fishing trips occurred in the AMPs nationally. This contradicts Lynch et al. (2019) who used Western Australia's recreational fishing monitoring data to estimate that 14,200 trips occurred in Ningaloo Marine Park (Commonwealth) alone in 2015/16. The shortfall in trips is thought to be a result of the following: the allocation of trips to on-the-water locations in the national model is based on the behaviour of average fishers in New South Wales and Western Australia. However, it is unlikely to be "average fishers" that are accessing the offshore locations of the AMPs. Instead, those accessing these waters are likely to have larger

boats, be less opposed to travelling offshore, and more inclined to target offshore species. The problem is that fisher heterogeneity has not been captured (Haab et al. 2012).

One solution is to introduce heterogeneity into the model of on-the-water site choice. This can be done on observable attributes (e.g., fisher avidity). Doing so would significantly complicate component 1 of our model, as we would require estimates of trips at each boat ramp by month for each avidity level; suitable data for generating these estimates is not available. Alternatively, unobservable heterogeneity could be introduced by allowing the β values in the utility function above to vary randomly across the population following some density distribution (e.g., Train (1998)). However, this would significantly complicate component 2 of our model as the β*'s* would have to be sampled from this distribution for the simulation.

Instead, we opted for a simpler solution. The underlying utility functions were re-calibrated by adjusting the coefficient on the travel cost parameter in the New South Wales and Western Australian utility functions. The adjustment was performed manually, aiming to produce estimates in line with Lynch et al. (2019)[3]. Doing so produced results with face-value validity for the Western Australian case. However, reducing the influence of travel cost in the New South Wales model had the implication of placing more weight on depth (which had positive utility in this model). This inflated trip numbers to deeper waters resulting in an excess of trips in the deeper Temperate East Network (Figure 171). As such, we focus on the Western Australian based models. It should be remembered that the unique conditions surrounding each individual location are not necessarily captured in the model. Some of the implications are discussed in the results below.

Two national recreational fishing models are reported on:

- WA-based y0: A model using the calibrated Western Australia utility function from the Western Australia source study Navarro et al. (submitted for publication) and assuming no competition amongst adjacent boat ramps (y in EQ3. is set to 0).

- WA-based y0.5: A model using the calibrated Western Australia utility function from the Western Australia source study Navarro et al. (submitted for publication) and assuming intermediate levels of competition amongst adjacent boat ramps (y in EQ3. is set to 0.5).

[3] The calibration was predominantly based on Lynch et al. (2019)'s estimate of the number of trips in the Hunter Marine Park (1,900 fisher days). Ningaloo Marine Park (Commonwealth) was not used for reasons discussed in the results below.

3. RESULTS

3.1 Sample descriptions

3.1.1 General Public

A total of 3,026 responses were received from the general public survey (Figure 6). This included 774 responses from people residing in the South-east Network, 768 in the South-west, 803 in the Temperate East and 538 in the Coral Sea Marine Park. Due to a lack of available responses in the online panel (reflecting low population numbers generally) relatively small samples were obtained from the North (116) and North-west networks (27).

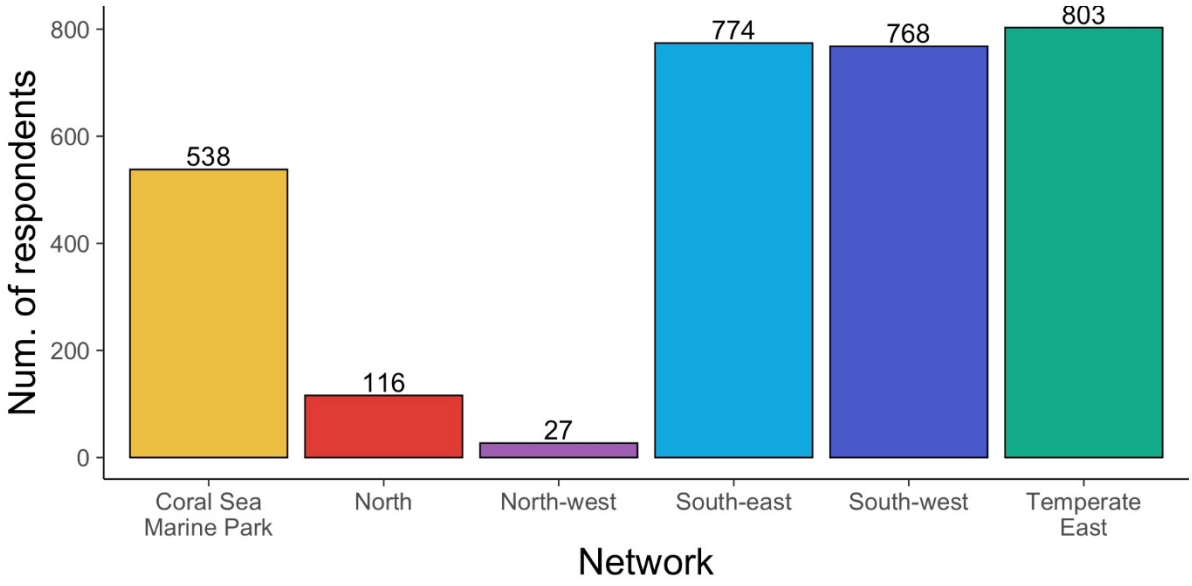

Figure 6. Sample size of general public survey by network based on proximity of home postcode to each of the networks.

In the well sampled networks (South-west, South-east, Temperate East and Coral Sea Marine Park) our sample is closely representative of the general population of adults (18+) by age (Figure 7) and gender (Figure 8). In the North and North-west networks, our sample over-represents 25- to 34-year-olds: this age group accounted for 48% of our sample in both networks but makes up just 25% of the adult population in the North and 28% in the North-west (Figure 7). Similarly, females are over-represented in the North and North-west networks (Figure 8).

Overall, the general public survey was successful in obtaining a representative sample of the Australian population. However, small sample sizes and lack of representativeness in the North and North-west networks should be considered when interpreting results.

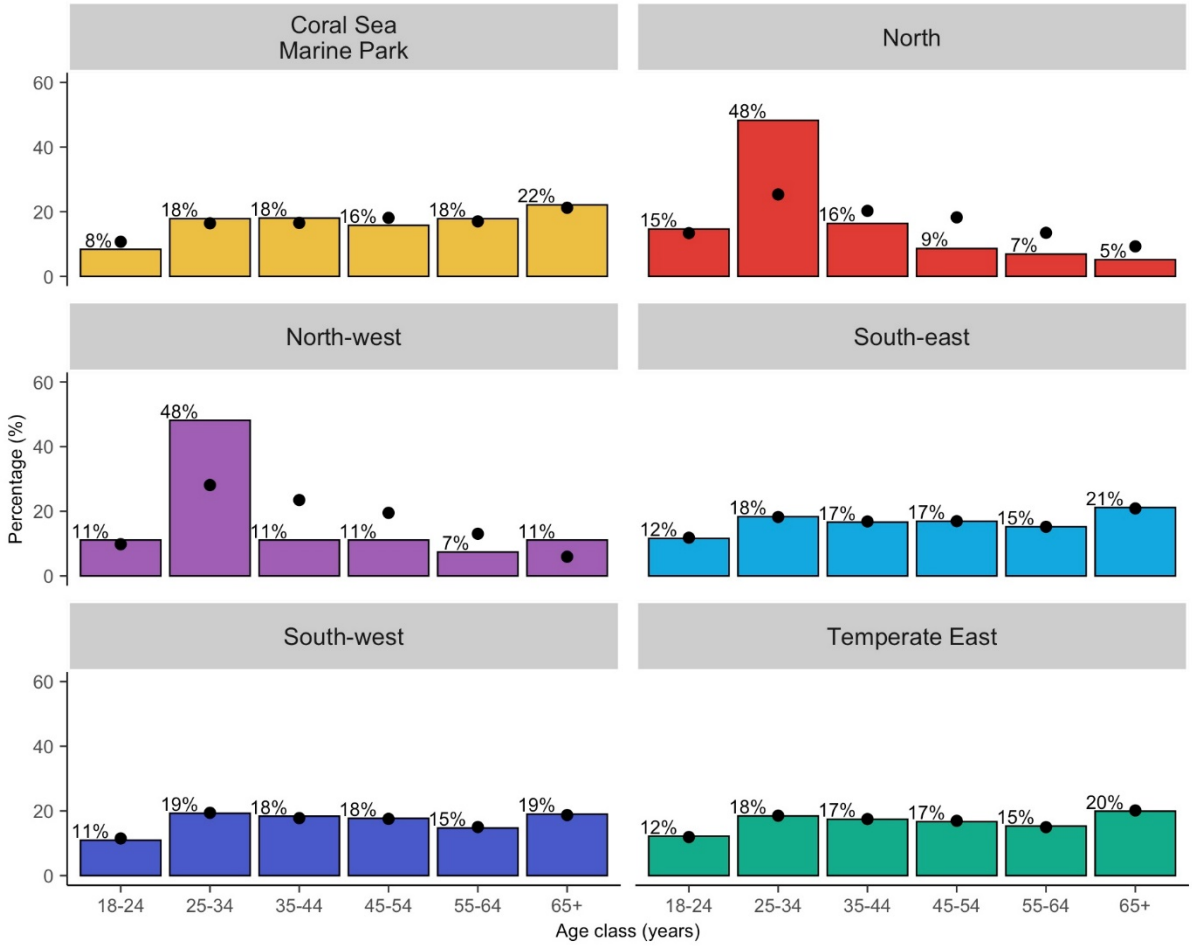

Figure 7. Percentage of respondents in the general public survey by age class in each network of the Australian Marine Parks. Points show 2016 census percentages.

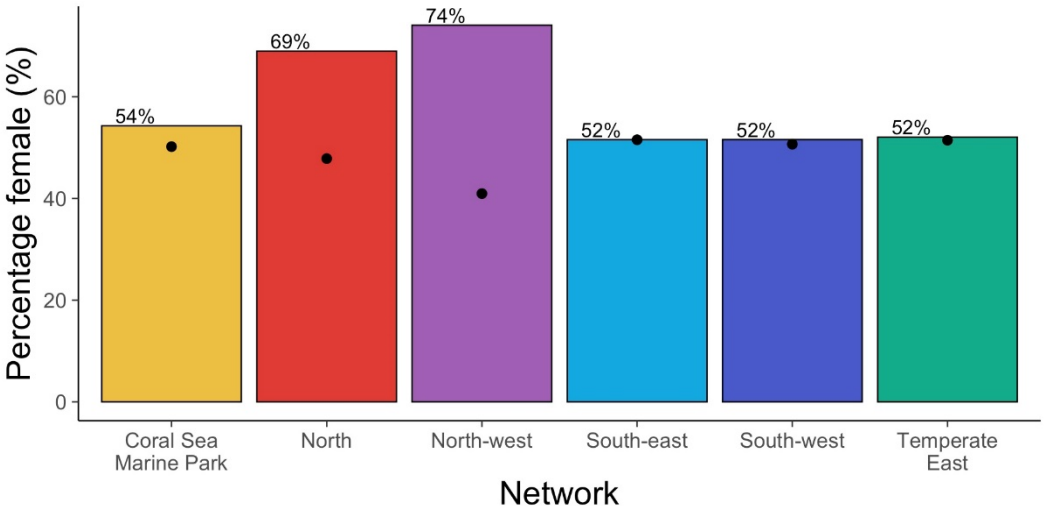

Figure 8. Percentage of female respondents in the general public survey by network of the Australian Marine Parks. Points show 2016 census percentages.

3.1.2 Recreational fishers

Boat-based recreational fisher responses were obtained from three surveys: the boat ramp survey, the general public survey, and the targeted survey. In total, 1,283 boat-based recreational fishers were surveyed, including 857 in the boat ramp survey, 410 in the general public survey and 16 in the targeted survey.

Sample sizes by location (for the boat ramp survey) and network (for the general public and targeted surveys) are shown in Figure 9. On average, 71 surveys were conducted at each of the boat ramp locations. The lowest sample sizes were obtained at Streaky bay (n = 19), Jervis Bay (n = 38)[4] and Victor Harbor (n = 39). For the general public survey, the largest sample sizes were obtained from the South-west Network (n = 116) and Coral Sea Marine Park (n = 114), and the smallest sample sizes were obtained in the North (n = 34) and North-west (n = 10) networks. The 16 responses to the targeted survey were mainly obtained from the South-west Network (n = 11).

[4] Note that surveys in Jervis Bay were affected by the 2020 NSW bushfire crisis. The sample may be somewhat unusual, particularly in that tourists who usually visit during school holidays (when our surveys were conducted) were likely present in reduced numbers.

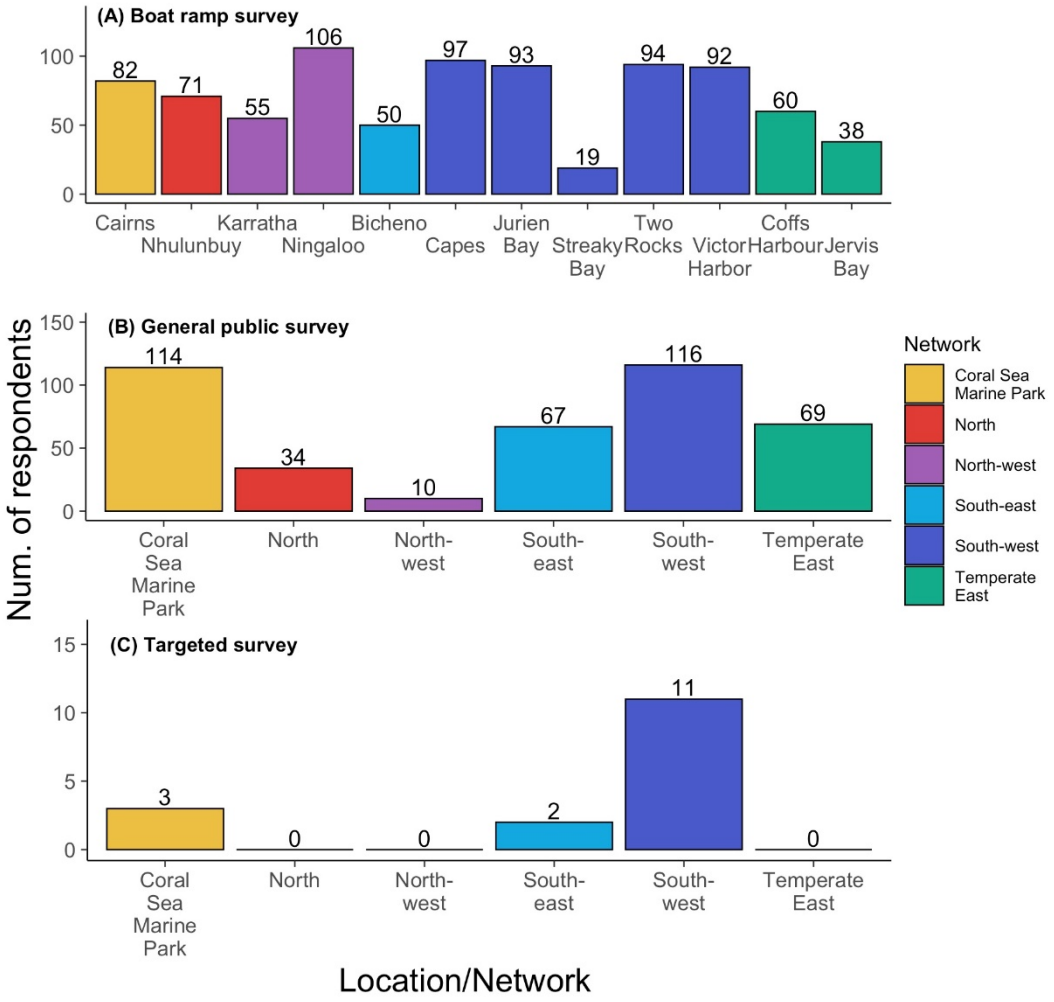

Figure 9. Sample size of fishers by location in: (A) the boat ramp survey, (B) the general public survey and (C) the targeted survey.

Boat-based recreational fishing avidity for each survey is reported in Figure 10. Respondents in the boat ramp and targeted surveys both tended to be relatively avid, with median avidities of 20 and 22 fishing trips per year, respectively. In comparison, the median avidity reported in the general public survey was 3 trips. Greater representation of high avidity fishers in the boat ramp survey, relative to the general public survey, aligns with our expectations, as sampling "on-site" tends to over-represent avid fishers. Similar patterns were found in the representation of females in our surveys, with very few females present in the boat ramp (8%), and targeted surveys (0%). In comparison, 51% of fisher respondents to the general public survey were female.

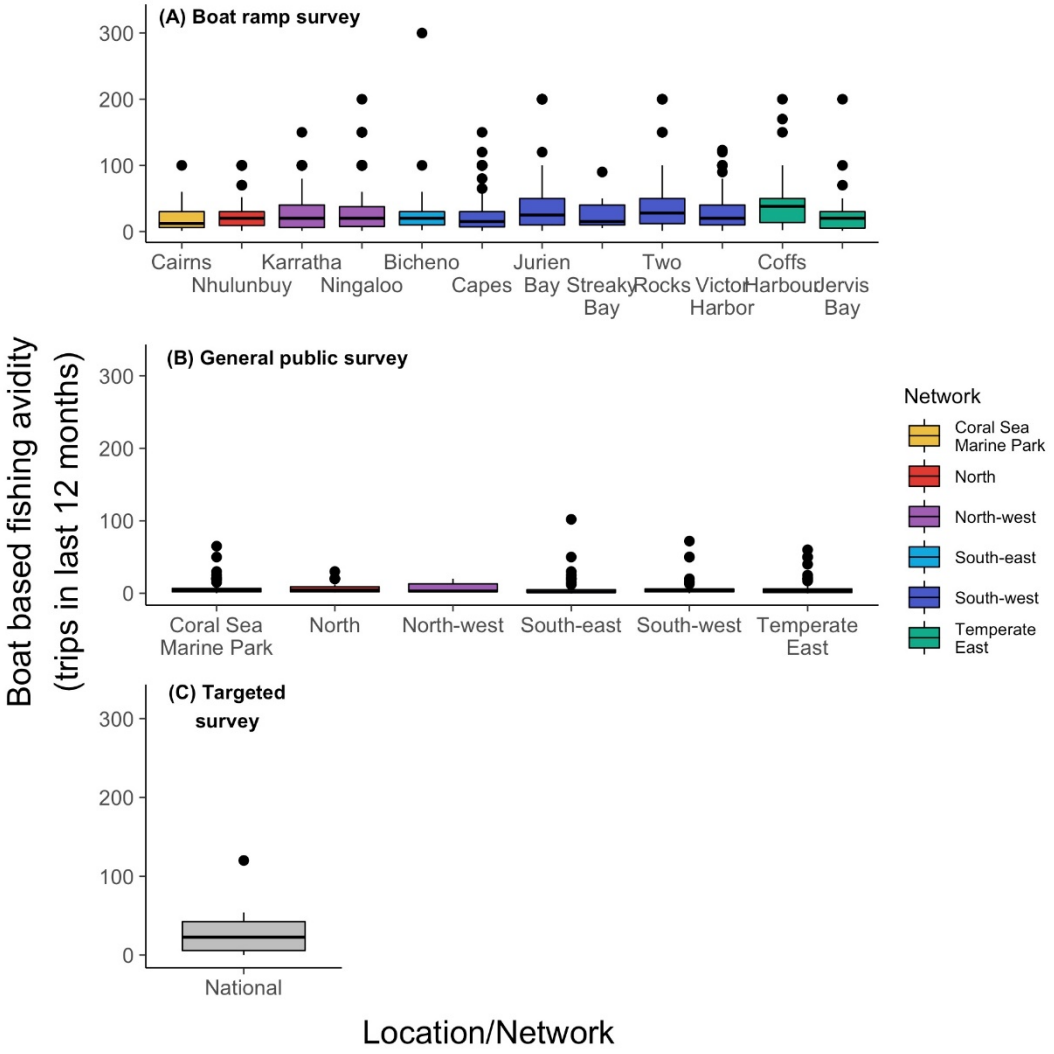

Figure 10. Boat-based fishing avidity of fishers by location in: (A) the boat ramp survey, (B) the general public survey and (C) the targeted survey.

Supplementary figures (See Appendix):

- Figure 47: Percentage of recreational fishing respondents that are female.
- Figure 48: Percentage of recreational fishing respondents to the boat ramp survey that are locals.
- Figure 49: Percentage of recreational fishing respondents to the boat ramp survey that participated in various non-fishing activities.
- Figure 50 Percentage of recreational fishing respondents to the general public survey that participated in various non-fishing activities.

3.1.3 Non-extractive recreational users

Responses from non-extractive recreational users were obtained from three surveys: the boat ramp survey, the general public survey, and the targeted survey. Note that, respondents that participated in both fishing and non-extractive recreational activities are included in both samples. In total, 732 boat-based non-extractive recreational users were surveyed, including 271 in the boat ramp survey, 450 in the general public survey and 11 in the targeted survey.

Sample sizes by location (for the boat ramp survey) and network (for the general public and targeted surveys) are shown in Figure 11. On average, 23 surveys with non-extractive recreational users were conducted at each of the boat ramp locations. The lowest sample sizes were obtained at Victor Harbor (n = 2) and Streaky Bay (n = 4). For the general public survey, the largest sample sizes were obtained from the South-west Network (n = 135) and Coral Sea Marine Park (n = 103). The 11 non-extractive recreational user responses to the targeted survey were mainly obtained from the South-west Network (n = 6).

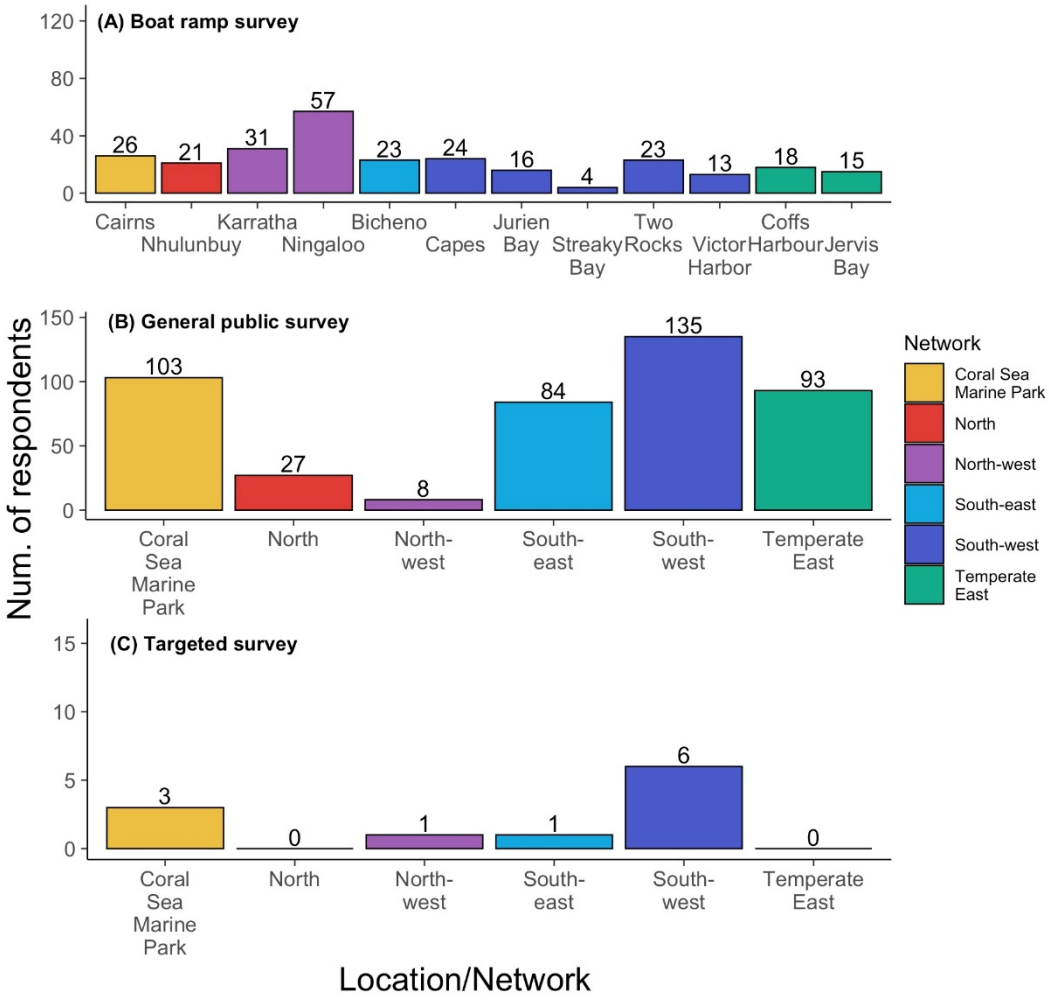

Figure 11. Sample size of non-extractive recreational users by location/network in: (A) the boat ramp survey, (B) the general public survey and (C) the targeted survey.

Figure 12 shows the activities non-extractive recreational users in the boat ramp survey reported participating in over the last 12 months. The main non-extractive recreational activity was diving or snorkelling (98%). Most also recreationally fished (97%). In contrast, the main non-extractive recreational activity reported in the general public survey was cruising on a privately owned yacht or motorboat (77%), with just 49% reporting doing diving or snorkelling (Figure 13).

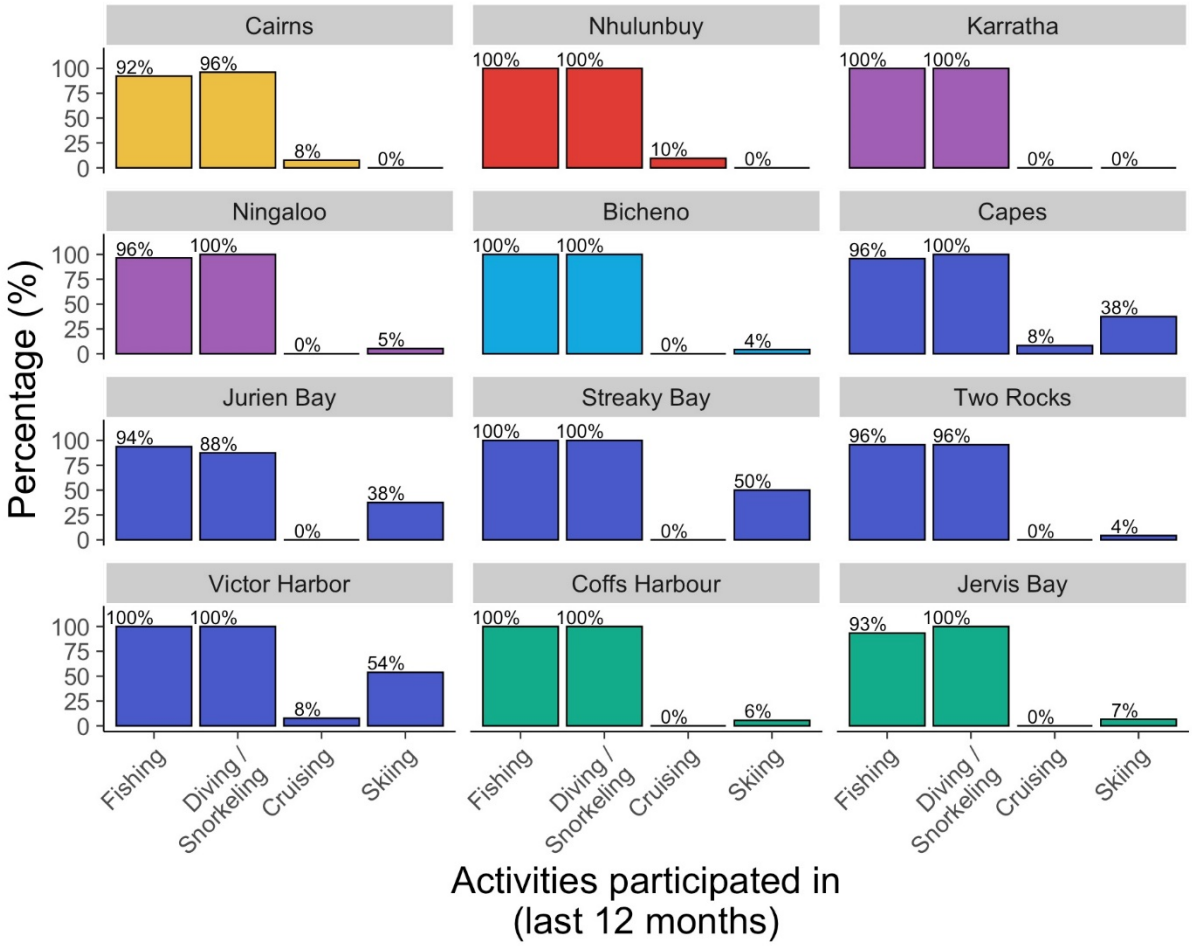

Figure 12. Percentage of non-extractive recreational user respondents by location in the boat ramp survey participating in boat-based activities.

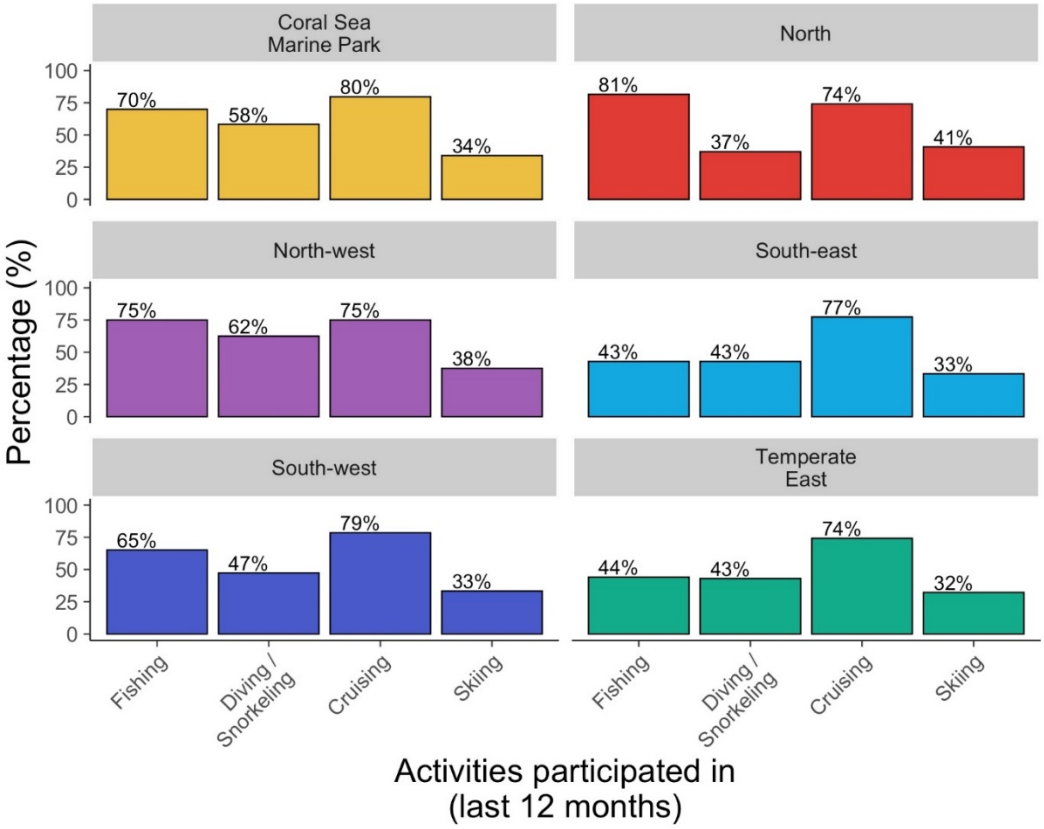

Figure 13. Percentage of non-extractive recreational user respondents by network in the general public survey participating in boat-based activities.

Supplementary figures (See Appendix):

- Figure 51 Percentage of non-extractive recreational user respondents that are female.
- Figure 52 Percentage of non-extractive recreational user respondents to the boat ramp survey that are locals.

3.1.4 Charter operators

The charter operator survey consisted of 55 complete responses across the six networks of the AMPs (Figure 14). Given that 646 emails were sent this reflects a response rate of approximately 8.5%. Interestingly, the survey was viewed by 110 respondents, with 50% failing to complete the survey, and many failing to provide any responses. Low response rates have been observed for similar online distributed surveys elsewhere (e.g., Brooke et al. (2015)). The national scope of the survey with possible limited perceived local relevance, and online distribution platform, may explain the low response rate.

Sample sizes in the charter operator survey varied by network. The largest samples were obtained from the Temperate East (n = 12), South-west (n = 11) and Coral Sea Marine Park (n = 11). Somewhat lower sample sizes were obtained from the North-west (n = 9), South-east (n = 8) and North (n = 4).

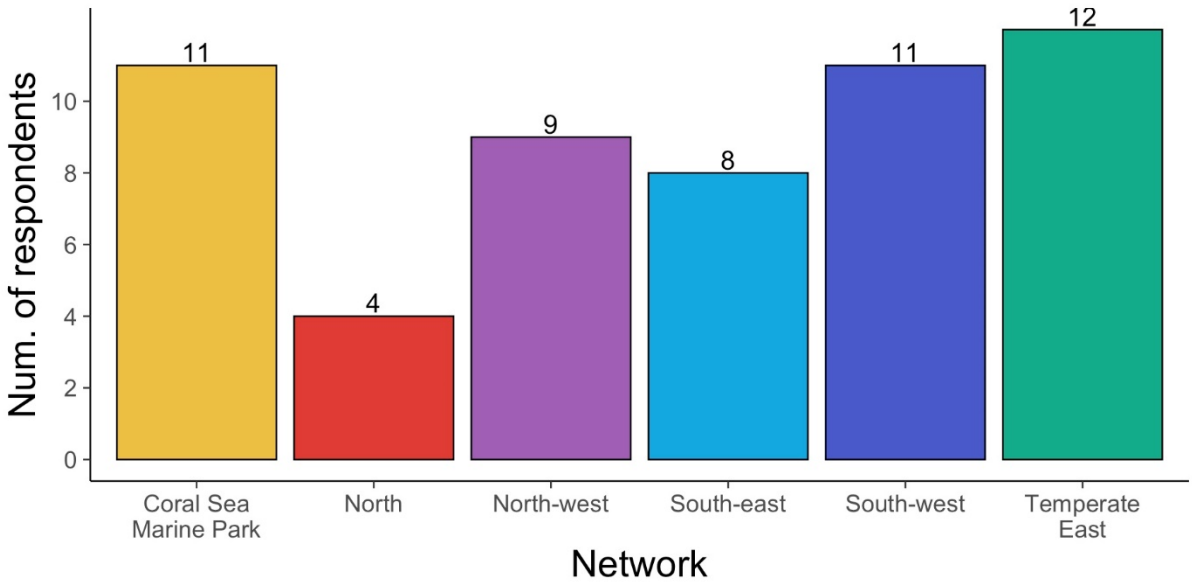

Figure 14. Sample size of charter operator survey by network based on main operating location in 2019.

Our sample includes a relatively diverse range of charter types (Figure 15). Across all six networks, fishing was the most popular charter type in our sample. Diving/snorkel charters were also well represented in the North-west (56%) and Coral Sea Marine Parks (55%).

The charter survey was predominantly completed by the owner of the charter business (88%) or the captain of a vessel (55%) (note that individuals can be both the owner and captain, Figure 53).

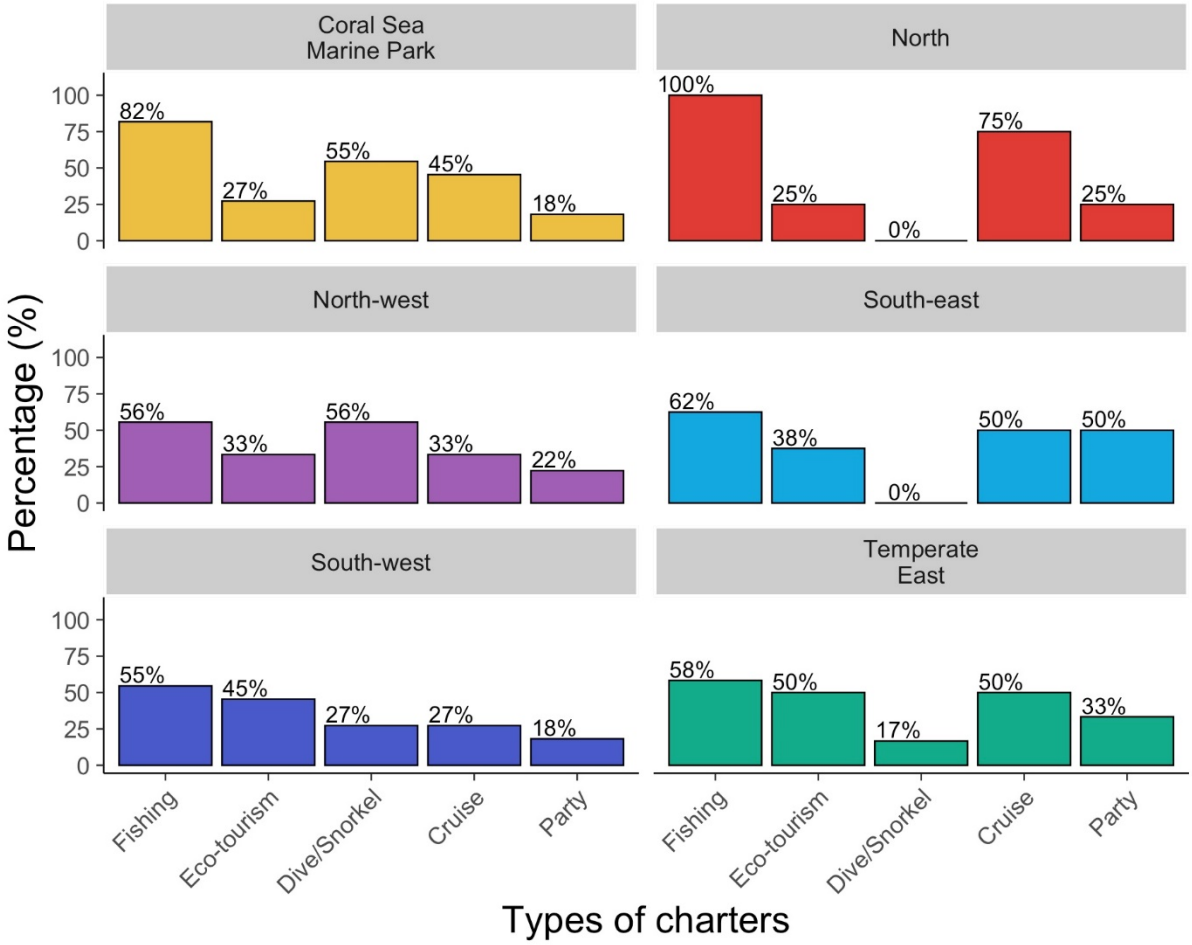

Figure 15. Types of charter operators in the charter operator survey sample by network of the Australian Marine Parks. Note that individual charter respondents could select multiple charter types.

Supplementary figures (See Appendix):

- Figure 53 Role of the individual who completed the charter operator survey within the charter business. Note that an individual can have multiple roles (e.g., an owner operator).
- Figure 54 Size of fleet (number of vessels excluding tenders) used to run charter businesses as reported in the charter survey.

3.2 Awareness

3.2.1 General Public

Spatial scale	Sample size	Stated awareness of an AMP (%)	Know the difference between state and Commonwealth waters (%)
Network			
Coral Sea Marine Park	538	48	36
North	116	52	45
North-west	27	52	48
South-east	774	40	32
South-west	768	37	39
Temperate East	803	37	39
National	3026	44	40

Figure 16. Summary table showing the general publics' awareness of the Australian Marine Parks (AMPs) and related management.

Nationally, 44% of the general public stated being aware of the AMPs (Figure 16). This proportion differed significantly across the six networks (X^2 = 28, p-value < 0.001). Highest AMP awareness was found in the North, North-west and Coral Sea Marine Park networks, each with approximately 50% AMP awareness (Figure 16, also see Figure 55 for confidence intervals). Compared to a previous study by Burton et al. (2015) which focussed on the South-east Network, AMP awareness levels found here were relatively low. Burton et al. (2015) found 57% of South-east Network residents were aware of the Commonwealth Marine Reserves, whereas we found that just 40% of residents in this network were aware of the AMPs.[5]

Relatively few respondents were aware of the difference between state and Commonwealth waters in Australia (40%, Figure 16). Awareness of this distinction in management boundaries differed across networks (X^2 = 17, p-value < 0.01), being highest in the North (45%) and North-west networks (48%) (Figure 16, also see Figure 56 for confidence intervals). Our findings

[5] Note that the AMPs were previously called the Commonwealth Marine Reserves. Our question asked whether respondents had heard of either the AMPs or Commonwealth Marine Reserves.

closely match those of Young et al. (2007) at the national scale who found 37% of respondents were aware of the distinction between state and Commonwealth waters.

Respondents who stated being aware of the AMPs were then asked how they had learnt about them. The most common response was news media (39.1%) followed by state fisheries/marine park websites (30.9%). Generally, similar patterns in sources of information were found across the six networks (Figure 17).

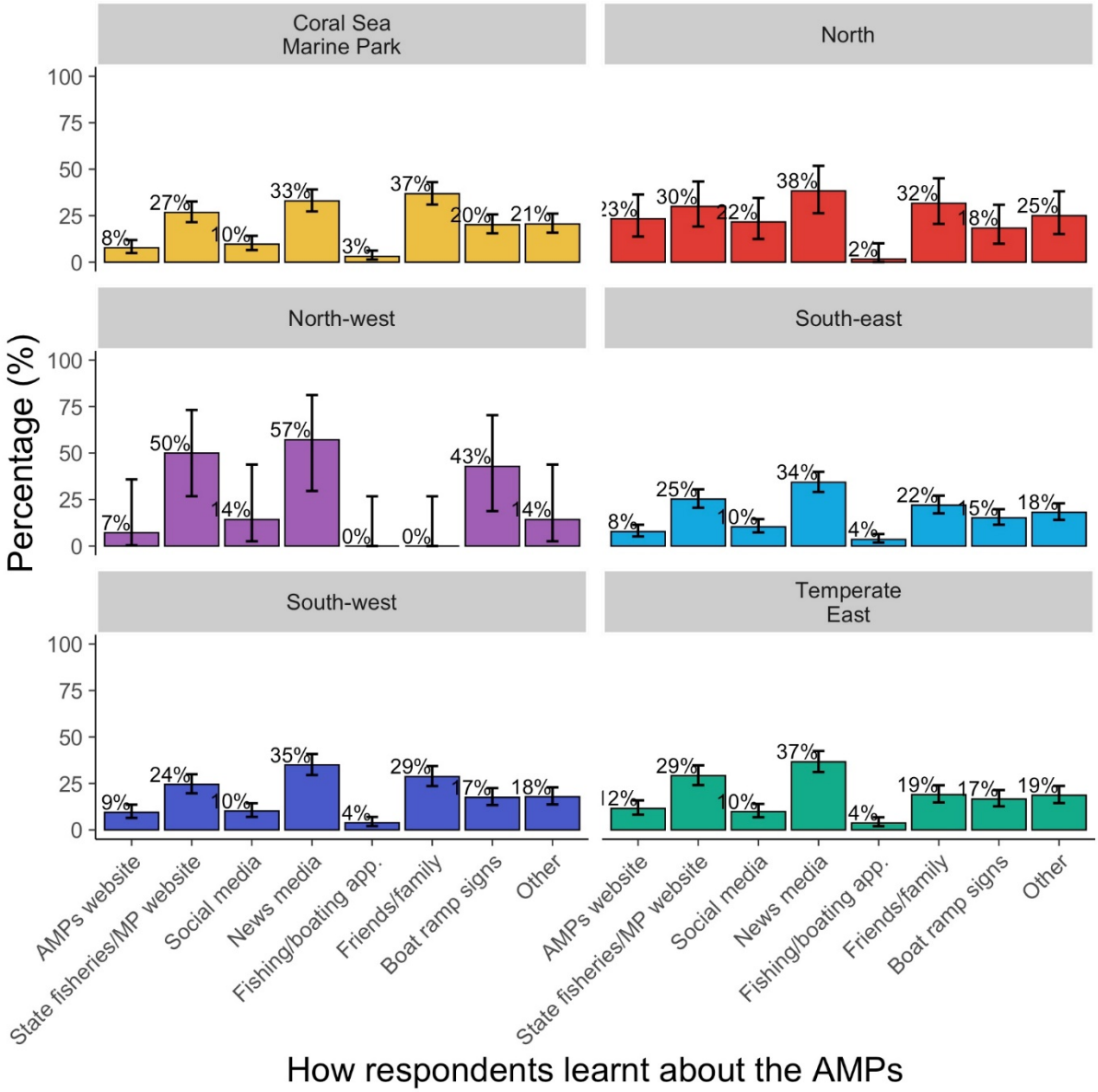

Figure 17. How members of the general public learnt about the Australian Marine Parks (AMPs).

To test awareness for different aspects of the AMPs, respondents were provided with information about the AMPs, and those reporting to know about the AMPs were asked if they had learnt anything new in this information. A total of 59.0% reported learning that “44 new AMPs were established in 2018”, and 47.4% reported learning about the “offshore location of the AMPs”, 38.9% reported learning that the “Commonwealth Marine Reserves were now called the Australian Marine Parks” and 39.6% reported learning that the “Australian Marine

Parks are multiple-use". Responses to this question were relatively similar across networks (Figure 18).

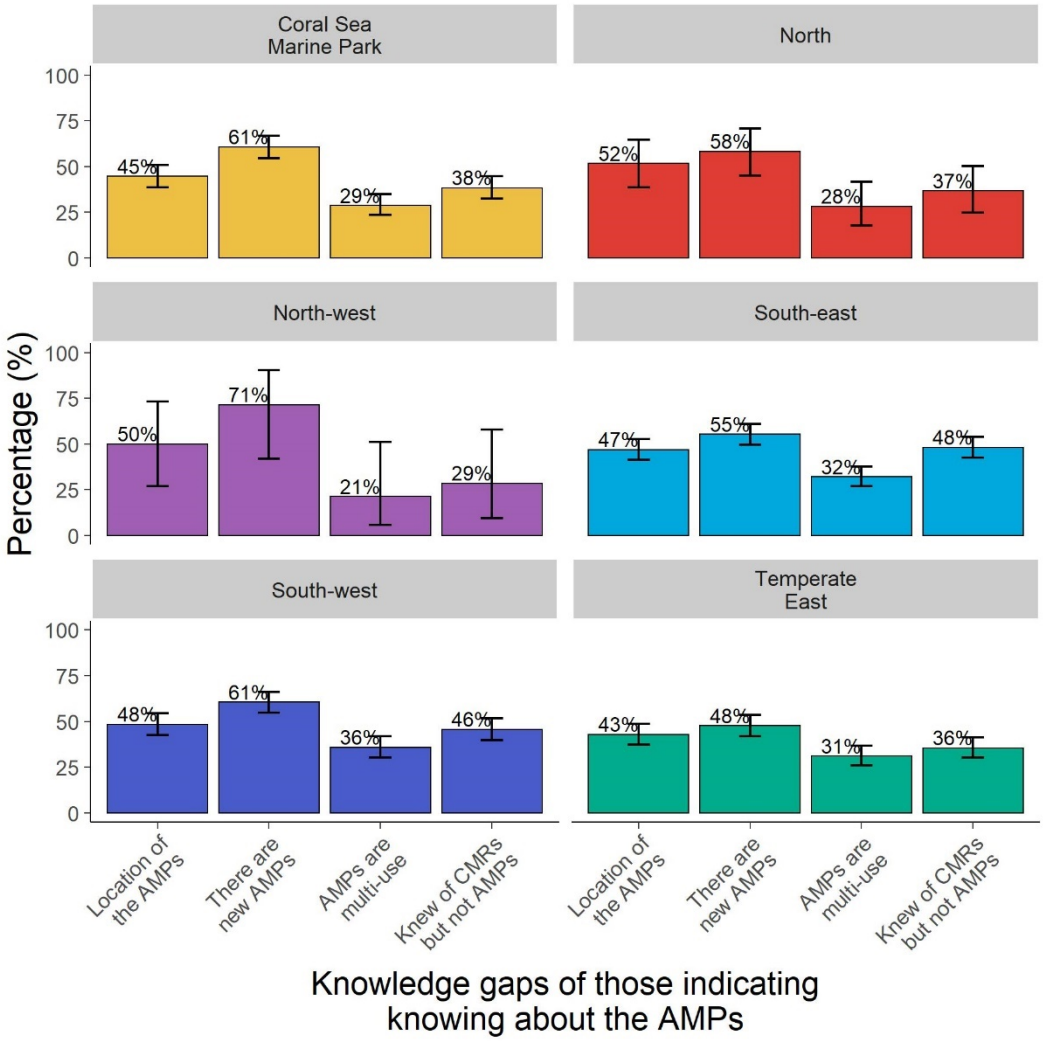

Figure 18. Knowledge gaps of respondents to the general public survey about the Australian Marine Parks (AMPs). Note that CMRs stands for Commonwealth Marine Reserves. As an example of interpretation, 61% of Coral Sea Marine Park respondents to the general public survey, who had indicated that they knew about the AMPs generally, did not know that new AMPs came into effect in 2018.

Finally, the survey sought insights into which aspects of the AMPs people would like to know more about, and how to communicate this information. The most common responses were; wanting to know more about the habitats, plants, and animals in the AMPs (73%), the rules in the AMPs (53%), and the effectiveness of the AMPs in protecting habitats, plants, and animals (48%). Preferences for information were relatively consistent across networks (Figure 19).

In terms of how to communicate this information, the most common responses were through the AMPs website (45%), through social media (45%), and through state fisheries/MP websites (37%). Relatively similar preferences for contact methods were found across the networks (Figure 20).

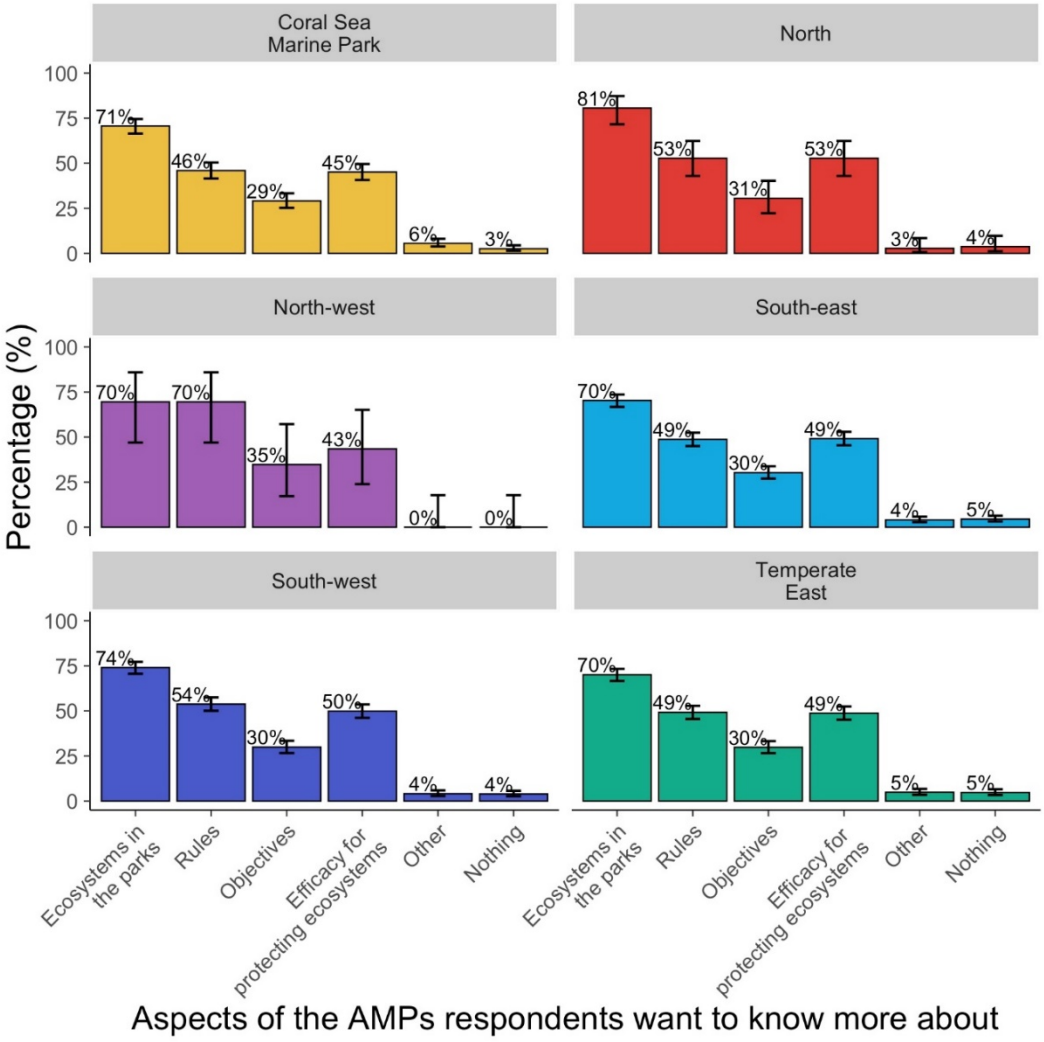

Figure 19. Aspects of the Australian Marine Parks (AMPs) that the general public want to know more about.

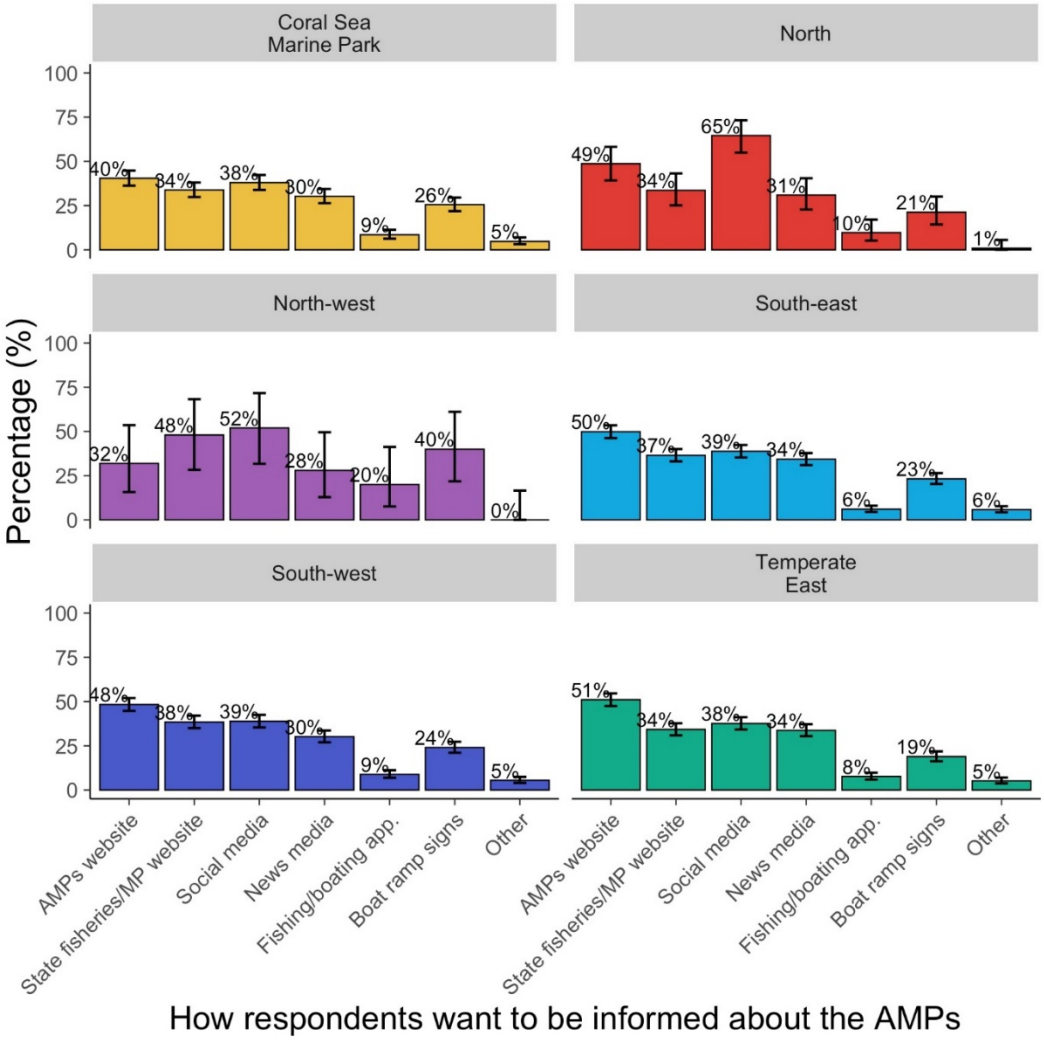

Figure 20. Preferred methods for informing the general public about the Australian Marine Parks (AMPs).

Supplementary figures (See Appendix):

- Figure 55. General public awareness of the Australian Marine Parks (AMPs).
- Figure 56. General public awareness of the difference between state and Commonwealth waters in Australia.
- Figure 57. General public level of knowledge about the marine ecosystems inside the Australian Marine Parks.

3.2.2 Recreational fishers

A total of 22% of recreational fishers in the boat ramp survey and 53% in the targeted survey reported being aware of an AMP in an area they fished in (Figure 21).[6] Awareness of an AMP in the boat ramp survey differed significantly across locations (X^2 = 50, p-value < 0.001). The highest awareness was found in Cairns (43%) and Karratha (40%), and the lowest in Two Rocks (9%), Capes (12%), Nhulunbuy (13%), Victor Harbor (13%) and Jervis Bay (13%, Figure 21 and see Figure 58 for confidence intervals).

Spatial scale		Sample size	Stated awareness of an AMP in area (%)	Can correctly name an AMP (%)	Stated awareness of a state MP in area (%)	Can correctly name a state MP (%)
Location						
Cairns	◣	82	43	37	96	67
Nhulunbuy	◣	71	13	33		
Karratha	◣	55	40	0		
Ningaloo	◣	106	22	0	99	94
Bicheno	◣	50	28	36	94	74
Capes	◣	97	12	0	81	32
Jurien Bay	◣	93	16	0	96	30
Streaky Bay	◣	19	16	0	58	82
Two Rocks	◣	94	13	8	64	55
Victor Harbor	◣	92	25	48	86	81
Coffs Harbour	◣	60	22	15	93	73
Jervis Bay	◣	38	13	0	92	77
Network						
Coral Sea Marine Park	◣	82	43	37	96	67
North	◣	71	13	33		
North-west	◣	161	31	0	99	94
South-east	◣	50	28	36	94	74
South-west	◣	395	16	11	77	56
Temperate East	◣	98	17	8	93	75
National	◣	857	22	15	86	67
National	◉	16	53	12	67	70

Figure 21. Summary table showing recreational fishers' awareness of the Australian Marine Parks (AMPs) and related management. ◣ indicates the boat ramp survey and ◉ indicates the targeted survey. Note that sample sizes for columns for correctly naming a marine park are based on just those that stated being aware of the marine park; e.g., for the boat ramp survey at Cairns, 82 surveys were completed of which 35 (82*0.43) stated being aware of the AMPs 37% of which could correctly name an AMP.

To further test fisher's awareness, those respondents who reported being aware of the AMPs were asked if they could name an AMP in the area. Just 15% of fishers who stated being aware of an AMP in the boat ramp survey and 12% of fishers in the targeted survey correctly named an AMP. Significant differences in correct responses were found across locations of the boat

[6] For the boat ramp survey respondents were asked about the AMPs in the location they were interviewed in, whilst in the targeted survey they were asked about AMPs in the sub-network (Figure 3) they had fished most in over the last 12 months.

ramp survey (X^2 = 43, p-value < 0.001), with the greatest number of correct responses found in Victor Harbor (48%) and Cairns (37%) (Figure 21 and see Figure 59 for confidence intervals).

To place these awareness levels into context, the same awareness questions were asked about state marine parks in the area (where relevant). Nationally, 86% of fishers in the boat ramp survey and 67% in the targeted survey were aware of a state MP in the area (Figure 21 and see Figure 60 for confidence intervals). A total of 56% of these fishers in the boat ramp survey and 78% in the targeted survey went on to correctly name a state MP in the area (Figure 21 and see Figure 61 for confidence intervals). These results suggest that recreational fishers have far lower awareness of AMPs relative to state marine parks.

Nationally, recreational fisher awareness of the difference between state and Commonwealth waters in Australia was measured at 48% in the boat ramp survey, 50% in the general public survey, and 53% in the targeted survey (Figure 22). This is slightly higher than awareness of the distinction between state and Commonwealth waters in the general public (44%). Significant differences existed in this distinction across boat ramp surveys (X^2 = 87, p-value < 0.001), with highest awareness in Bicheno (81%) and Streaky Bay (74%), and lowest awareness in Nhulunbuy (23%) and Karratha (25%).

We also tested whether recreational fishers recognised that marine parks are multiple use, with fishing allowed in some parts of a marine park, but not others. Nationally, 55% of recreational fishers in the boat ramp survey and 64% of fishers in the targeted survey were aware of the multiple-use nature of marine parks (Figure 23). Significant differences occurred across boat ramp locations (X^2 = 50, p-value < 0.001), with the highest awareness of the multiple-use nature of marine parks in Coffs Harbour (75%), Jervis Bay (74%) and Cairns (74%), and the lowest levels in Bicheno (32%). Low levels of awareness of the multiple-use nature of marine parks in Bicheno likely reflects that there are few multiple use marine parks in Tasmanian state waters, though there are no-take marine reserves.

In the boat ramp survey, fishers were then asked how they would prefer to be informed about the rules in the AMPs. Nationally, the most preferred method was through state fisheries or state marine park websites (40%), followed by fishing/boating apps (14%). Preferences differed across locations in the boat ramp survey (X^2 = 428, p-value < 0.001). Notably, preferences for information to be provided through fishing/boating apps was greatest in Victor Harbor (42%) and Capes (32%, Figure 24).

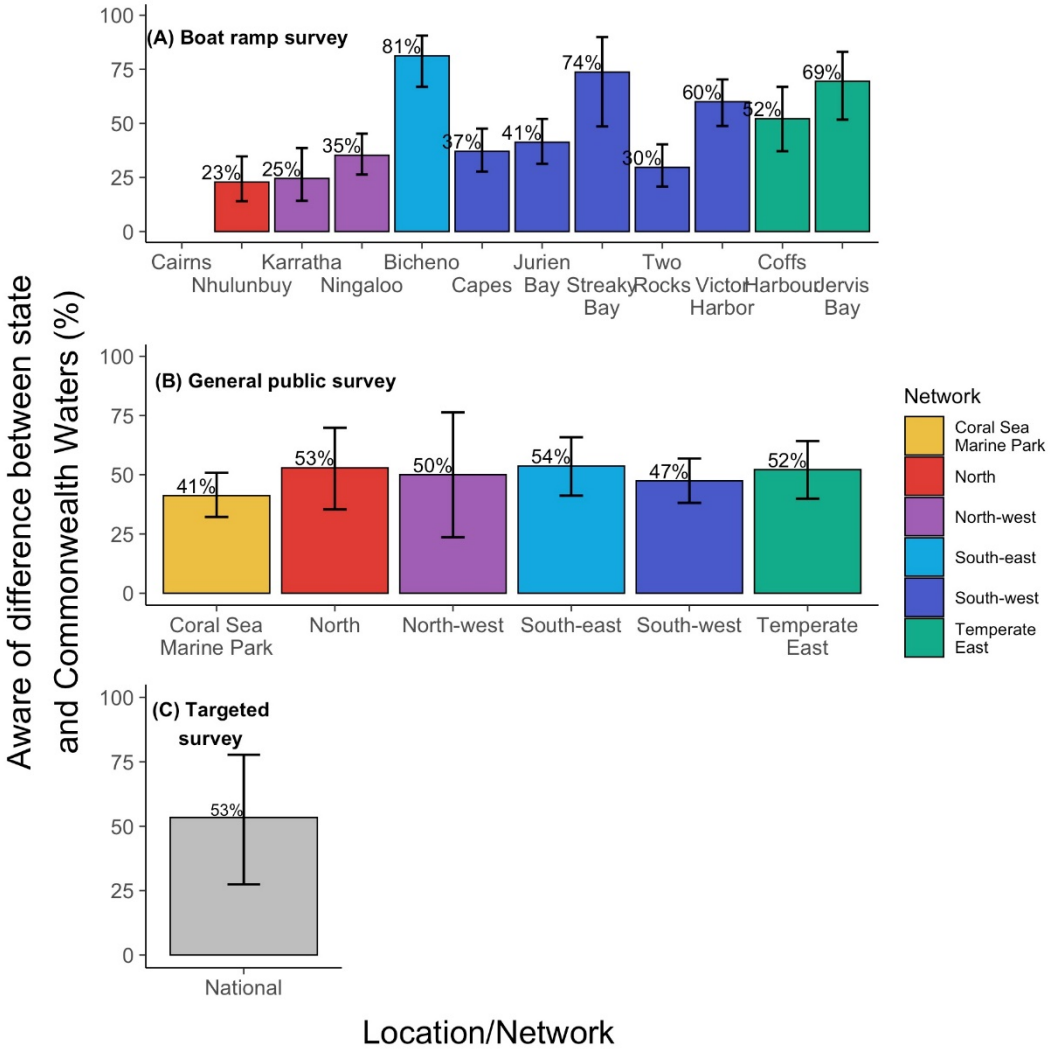

Figure 22. Recreational fishers' awareness of the difference between state and Commonwealth waters in Australia for: (A) the boat ramp survey, (B) the general public survey and (C) the targeted survey. Note that this question was not asked in the Cairns boat ramp survey as the Great Barrier Reef Marine Park straddles state and Commonwealth waters.

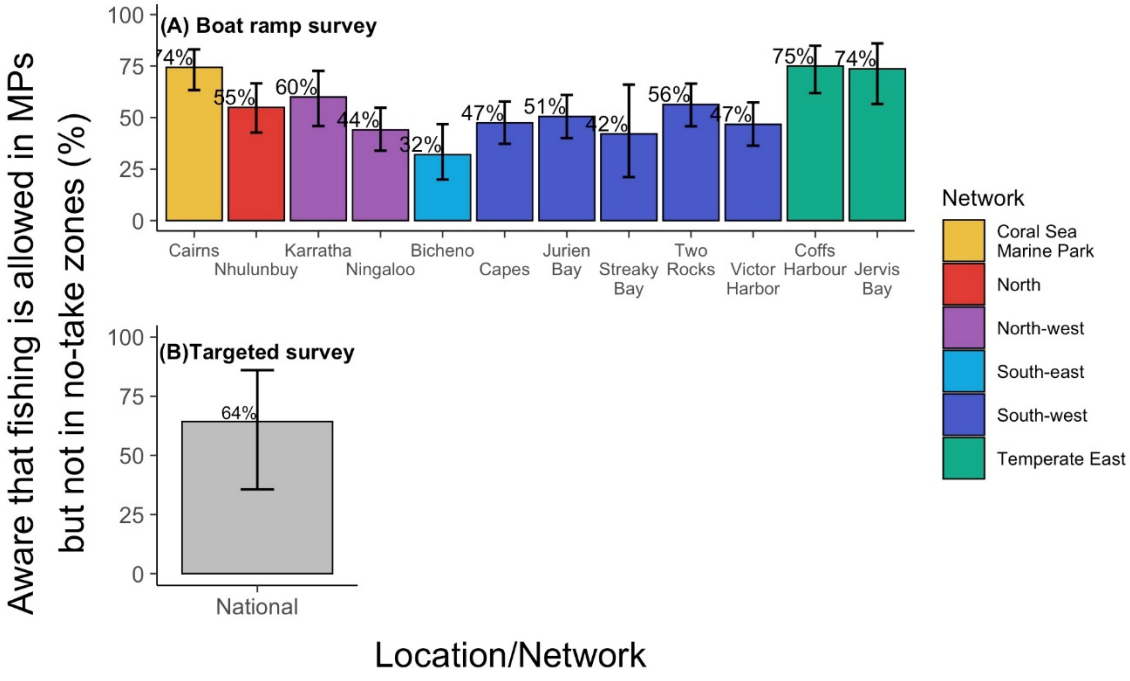

Figure 23. Recreational fishers' awareness that fishing is allowed in some parts of marine parks (MPs), but not in no-take zones (National Park Zones in the Australian Marine Parks) for: (A) the boat ramp survey and (B) the targeted survey.

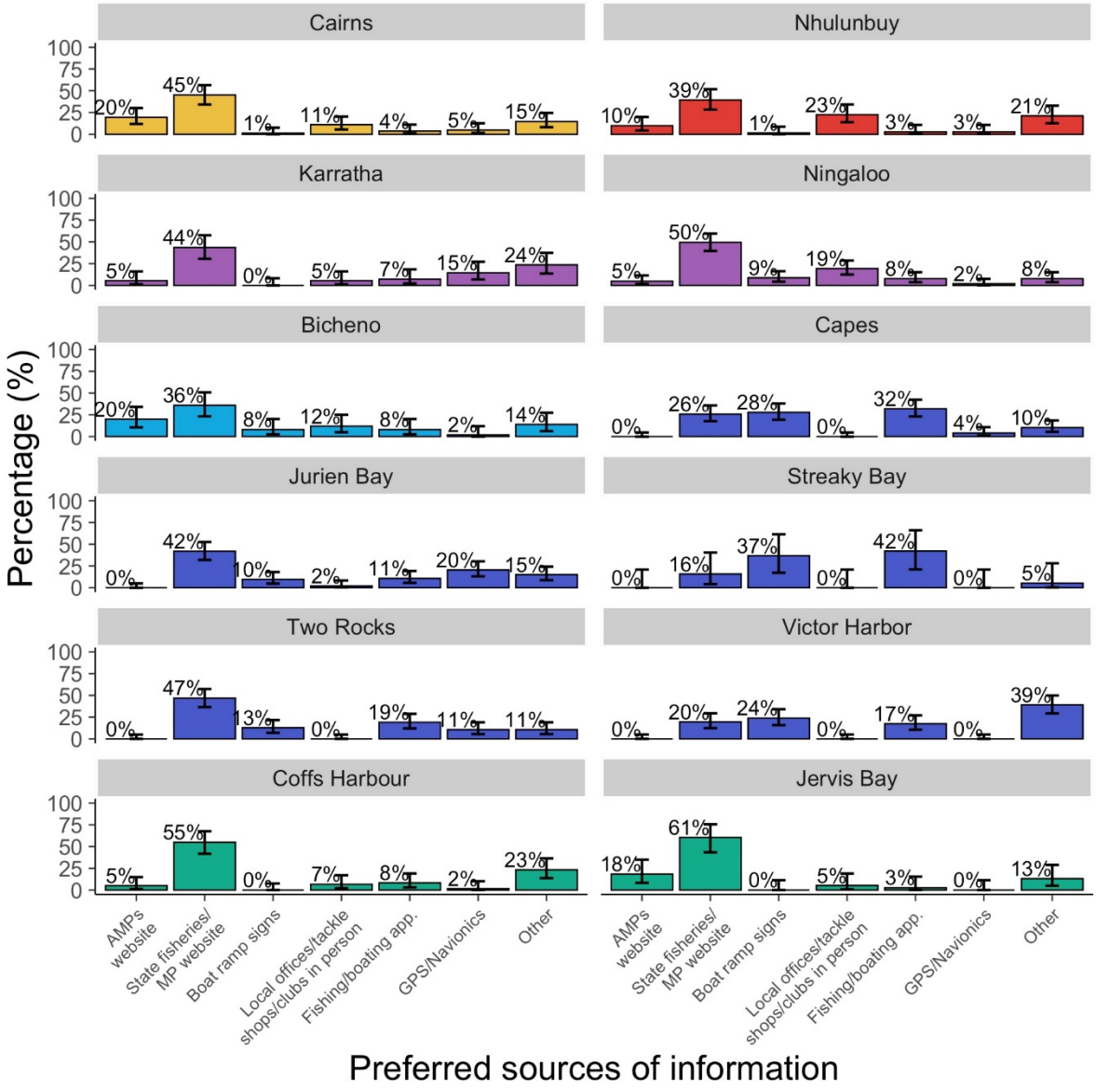

Figure 24. Preferred methods for being informed about the Australian Marine Parks (AMPs) amongst recreational fishers in the boat ramp survey.

Supplementary figures (See Appendix):

- Figure 58. Recreational fishers stated awareness of an Australian Marine Park (AMP). In the boat ramp survey (A) this was awareness of an AMP in the boat ramp survey location, whilst in the targeted survey (B) this was awareness of an AMP in the region the respondent fished in most frequently.

- Figure 59. Percentage of recreational fishers able to name an Australian Marine Park (AMP). In the boat ramp survey (A) this was ability to name of an Australian Marine Park in the boat ramp survey location, whilst in the targeted survey (B) this was ability to name an Australian Marine Park in the region the respondent fished in most frequently.

- Figure 60. Recreational fishers' stated awareness of a state marine park. In the boat ramp survey (A) this was awareness of a state marine park in the boat ramp survey location, whilst in the targeted survey (B) this was awareness of a state marine park in the region the respondent operated in most frequently.

- Figure 61. Percentage of recreational fishers able to name a state marine park. In the boat ramp survey

- Figure 62. Recreational fishers' awareness of the Australian Marine Parks (AMPs) in the general public survey. Respondents were deemed to have heard of the AMPs if they had heard of either the AMPs or the Commonwealth Marine Reserves.

- Figure 63. Recreational fishers preferred sources of information about the Australian Marine Parks in the general public survey.

3.2.3 Non-extractive recreational users

A total of 26% of non-extractive recreational users in the boat ramp survey and 40% in the targeted survey reported being aware of an AMP in an area they visited (Figure 25).[7] Awareness of an AMP in the boat ramp survey was not significantly different across locations (X^2 = 19, p-value = 0.06, Figure 64).

[7] For the boat ramp survey respondents were asked about the AMPs in the location they were interviewed in. In the targeted survey they were asked about AMPs in the sub-network (Figure 3) where they had conducted boat-based non-extractive recreational activities most in the last 12 months.

Spatial scale		Sample size	Stated awareness of an AMP in area (%)	Can correctly name an AMP (%)	Stated awareness of a state MP in area (%)	Can correctly name a state MP (%)
Location						
Cairns	◣	26	50	38	100	81
Nhulunbuy	◣	21	10	0		
Karratha	◣	31	42	0		
Ningaloo	◣	57	21	0	100	94
Bicheno	◣	23	26	33	91	71
Capes	◣	24	17	0	88	19
Jurien Bay	◣	16	38	0	100	44
Streaky Bay	◣	4	0		75	100
Two Rocks	◣	23	26	17	87	75
Victor Harbor	◣	13	31	75	85	82
Coffs Harbour	◣	18	33	33	100	72
Jervis Bay	◣	15	20	0	93	64
Network						
Coral Sea Marine Park	◣	26	50	38	100	81
North	◣	21	10	0		
North-west	◣	88	31	0	100	94
South-east	◣	23	26	33	91	71
South-west	◣	80	22	23	87	64
Temperate East	◣	33	27	17	97	68
National	◣	271	26	18	92	70
National	◉	11	40	0	60	83

Figure 25. Summary table showing non-extractive recreational users' awareness of the Australian Marine Parks (AMPs) and related management. ◣ indicates the boat ramp survey and ◉ indicates the targeted survey. Note that sample sizes for columns for correctly naming a marine park are based on just those that stated being aware of the marine park; e.g., for the boat ramp survey at Cairns, 26 surveys were completed of which 13 (26*0.5) stated being aware of the AMPs 38% of which could correctly name an AMP.

For those that stated being aware of an AMP, 18% in the boat ramp survey, and 0% in the targeted survey were able to correctly name an AMP in the area (Figure 25). Significant differences in correct responses were found across locations of the boat ramp survey (X^2 = 24, p-value = 0.008), with the greatest number of correct responses found in Victor Harbor (75%), though these estimates are associated with wide confidence intervals (Figure 65).

In comparison, 92% of non-extractive recreational users in the boat ramp survey and 60% in the targeted survey reported knowing about state marine parks in the area (Figure 25 and see Figure 66 for confidence intervals). Of those, 70% in the boat ramp survey and 83% in the targeted survey were able to correctly name a state marine park (Figure 25 and see Figure 67 for confidence intervals).

Nationally, non-extractive recreational users' awareness of the difference between state and Commonwealth waters in Australia was measured at 57% in the boat ramp survey, 51% in the general public survey, and 64% in the targeted survey (Figure 26). This is slightly higher than awareness of the distinction between state and Commonwealth waters in the general public (44%). Significant differences existed in this distinction across boat ramp surveys (X^2 = 46, p-value < 0.001), with highest awareness in Streaky Bay (100%) and Bicheno (82%), and lowest

awareness in Karratha (21%) and Nhulunbuy (24%), though wide confidence intervals are associated with these estimates (Figure 26).

A total of 65% of non-extractive recreational users in the boat ramp survey and 55% in the targeted survey were aware that marine parks are multiple use, with fishing allowed in some parts but not others (Figure 27). Significant differences occurred across boat ramp locations (X^2 = 27, p-value = 0.004), with highest awareness of the multiple-use nature of marine parks in Jurien Bay (88%) and lowest awareness in Bicheno (43%) and Ningaloo (45%, Figure 27).

Non-extractive recreational users in the boat ramp survey preferred receiving information about the AMPs from state fisheries or state marine park websites (39%), followed by fishing/boating apps (15%). Preferences differed across locations in the boat ramp survey (X^2 = 156, p-value < 0.001). Notably, preferences were high for information to be provided at the Capes, Streaky Bay and Victor Harbor locations through boat ramp signs and fishing/boating apps (Figure 28).

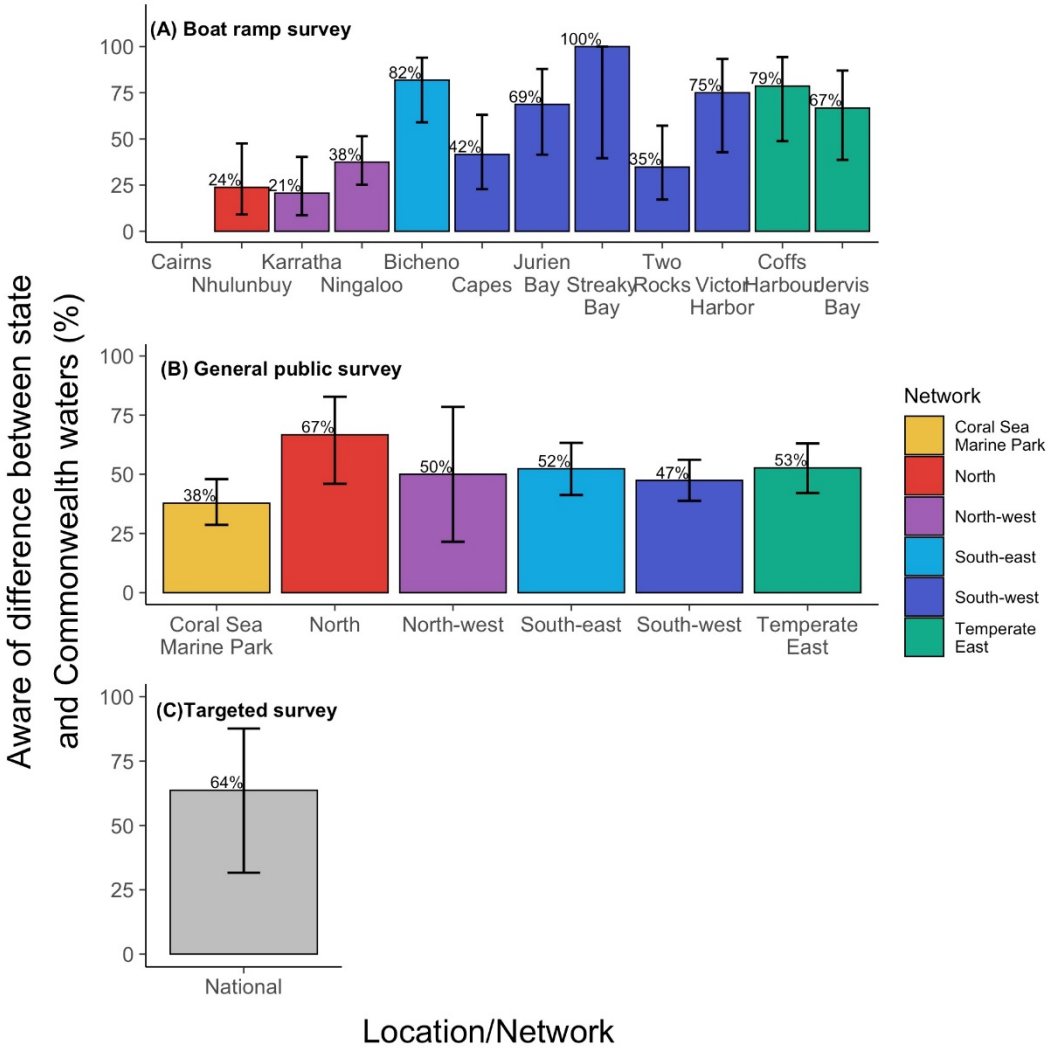

Figure 26. Non-extractive recreational users' awareness of the difference between state and Commonwealth waters in Australia for: (A) the boat ramp survey, (B) the general public survey and (C) the targeted survey. Note that this question was not asked in the Cairns boat ramp survey as the Great Barrier Reef Marine Park straddles state and Commonwealth waters.

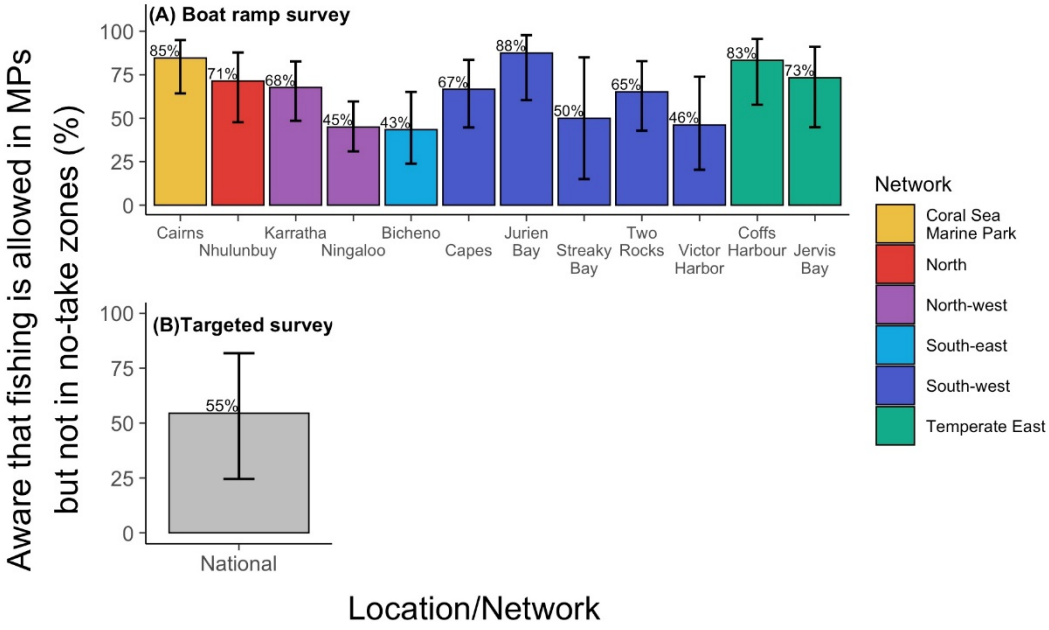

Figure 27. Non-extractive recreational users' awareness that fishing is allowed in some parts of marine parks (MPs), but not in no-take zones (National Park Zones in the Australian Marine Parks) for: (A) the boat ramp survey and (B) the targeted survey.

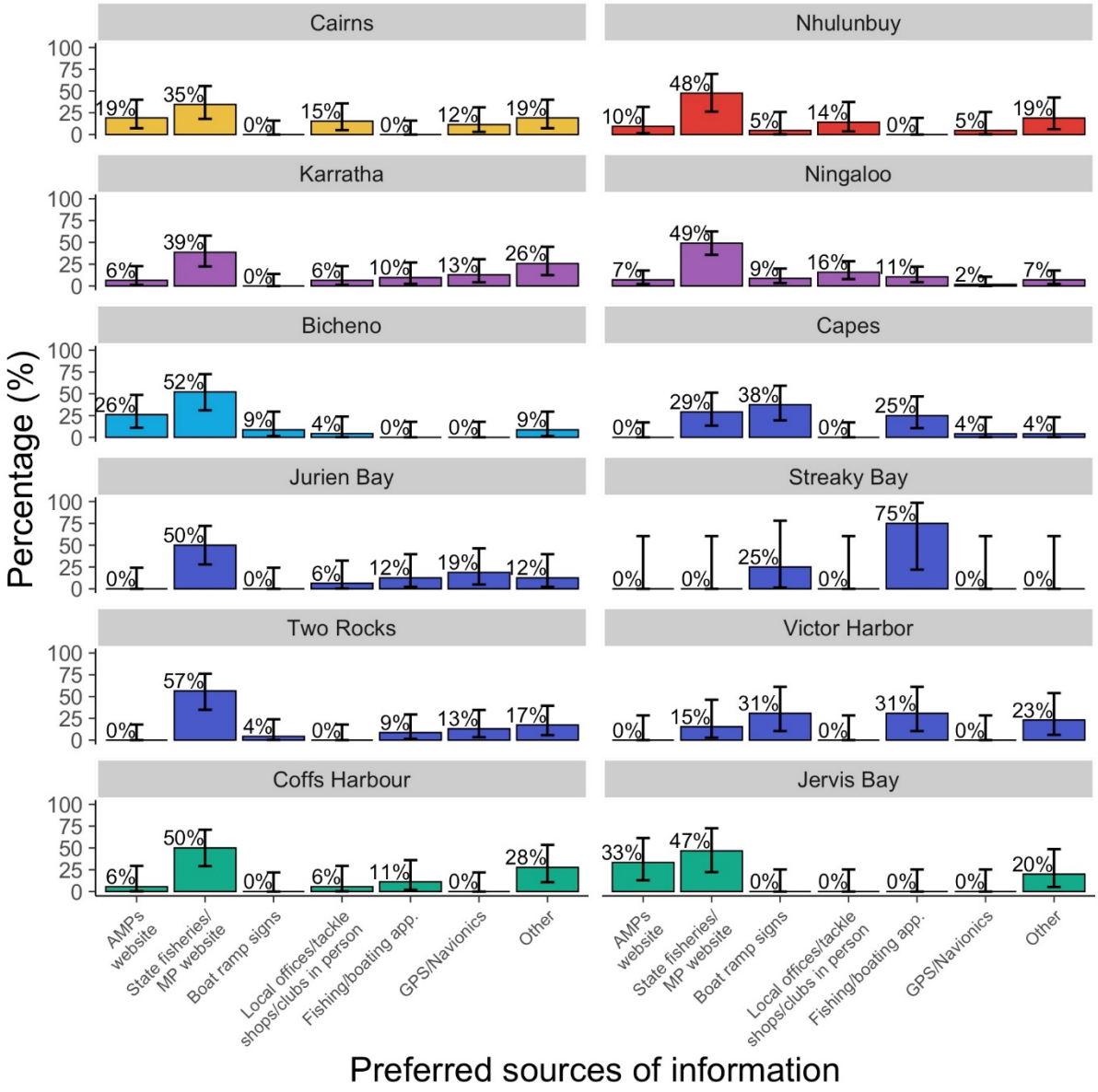

Figure 28. Preferred methods for being informed about the Australian Marine Parks amongst non-extractive recreational users in the boat ramp survey.

Supplementary figures (See Appendix):

- Figure 64. Non-extractive recreational users' stated awareness of an Australian Marine Park (AMP). In the boat ramp survey (A) this was awareness of an AMP in the boat ramp survey location, whilst in the targeted survey (B) this was awareness of an AMP in the region the respondent operated in most frequently.

- Figure 65. Percentage of non-extractive recreational users able to name an Australian Marine Park (AMP). In the boat ramp survey (A) this was ability to name of an Australian Marine Park in the boat ramp survey location, whilst in the targeted survey (B) this was ability to name an Australian Marine Park in the region the respondent operates in most frequently.

- Figure 66. Non-extractive recreational users' stated awareness of a state marine park. In the boat ramp survey (A) this was awareness of a state marine park in the boat ramp survey location, whilst in the targeted survey (B) this was awareness of a state marine park in the region the respondent operated in most frequently. This question was not asked in Nhulunbuy or Karratha due to a lack of adjacent state marine parks.

- Figure 67. Percentage of non-extractive recreational users able to name a state marine park. In the boat ramp survey (A) this was ability to name a state marine park in the boat ramp survey location, whilst in the targeted survey (B) this was ability to name a state marine park in the region they operate in most frequently. This question was not asked in Nhulunbuy or Karratha due to a lack of adjacent state marine parks.

- Figure 68. Non-extractive recreational users preferred sources of information about the Australian Marine Parks in the general public survey.

3.2.4 Charter operators

Averaging across the six networks, 80% of respondents indicated being aware of the AMPs (Figure 29)[8]. No significant differences in awareness were detected across networks (X^2 = 6.7, p-value = 0.2 and see Figure 69 for confidence intervals).

Spatial Scale	Sample Size	Has heard of AMPs	Is familiar with the location of Commonwealth NPZs	Tested awareness of rules for Charter fishing	Tested awarness of rules for transiting with fishing gear	Tested awareness of Eco-tourism rules
Network						
Coral Sea Marine Park	12	92	83	55	70	60
North	4	75	25	0	25	50
North-west	11	100	27	33	67	73
South-east	9	67	11	20	17	100
South-west	11	64	45	0	0	44
Temperate East	13	77	23	17	22	67
National	60	80	38	25	39	65

Figure 29. Summary table showing charter operators awareness of the Australian Marine Parks (AMPs) and related management. Familiarity of location of Commonwealth NPZs refers to respondents who stated being very of extremely familiar with NPZ locations.

When asked to rate their familiarity with the location of the NPZs in the sub-network they operate most in, 17% indicated being not familiar at all, 28% being somewhat familiar and 17% indicated being moderately familiar. A total of 38% were very or extremely familiar with the location of NPZs (Figure 29 and see Figure 71 for confidence intervals)[9]. No significant differences were found across networks (*KW* = 11, p-value = 0.05). The most frequently cited

[8] Note that the question format here differed from the other surveys. Here respondents were provided information about the AMPs and asked if they had learnt anything new. Those not selecting "Yes, I did not know about the Australian Marine Parks" were assumed to be aware of the AMPs. This may over-estimate awareness.
[9] Note that not all charter operators operated inside the AMPs.

method for identifying the locations of NPZs when on the water amongst charter operators was GPS (76%) followed by remembering their location (32%) and paper maps (24%, Figure 72).

Charter operator's awareness of activities allowable in different zones of the AMPs was tested, with 25% of charter operators correctly identifying that charter fishing is allowable in Habitat Protection Zones (HPZs), Multiple Use Zones (MUZs) and Special Purpose Zones (SPZs, Figure 29). A total of 39% correctly identified that charter vessels can transit through all zones[10] provided fishing gear is stowed (Figure 29), and 65% correctly identified that eco-tourism is allowable in all zones (Figure 29). Note that in general, charter operators were erring on the side of caution in their responses. For example, just one respondent suggested that charter fishing was allowable in NPZs. No significant differences were found in any aspect of the tested awareness of activities allowable across networks (Figure 29 and see Figure 70 for confidence intervals).

When asked how they would prefer to be informed about the management of the AMPs, the overwhelming response from charter operators was via email (72%), with some preference also for brochures (31%, Figure 30).

[10] Sanctuary Zones of the AMPs were not included in the test.

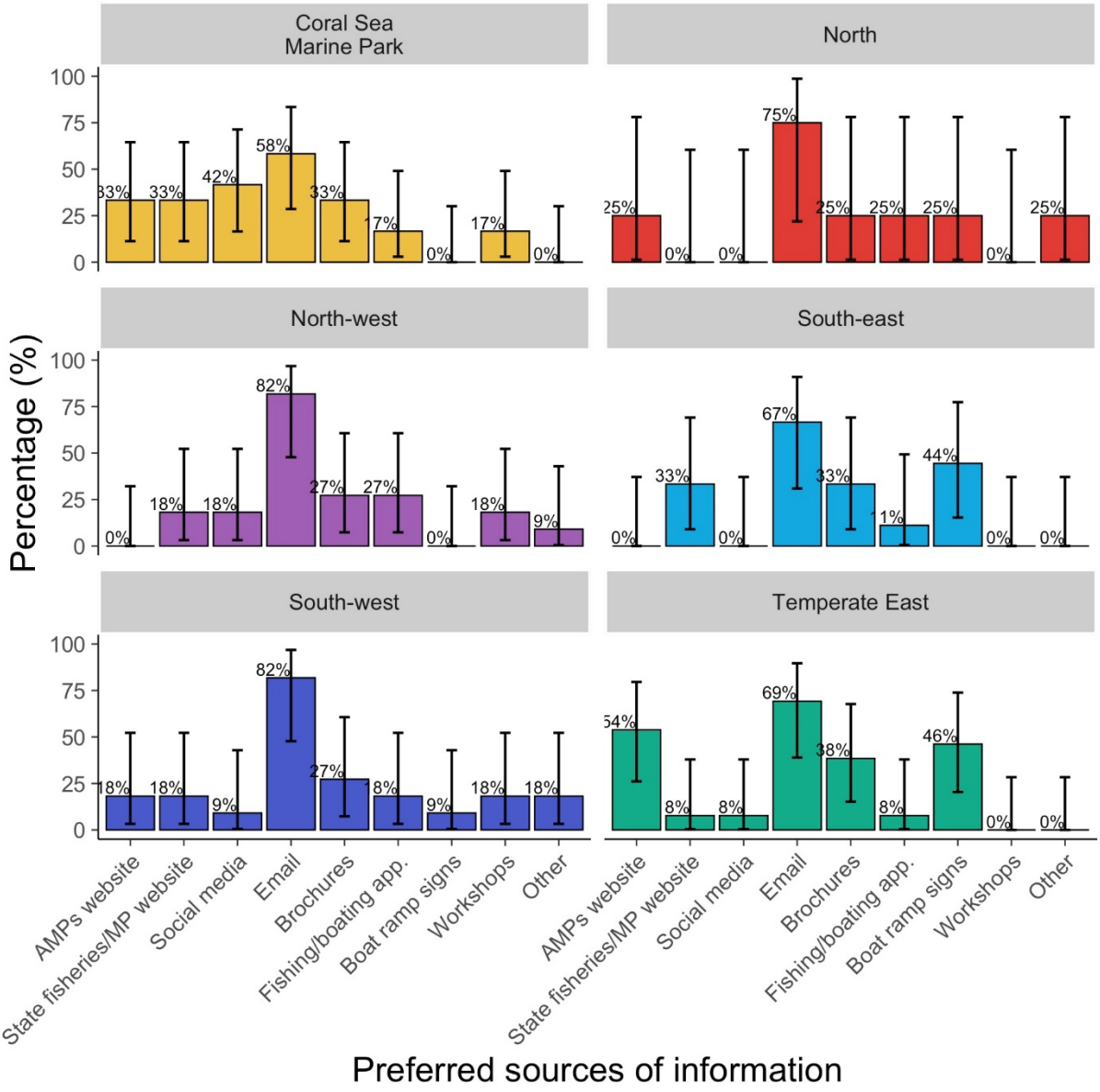

Figure 30. Preferred methods for informing charter operators about the Australian Marine Parks.

Supplementary figures (See Appendix):

- Figure 69. Charter operator stated awareness of the Australian Marine Parks.
- Figure 70. Tests of awareness of the activities allowable in different Australian Marine Parks.
- Figure 71. Charter operator's stated familiarity with the location of National Park Zones in the Australian Marine Parks.
- Figure 72. Method used by charter operators to remember the location of National Park Zones in the Australian Marine Parks.
- Figure 73. Knowledge gaps of charter operators about the Australian Marine Parks.

3.3 Use

3.3.1 Recreational fishers

Surveys

Each recreational fisher in the surveys reported use patterns for a subset of their fishing trips in the last 12 months using various mapping exercises (see methods for details). For recreational fishers in the boat ramp survey, use patterns for fishing trips in the survey location were reported corresponding to 16,000 fishing trips across survey locations (Figure 31). For the general public survey and targeted survey, use patterns were recorded for respondent's fishing trips to all locations in which AMPs occur (Figure 3)[11]. This included use patterns for 2,000 trips in the general public survey and 361 in the targeted survey (Figure 31).

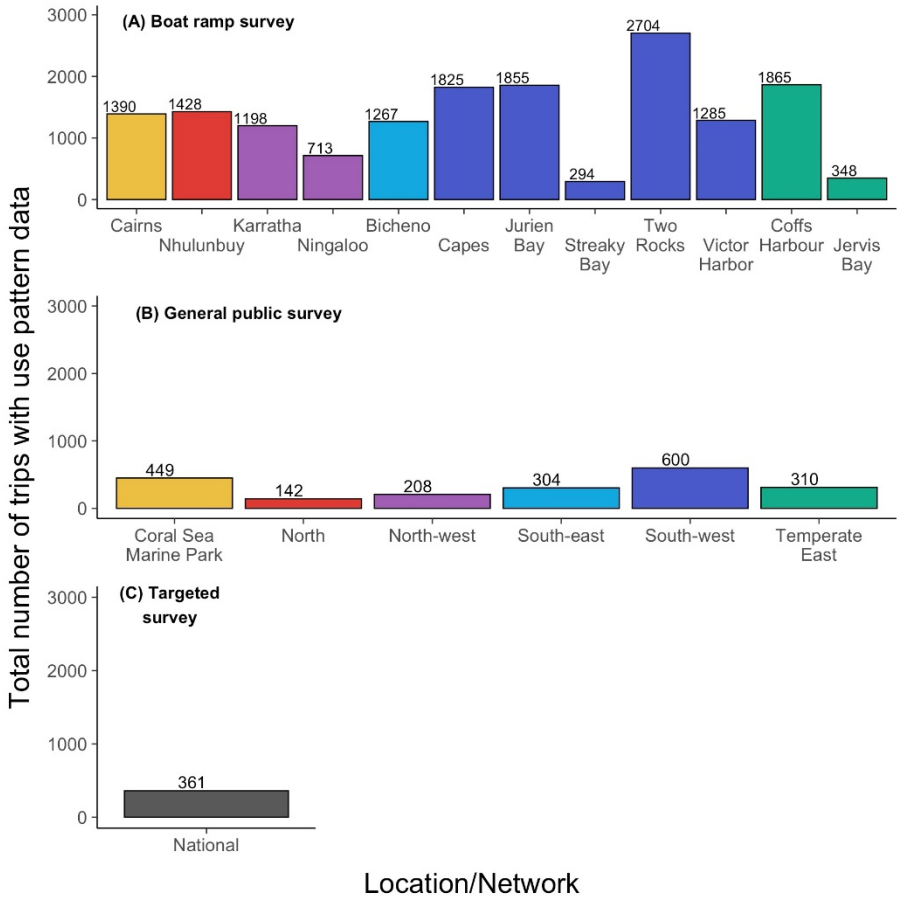

Figure 31. Number of trips for which use pattern data was reported in: (A) the boat ramp survey, (B) the general public survey and (C) the targeted survey. Note that in the boat ramp survey fishers reported use patterns for trips in the last 12 months in the survey location. In the general public and targeted surveys, fishers reported use patterns for trips in the last 12 months to any of the locations where AMPs occur.

[11] The difference between the total number of trips in which location details are reported, and the annual avidity of fishers is due to trips taken between locations where AMPs occur as defined in Figure 3.

The mapping exercises were designed to provide an indication of the proportion of fishing trips in various locations that occur within the AMPs. For the boat ramp survey, on average across locations, 22% of recreational fishing trips occurred inside the AMPs (Figure 32). This proportion differed significantly across locations (X^2 = 108, p-value < 0.001). The highest proportion of trips in the AMPs occurred in Ningaloo (44%) and Jurien Bay (36%). Lowest trip proportions in the AMPs were recorded in Cairns (1%) and Nhulunbuy (3%).

For the general public survey, 21% of fishing trips in locations with AMPs (Figure 3) occurred inside the AMPs (Figure 32). No significant differences were detected across networks (X^2 = 4, p-value = 0.5). For the targeted survey 8% of fishing trips in locations with AMPs occurred inside the AMPs (Figure 32).

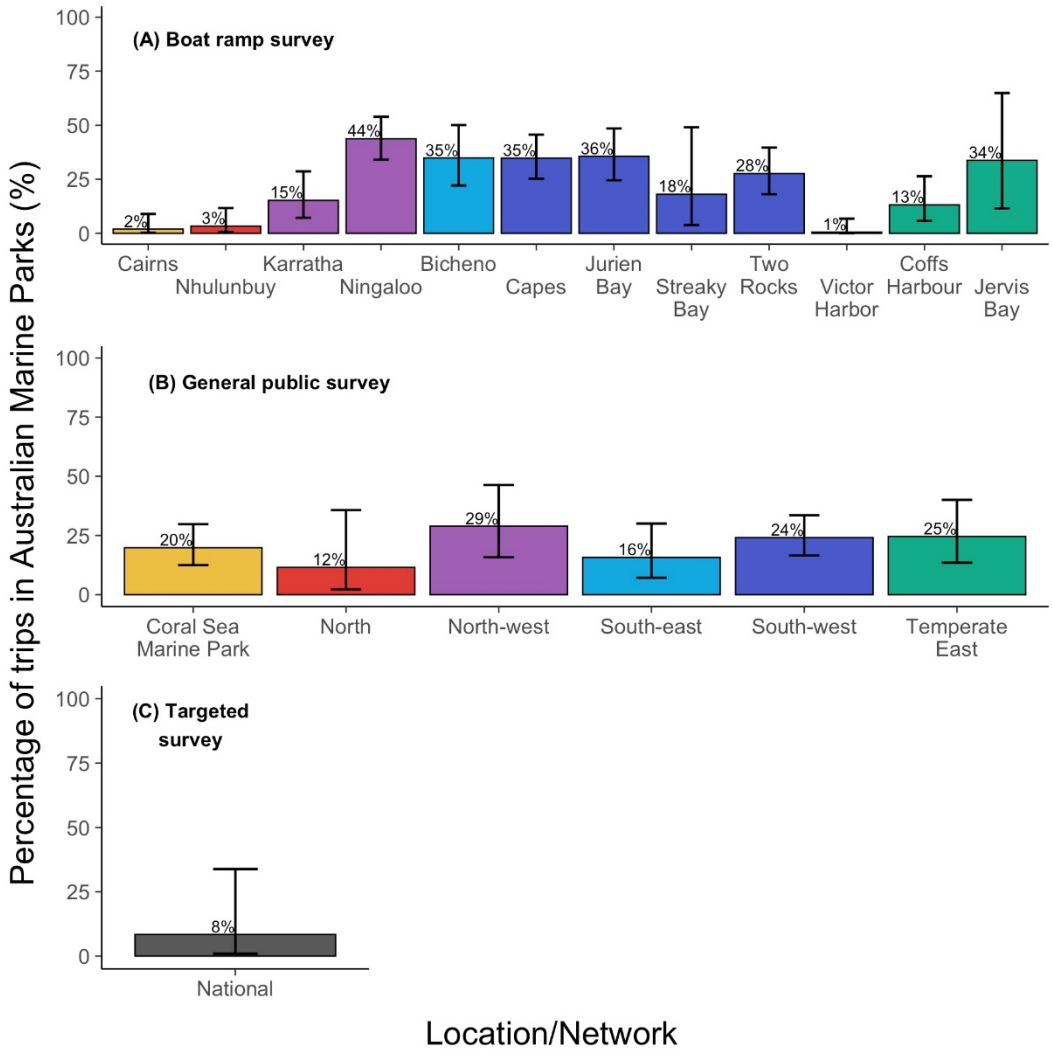

Figure 32. Percentage of recreational fishing trips inside the Australian Marine parks (AMPs). For the boat ramp survey (A) this is the percentage of the trips in the survey location that were inside the AMPs. For the general public (B) and targeted survey (C) this is the percentage of trips inside the AMPs in the 39 locations where AMPs occur. This is not the percentage of recreational fishing trips in Australia that were in the AMPs.

National model of recreational fishing

The national models of recreational fishing estimate the number of boat-based line fishing in a spatial grid around Australia. Importantly, unlike the boat ramp surveys, trip numbers are

scaled to national estimates (rather than being a proportion in sample). In total, the locations of 5.7 million boat-based line fishing trips estimated to occur each year in Australia were allocated to a grid.

For reporting purposes, we discuss the y = 0 model which assumes no competition for people across adjacent boat ramps. We suggest using this model for reporting purposes. Based on the WA-based y0 model, between 11 and 25 thousand trips occur within the AMPs each year, roughly 0.3% of all boat-based line fishing trips. The greatest numbers of these trips occurred in the Temperate East (4,200 CI: 2,800 – 6,000), South-west networks (5,500 CI: 4,200 – 7,000) and South-east network (4,900 CI: 2,200 – 8000). Very few trips were predicted to occur in the Coral Sea Marine Park (0) or North Network (360 CI: 200 – 550, Figure 33).

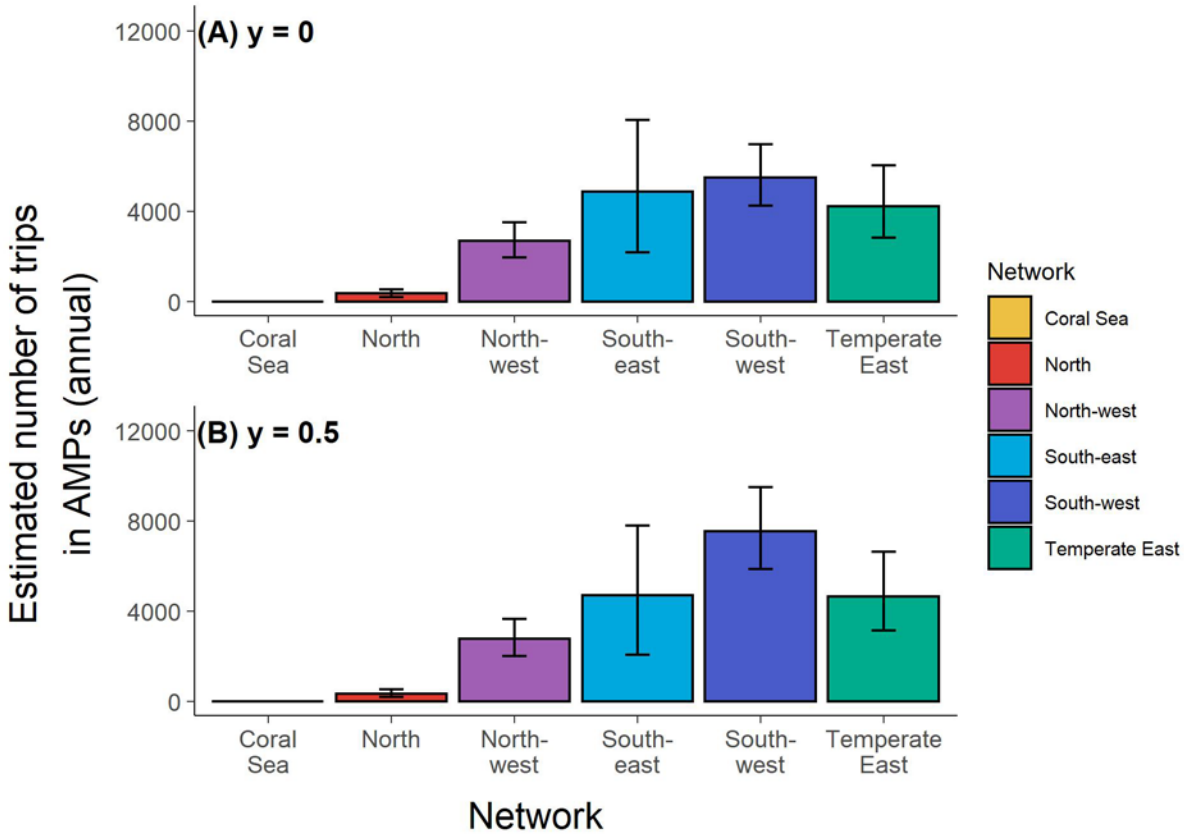

Figure 33. Estimated number of recreational boat-based line fishing trips in the Australian Marine Parks using the WA-based national recreational fishing models. (A) shows scenario with no competition between adjacent ramps (WA-based y0) and (B) allows for intermediate levels of competition between adjacent ramps (WA-based y0.5).

Figure 34 shows the estimated number of trips for the eight marine parks in the AMPs estimated to have the highest level of use based on the WA-based y0 model. Marine Parks estimated to have the highest numbers of trips include Murray Marine Park (3,000 CI: 1,400 – 4,800), Two Rocks Marine Park (2,300 CI: 1,900 – 2,700), Solitary Islands Marine Park (2,300 CI: 1,600 – 3,000) and Hunter Marine Park (2,000 CI: 1,200 – 2,900).

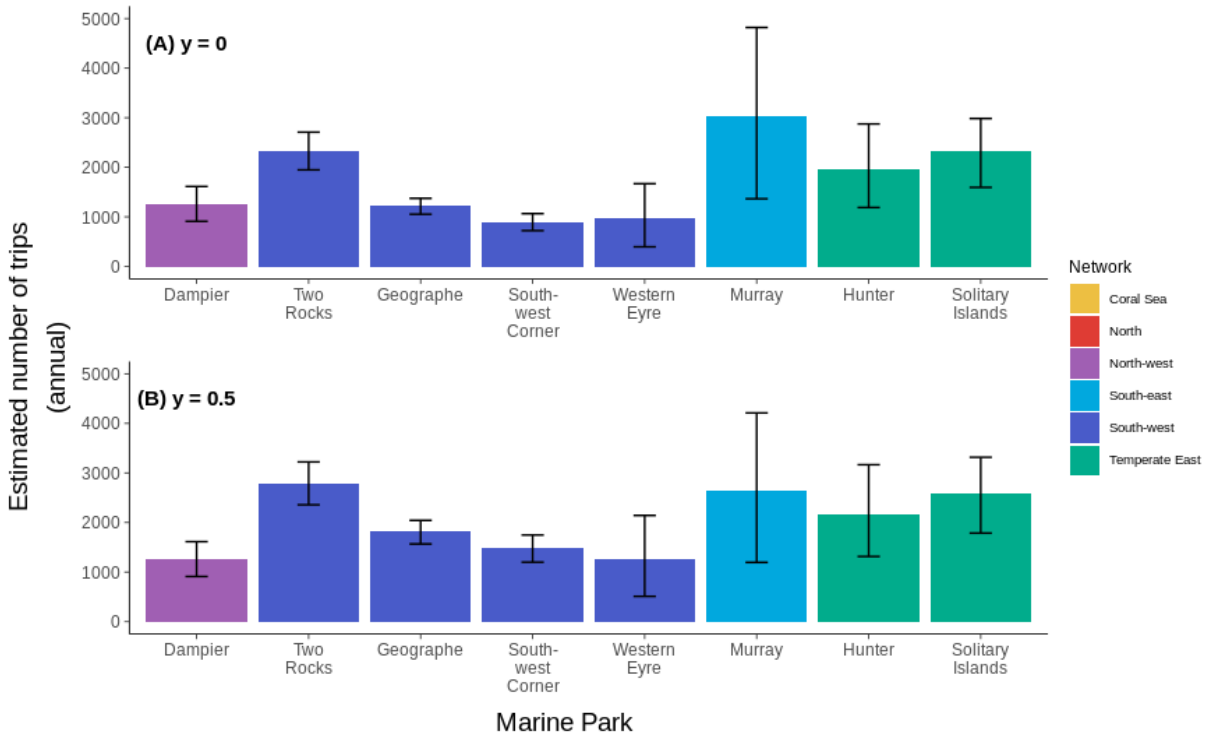

Figure 34. Estimated number of recreational boat-based line fishing trips in high use Australian Marine Parks using the WA-based national recreational fishing models. (A) shows scenario with no competition between adjacent ramps (WA-based y0) and (B) allows for intermediate levels of competition between adjacent ramps (WA-based y0.5).

Figure 35 shows gridded maps of trip predictions for four key locations based on the WA-based y0 model. The maps highlight that use patterns are strongly governed by access points. This is indicative of the role that the travel cost parameter in the utility functions plays in explaining site choice. The figures also highlight some limitations of the modelling approach. In particular, the model appears to be under-estimating the number of trips occurring in Ningaloo Marine Park (Commonwealth). The relatively low numbers of trips predicted in Ningaloo Marine Park (Commonwealth) is likely a result of trips being allocated to the Exmouth's town boat ramp rather than ramps on the West Coast (Tantabiddi and Bundegi). The allocation of trips to ramps is based solely on population density. Pull factors that might exist in a particular example, in this case the proximity to the Ningaloo Reef, are not captured in the boat ramp choice. As such, our national model appears to under-estimate the number of trips occurring in Ningaloo Marine Park (Commonwealth).

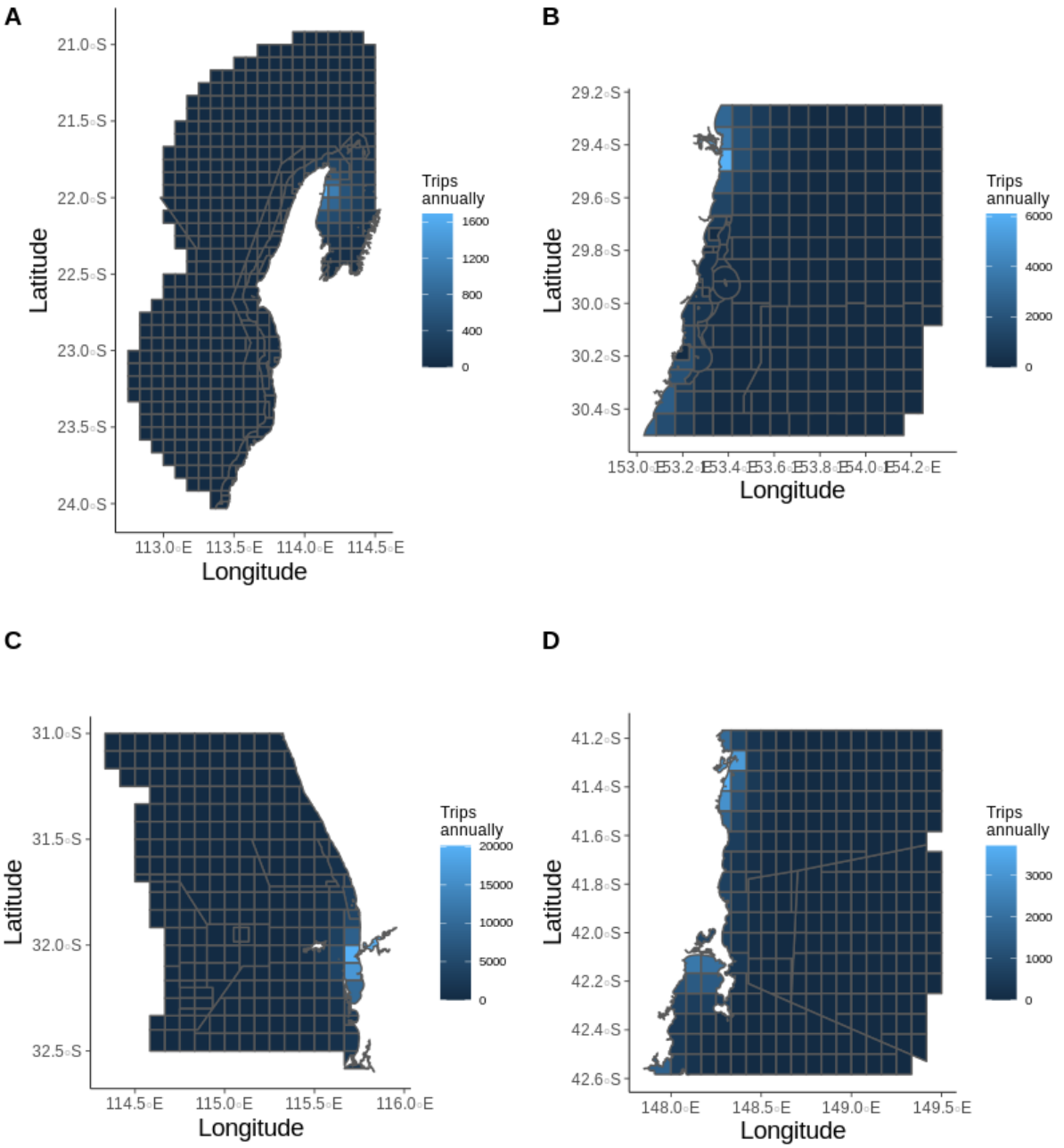

Figure 35. Estimated numbers of trips on gridded map for key locations using WA-based national recreational fishing models with no competition between adjacent ramps (WA-based y0). A: Ningaloo, B: Coffs Harbour, C: Perth, D: Bicheno.

3.3.2 Non-extractive recreational users

As collection of spatial use patterns for recreational fishers was prioritised, less data was collected on use patterns of non-extractive recreational users. This was especially the case for the boat ramp survey where most respondents had fished in the location in the last 12 months, and so spatial use patterns were only recorded for 23 non-extractive trips (Figure 36). More data was available from the general public and targeted surveys, with use patterns from 1,370 and 361 non-extractive trips, respectively.

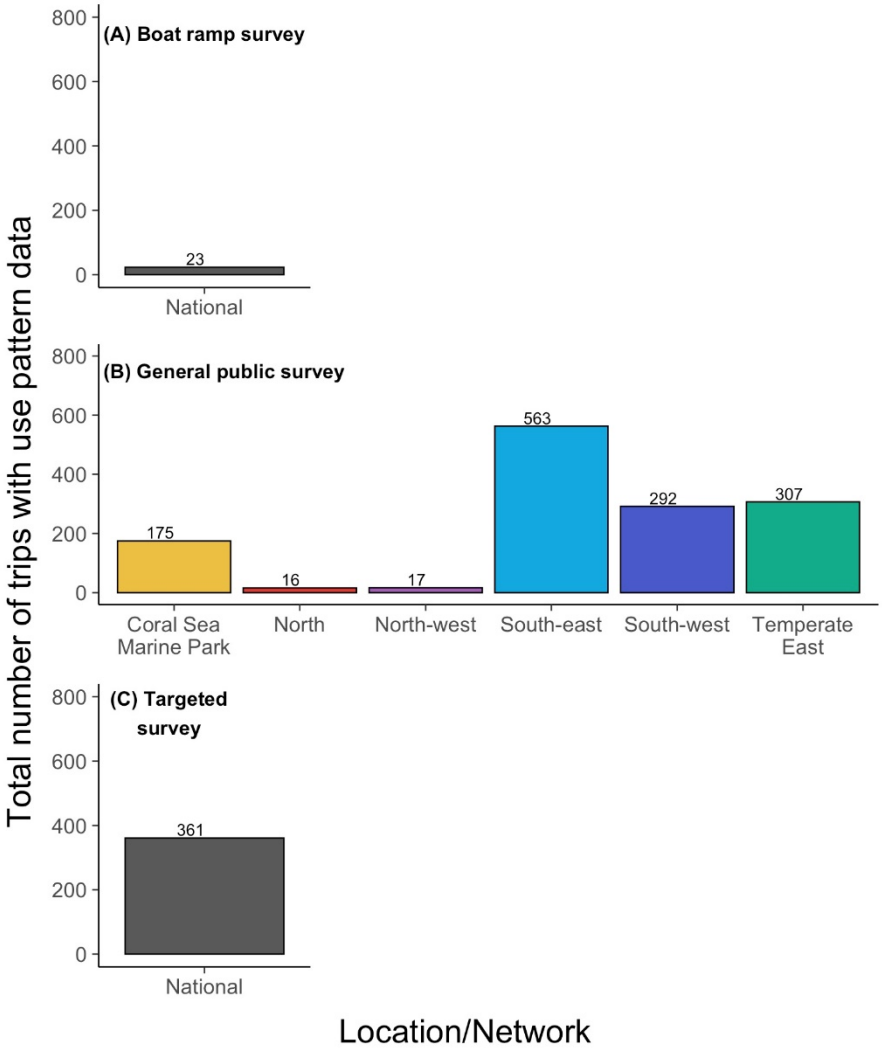

Figure 36. Number of trips for which use pattern data was reported in: (A) the boat ramp survey, (B) the general public survey and (C) the targeted survey. Note that in the boat ramp survey non-extractive recreational users reported use patterns for trips in the last 12 months in the survey location. In the general public and targeted surveys, non-extractive recreational users reported use patterns for trips in the last 12 months to any of the locations where AMPs occur.

The mapping exercises were designed to provide an indication of the proportion of non-extractive recreational trips in various locations that occur within the AMPs. None of the 23 non-extractive trips from the boat ramp survey occurred within the AMPs (Figure 37). For the general public survey 15% of non-extractive trips occurred in the AMPs, somewhat less than the 21% of fishing trips in locations with AMPs (Figure 37). No significant differences were detected in the proportion of non-extractive trips in the AMPs across networks (X^2 = 7.5, p-

value = 0.2). For the targeted survey 8% of non-extractive trips in locations with AMPs occurred inside the AMPs (Figure 37).

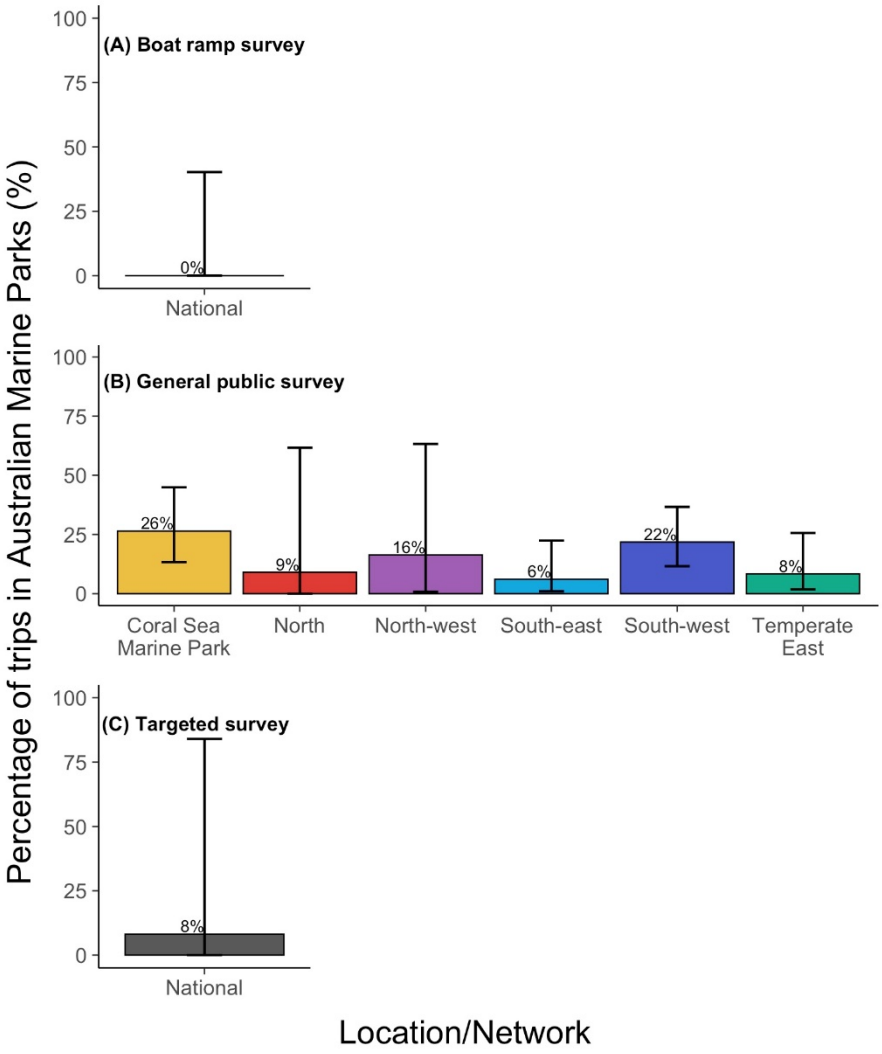

Figure 37. Percentage of non-extractive recreational user trips inside the Australian Marine parks (AMPs). For the boat ramp survey (A) this is the percentage of the trips in the survey location that were inside the AMPs. For the general public (B) and targeted survey (C) this is the percentage of trips inside the AMPs in the 39 locations where AMPs occur. This is not the percentage of trips in Australia that were in the AMPs.

3.3.3 Charter operators

Charter operators were asked to record the percentage of their 2019 trips that occurred within the AMPs of the region they operated in most in 2019. On average across operators, 25% of charter client-trips[12] occurred inside the AMPs (Figure 38). The highest proportion of client-trips in the AMPs were reported in the Coral Sea Marine Park (45%) and North-west networks (50%). The wide confidence intervals on these estimates signal the variability in responses and relatively low sample sizes. No significant differences were detected across networks (X^2 = 0.08, p-value = 1). Charter operators on average reported that 25% of their fishing trips and 23% of their non-extractive trips occurred inside the AMPs. No significant differences were

[12] Client-trips were defined as individual fare paying customers.

detected across networks (Fishing trips: X^2 = 0.06, p-value = 1, Non-extractive trips: X^2 = 0.03, p-value = 1, Figure 38).

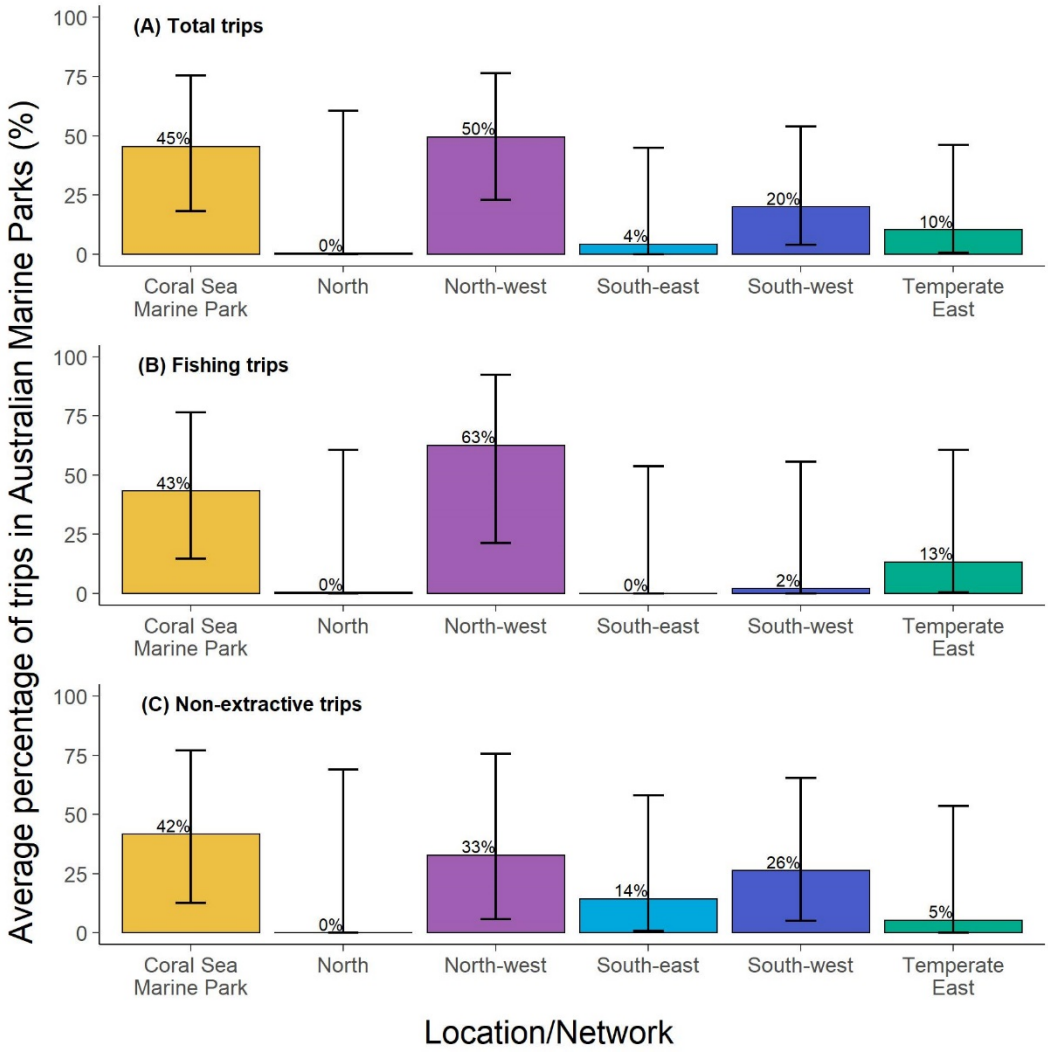

Figure 38. Average percentage of trips by each operator in the Australian Marine Parks (AMPs). Note that the average percentage of total trips reported in the AMPs can be higher than the corresponding percentages for both fishing trips and non-extractive trips when operators that only conduct fishing or non-extractive trips (not both) have high proportions of their trips in the AMPs.

3.4 Attitudes and perceptions

3.4.1 General public

The general public were generally supportive of the various zones in the AMPs. Averaging across networks, 75% reported being supportive of the National Park Zones (NPZs), 78% reported being supportive of the Habitat Protection Zones (HPZs), and 65% were supportive of the Multiple Use Zones (MUZs, Figure 39)[13]. No significant differences were found in the

[13] Note that in the general public survey Habitat Protection Zones included Recreational Use Zones, and Multiple Use Zones included Special Purpose Zones.

general publics' support for any of these zones across the networks (NPZs: Figure 74, HPZs: Figure 75, MUZs: Figure 76).

Spatial scale	Sample size	Supportive of Commonwealth NPZs (%)	Supportive of Commonwealth HPZs (%)	Supportive of Commonwealth MUZs (%)	Commonwealth NTZs benefit the environment (%)
Network					
Coral Sea Marine Park	538	75	76	65	82
North	116	76	83	65	85
North-west	27	74	70	63	70
South-east	774	76	79	64	81
South-west	768	76	81	68	82
Temperate East	803	75	79	63	80
National	3026	75	78	65	80

Figure 39. Summary table showing the general publics' attitudes and perceptions towards zones in the Australian Marine Parks (AMPs).

The general public also had positive views about the ability of zones in the AMPs to improve the health of marine ecosystems.[14] Averaging across networks, 80% reported that the NPZs would improve the health of marine ecosystems, 78% reported the same of the HPZs, and 59% for the MUZs. No significant differences were found across the networks (NPZs: Figure 77, HPZs: Figure 78, MUZs: Figure 79).

Presented with the AMPs as a whole, 64% reported that the zoning is well balanced between conservation and sustainable use, 28% report that there is not enough protection in the AMPs, and 8% report that the zoning is too restrictive (Figure 40). No significant differences were found in response across the networks (X^2 = 16, p-value = 0.08). Respondents were then asked for the main way in which they valued the AMPs. The most frequent response was for conservation of marine ecosystems for future generations (42%) and conservation of marine ecosystems for intrinsic reasons (28%, Figure 41). Some significant differences were found across the networks (X^2 = 44, p-value = 0.01). These differences were minor, and likely relate to higher value placed on the AMPs for improving recreational fishing experiences in the Coral Sea Marine Park, and North and North-west networks relative to the other networks (Figure 41).

[14] Marine ecosystems were defined as including marine plants and animals, their habitats, and their interactions.

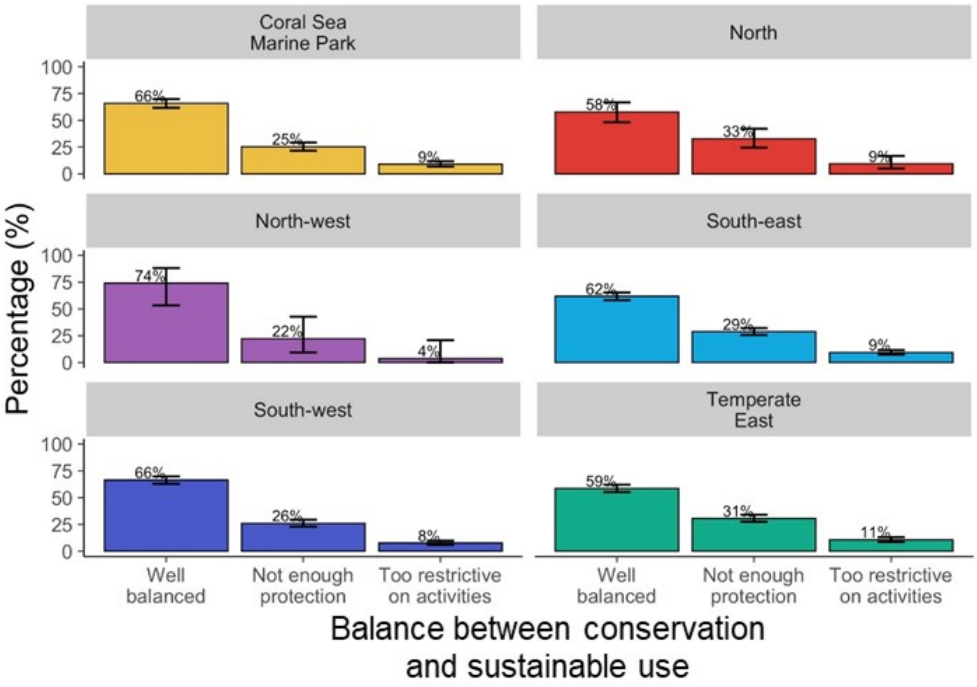

Figure 40. Perceptions about the balance between conservation and sustainable use in the zoning of the Australian Marine Parks (AMPs) amongst the general public.

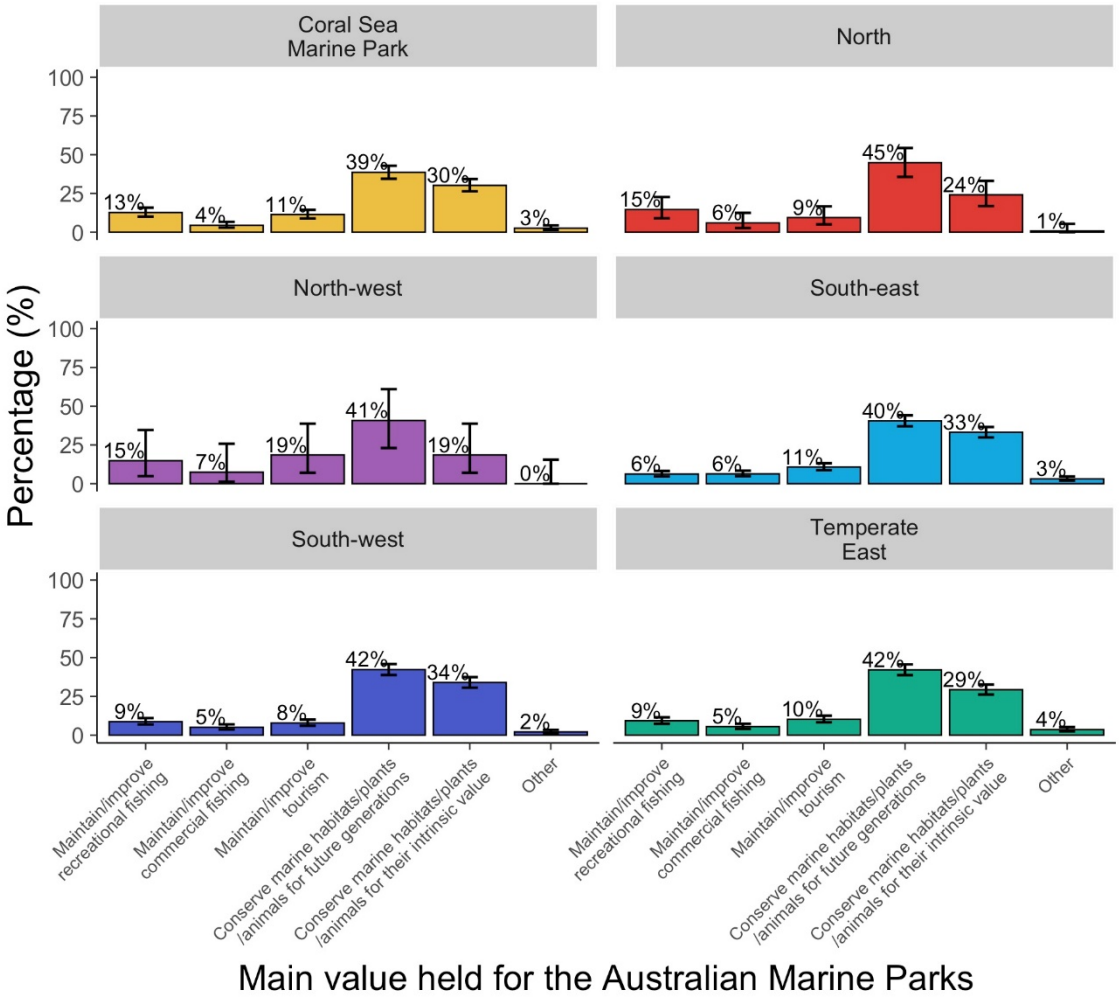

Figure 41. Main value held for the Australian Marine Parks amongst the general public.

Supplementary figures (See Appendix):

- Figure 74. Support of the general public for the National Park Zones in the Australian Marine Parks.
- Figure 75. Support of the general public for the Habitat Protection Zones in the Australian Marine Parks. Note that for simplicity, in the general public survey this included Habitat Protection Zones and Recreational Use Zones.
- Figure 76. Support of the general public for the Multiple Use Zones in the Australian Marine Parks. Note that for simplicity, in the general public survey this included Special Purpose Zones and Multiple Use Zones.
- Figure 77. Perceived effect of the National Park Zones in the Australian Marine Parks on the health of marine ecosystems (defined as marine plants, animals, habitats, and their interactions).

- Figure 78. Perceived effect of the Habitat Protection Zones in the Australian Marine Parks on the health of marine ecosystems (defined as marine plants, animals, habitats, and their interactions). Note that for simplicity, in the general public survey this included Habitat Protection Zones and Recreational Use Zones.

- Figure 79. Perceived effect of the Multiple Use Zones in the Australian Marine Parks on the health of marine ecosystems (defined as marine plants, animals, habitats, and their interactions). Note that for simplicity, in the general public survey this included Special Purpose Zones and Multiple Use Zones.

- Figure 80. General public perceptions about whether marine ecosystems are better, the same or worse than ten years ago.

- Figure 81. General public perceptions about whether marine ecosystems will be better, the same or worse in ten years.

3.4.2 Recreational fishers

Recreational fishers were generally supportive of the NPZs in the AMPs (Figure 42). Support for Commonwealth NPZs was measured at 80% of recreational fishers in the boat ramp survey, 83% in the general public survey and 50% in the targeted survey[15] (Figure 42 and see

Figure 82, Figure 83 and Figure 84 for confidence intervals). Significant differences in support for NPZs were found across locations in the boat ramp survey (*KW* = 33, p-value > 0.001). Highest levels of support for NPZs were found in Bicheno (96%), Ningaloo (91%) and Cairns (86%) and lowest levels of support were found in Jurien Bay (56%) and Capes (69%). Interestingly, lower levels of support in these regions are due to relatively high neutrality (35% in Jurien Bay and 25% in Capes) rather than opposition to the NPZs (Figure 82).

[15] Fishers in the boat ramp survey were asked for perceptions around the AMP zones in the survey location, fishers in the targeted survey were asked about AMP zones in the sub-network (Figure 3) where they fish most in the last 12 months, while general public fishers reflected on the AMP zones nationally.

Spatial scale		Sample size	Supportive of State NTRs	Supportive of Commonwealth NPZs	Supportive of Commonwealth HPZs	Supportive of Commonwealth SPZs	Supportive of Commonwealth RUZs	Supportive of Commonwealth MUZs	Commonwealth NPZs benefit the environment	Commonwealth NPZs negatively effect my fishing
Location										
Cairns	◣	82	89	86	86				85	1
Nhulunbuy	◣	71			89					
Karratha	◣	55	93					92		
Ningaloo	◣	106	93	91			95		85	3
Bicheno	◣	50	100	96			92		88	0
Capes	◣	97	68	69	87				85	4
Jurien Bay	◣	93	73	56		32			46	1
Streaky Bay	◣	19	89	84		67			14	14
Two Rocks	◣	94	87	82					85	5
Victor Harbor	◣	92	83					67		
Coffs Harbour	◣	60	70	78					87	2
Network										
Jervis Bay	◣	38	79		92	81				
Coral Sea Marine Park	◣	82	89	86	86				85	1
Coral Sea Marine Park	■	114		83	82			77	91	16
North	◣	71			89					
North	■	34		88	94			85	91	9
North-west	◣	161	93	91			95	92	85	3
North-west	■	10		90	90			70	90	10
South-east	◣	50	100	96			92		88	0
South-east	■	67		82	79			76	84	8
South-west	◣	395	80	73	87	50		67	58	6
South-west	■	116		69	73			72	77	9
Temperate East	◣	98	74	78	92	81			87	2
Temperate East	■	69		83	84			72	86	9
National	◣	857	84	80	88	60	94	80	72	4
National	■	410		83	84			76	86	10
National	◉	16	67	50	69	50		75	71	15

Figure 42. Summary table showing recreational fishers' attitudes and perceptions towards zones in the Australian Marine Parks (AMPs) and no-take marine reserves (NTR's) in state waters. ◣ indicates the boat ramp survey, ■ indicates the general public survey and ◉ indicates the targeted survey.

As a point of comparison, recreational fishers' support for no-take marine reserves in state waters (which have similar rules to NPZs in the AMPs) was also recorded where relevant. A total of 84% of recreational fishers in the boat ramp survey and 67% in the targeted survey reported supporting state no-take marine reserves (Figure 42 and see Figure 85 and Figure 86 for confidence intervals). Overall, recreational fishers support for NPZs in the AMPs appears to be relatively similar to their support for state no-take marine reserves.

Support for other zone types in the AMPs was also recorded. Support for the HPZs was measured at 88% in the boat ramp survey, 84% in the general public survey and 69% in the targeted survey (Figure 42 and see Figure 87 and Figure 88 for confidence intervals). No significant differences were found in support for HPZs across boat ramp locations ($KW = 4$, $p = 0.3$). Support for MUZs was measured at 80% in the boat ramp survey, 76% in the general public survey and 75% in the targeted survey with some significant difference across boat ramp locations ($KW = 17$, $p > 0.001$, Figure 42 and see Figure 89 and Figure 90 for confidence intervals). Support for Recreational Use Zones (RUZs) was measured at 94% in the boat ramp survey, with some differences across locations ($KW = 24$, $p < 0.001$, Figure 42 and see Figure 91 for confidence intervals). Support for SPZs was measured at 60% in the boat ramps surveys and 50% in the targeted survey. Some significant differences were detected across boat ramp locations ($KW = 13$, $p > 0.001$, Figure 42 and see Figure 92 for confidence intervals).

Recreational fishers were also asked for their perceptions about how these zones would affect marine environments. For the NPZs, 72% of fishers in the boat ramp survey, 86% in the general public survey and 71% in the targeted survey believed the NPZs would improve the health of marine environments (Figure 42 and see Figure 93, Figure 94 and Figure 95 for confidence intervals). Significant differences occurred across locations in the boat ramp survey ($KW = 72$, $p < 0.001$), most notably with high levels of fishers in Jurien Bay (54%) and Streaky Bay (86%) who perceived that the NPZs would have no effect on the marine environment.

Generally similar results were found for state no-take marine reserves, with 73% of fishers in the boat ramp survey and 79% in the targeted survey reporting benefits for the marine environment (Figure 96 and Figure 97). Significant differences were found across locations in the boat ramp survey ($KW = 172$, $p < 0.001$), this time likely due to a large portion of respondents in Victor Harbor and Streaky Bay reporting that the state no-take zones would have no effect on the marine environment (77% and 94%).

For HPZs, 93% of fishers in the boat ramp survey, 86% in the general public survey and 77% in the targeted survey reported positive effects of HPZs on the marine environment (Figure 98 and Figure 99). No significant differences were found across boat ramp locations ($KW = 4$, $p = 0.2$). For MUZs, 48% of fishers in the boat ramp survey, 72% in the general public survey and 42% in the targeted survey perceived environmental benefits (Figure 100 and Figure 101). For RUZs, 81% of respondents to the boat ramp survey perceived environmental benefits (Figure 102). Finally, for SPZs, 44% of fishers in the boat ramp survey and 42% in the targeted survey perceived environmental benefits (Figure 103).

Overwhelmingly when asked about impacts of AMP zones on their fishing, most fishers perceived no, or positive impact, with very few reporting negative impacts. For NPZs, 82% of fishers in the boat ramp survey, 45% in the general public and 62% in the targeted survey reported no-impacts of NPZs on their fishing (Figure 42 and see Figure 104, Figure 105 and Figure 106 for confidence intervals). For the general public survey 45% of fishers indicated that the NPZs would benefit their fishing. Significant differences were found in responses across boat ramp survey locations ($KW = 70$, $p < 0.001$).

For state no-take marine reserves, 71% of fishers in the boat ramp survey and 80% in the targeted survey reported no impacts on their fishing (Figure 107 and Figure 108). Significant differences were found across boat ramp survey locations ($KW = 107$, $p < 0.001$). These results suggest that state no-take marine reserves and Commonwealth NPZs are broadly comparable in terms of perceived fishing impacts.

For HPZs, 57% of fishers in the boat ramp survey, 47% in the general public survey and 58% in the targeted survey perceived no impacts on their fishing (Figure 109 and Figure 110). Positive fishing impacts of HPZs were found for 43% of fishers in the boat ramp survey, 50% of fishers in the general public survey and 33% in the targeted survey. Significant differences were found across boat ramp survey locations ($KW = 89$, $p < 0.001$). For MUZs, 94% of fishers in the boat ramp, 39% in the general public and 73% in the targeted survey perceived no impacts on their fishing (Figure 111 and Figure 112). A further 55% of fishers in the general public survey perceived that MUZs would improve their fishing. No significant differences were found across boat ramp survey locations ($KW = 0.4$, $p = 0.5$). For RUZs, 47% of fishers in the boat ramp survey perceived no impacts whilst 52% perceived positive fishing impacts (Figure 113). Significant differences were found across locations ($KW = 19$, $p < 0.001$). For SPZs, 79% of fishers in the boat ramp survey and 73% in the targeted survey perceived no impacts on their fishing Figure 114.

Supplementary figures (See Appendix):

- Recreational fishers' support for AMP zones and state no-take marine reserves: Figure 82 to Figure 92
- Recreational fishers' beliefs about the impacts of AMP zones and state no-take marine reserves on the marine environment: Figure 93 to Figure 103.
- Recreational fishers' beliefs about the impacts of AMP zones and state no-take marine reserves on their fishing: Figure 104 to Figure 114.

3.4.3 Non-extractive recreational users

Nationally, most non-extractive recreational users reported supporting the NPZs in the AMPs. This included 86% of non-extractive users in the boat ramp survey, 80% in the general public survey and 80% in the targeted survey[16] (Figure 43 and see Figure 115, Figure 116 and Figure 117 for confidence intervals). Significant differences in support for NPZs were found across locations in the boat ramp survey (*KW* = 19, p-value = 0.008). Highest levels of support for NPZs were found in Bicheno (100%) and Streaky Bay (100%) and lowest levels of support were found in Jurien Bay (44%). Interestingly, lower levels of support in Jurien Bay are due to relatively high neutrality (44%) rather than opposition to the NPZs.

[16] Fishers in the boat ramp survey were asked for perceptions around the AMP zones in the survey location, fishers in the targeted survey were asked about AMP zones in the sub-region they fish most in, while general public fishers reflected on the AMP zones nationally.

Spatial scale		Sample size	Supportive of State NTRs	Supportive of Commonwealth NPZs	Supportive of Commonwealth HPZs	Supportive of Commonwealth SPZs	Supportive of Commonwealth RUZs	Supportive of Commonwealth MUZs	Commonwealth NPZs benefit the environment
Location									
Cairns	◣	26	92	92	88				88
Nhulunbuy	◣	21			76				
Karratha	◣	31	97					87	
Ningaloo	◣	57	96	95			95		91
Bicheno	◣	23	100	100			87		91
Capes	◣	24	75	79	92				96
Jurien Bay	◣	16	56	44		0			53
Streaky Bay	◣	4	100	100		100			33
Two Rocks	◣	23	87	91					96
Victor Harbor	◣	13	92					67	
Coffs Harbour	◣	18	72	83					89
Network									
Jervis Bay	◣	15	73		93	77			
Coral Sea Marine Park	◣	26	92	92	88				88
Coral Sea Marine Park	■	103		81	82			73	86
North	◣	21			76				
North	■	27		85	96			81	93
North-west	◣	88	97	95			95	87	91
North-west	■	8		88	88			62	100
South-east	◣	23	100	100			87		91
South-east	■	84		76	77			73	83
South-west	◣	80	82	79	92	50		67	70
South-west	■	135		73	79			72	81
Temperate East	◣	33	73	83	93	77			89
Temperate East	■	93		78	86			75	87
National	◣	271	86	86	87	59	91	77	80
National	■	450		80	85			73	88
National	◉	11	90	80	89	86		100	90

Figure 43. Summary table showing non-extractive recreational users' attitudes and perceptions towards zones in the Australian Marine Parks (AMPs) and no-take marine reserves (NTR's) in state waters. ◣ indicates the boat ramp survey, ■ indicates the general public survey and ◉ indicates the targeted survey.

As a point of comparison, non-extractive users' support for no-take marine reserves in state waters (which have similar rules to NPZs in the AMPs) was also recorded where relevant. A total of 86% of non-extractive users in the boat ramp survey and 90% in the targeted survey reported supporting the state no-take marine reserves (Figure 43 and see Figure 118 and Figure 119 for confidence intervals). These figures suggest that support for Commonwealth NPZs is broadly comparable to support for adjacent state no-take marine reserves.

Support for other zone types was also recorded. Support for the HPZs was 87% in the boat ramp survey, 85% in the general public survey and 89% in the targeted survey (Figure 43 and see Figure 120 and Figure 121 for confidence intervals). No significant differences were found in HPZ support across boat ramp locations ($KW = 6$, $p = 0.1$). Support for MUZs was 77% in the boat ramp survey, 73% in the general public survey and 100% in the targeted survey with some significant difference across boat ramp locations ($KW = 6$, $p = 0.01$, Figure 43 and see Figure 122 and Figure 123 for confidence intervals). Support for RUZs was 91% in the boat ramp survey, with some differences across locations ($KW = 12$, $p < 0.001$, Figure 43 and see Figure 124 for confidence intervals). Support for SPZs was 59% in the boat ramps surveys and 86% in the targeted survey. Some significant differences were detected across boat ramp locations ($KW = 6.7$, $p = 0.03$, Figure 43 and see Figure 125 for confidence intervals).

Non-extractive recreational users were also asked for their perceptions about how these zones would affect marine environments. Positive perceptions amongst non-extractive users about the impact of NPZs on the environment were recorded, including 80% in the boat ramp survey

and 88% in the general public survey, and 90% in the targeted survey (Figure 43 and see Figure 126, Figure 127 and Figure 128 for confidence intervals). Significant differences occurred across locations in the boat ramp survey (*KW* = 23, p = 0.001), most notably with high levels of non-extractive users in Jurien Bay (47%) and Streak Bay (67%) who perceived that the NPZs would have no effect on the marine environment.

Generally similar results were found for state no-take marine reserves, with 82% of non-extractive users in the boat ramp survey and 78% in the targeted survey reporting benefits for the marine environment (Figure 129 and Figure 130). Significant differences were found across locations in the boat ramp survey (*KW* = 32, p < 0.001), again due to a large portion of respondents in Victor Harbor (46%) and Streak Bay (75%) reporting that the state no-take zones would have no effect on the marine environment.

For HPZs, 95% of non-extractive recreational users in the boat ramp survey and 87% in the general public survey reported positive impacts on the marine environment (Figure 131 and Figure 132). No significant differences were found across boat ramp locations (*KW* = 5, p = 0.2). For MUZs, 58% of non-extractive users in the boat ramp survey and 70% in the general public survey perceived environmental benefits (Figure 133 and Figure 134). For RUZs, 78% of respondents to the boat ramp survey perceived environmental benefits (Figure 135). Finally, for SPZs, 45% of respondents in the boat ramp survey and 86% in the targeted survey perceived environmental benefits (Figure 136).

Non-extractive recreational users were then asked how these different zone types would affect their non-extractive activities. Note that recreational fishing was prioritised in this question, and so only those that did not participate in recreational fishing were asked about impacts on non-extractive activities. As a result, sufficient samples for reporting were only obtained through the general public survey. A total of 55% of non-extractive recreational users perceived that the NPZs would have no effect on their activities, and 38% perceived that they would have positive impacts (Figure 43 and see Figure 137). For HPZs neutral impacts were reported by 42% and positive impacts by 49% (Figure 138). And for MUZs, 49% of non-extractive recreational users reported neutral impacts and 43% reported positive effects (Figure 139).

Supplementary figures (See Appendix):

- Non-extractive recreational users' support for AMP zones and state no-take marine reserves: Figure 115 to Figure 125.
- Non-extractive recreational users' beliefs about the impacts of AMP zones and state no-take marine reserves on the marine environment: Figure 126 to Figure 136.
- Non-extractive recreational users' beliefs about the impacts of AMP zones and state no-take marine reserves on their fishing: Figure 137 to Figure 139.

3.4.4 Charter operators

A total of 57% of charter operators reporting being supportive of the NPZs in their area, while 26% were opposed (Figure 44). No significant differences were found across networks (KW = 7.5, p = 0.2, Figure 140). Similarly, 59% of charter operators reported being supportive of state

no-take marine reserves in their area and 31% reported being opposed (Figure 44), with no significant differences across networks (KW = 7.7, p = 0.1, Figure 141).

Spatial Scale	Sample Size	Supportive of State NTRs	Supportive of Commonwealth NPZs	Supportive of Commonwealth HPZs	Supportive of Commonwealth MUZs	Commonwealth NPZs benefit the environment	Commonwealth NPZs negatively effect my access to high quality sites	Commonwealth NPZs increase my operating costs	Commonwealth NPZs decrease my overall profitability
Network									
Coral Sea Marine Park	12	42	42	42		25	58	8	58
North	4		67	75	67	67	33	33	33
North-west	11	100	82	73	73	82	27	9	18
South-east	9	56	50	50	33	100	0	0	0
South-west	11	50	36	40	45	64	36	9	27
Temperate East	13	62	69	62	62	67	0	0	15
National	60	59	57	57	55	62	28	7	28

Figure 44. Summary table showing charter operators' attitudes and perceptions towards zones in the Australian Marine Parks (AMPs) and no-take marine reserves (NTR's) in state waters.

Charter operators support for other zone types was similar to their support for NPZs, with 57% reported supporting the HPZs, 55% reported supporting the MUZs, 40% reported supporting the SPZs, 83% reported supporting the RUZs, and 40% reported supporting the SPZs (Figure 44 and for confidence intervals see: HPZ: Figure 142, MUZ: Figure 143, RUZ: Figure 144 and SPZ: Figure 145). No significant differences were found across networks in charter operators support for any of these zone types.

Charter operators were also asked for their perceptions of how the zones in the AMPs would affect the environment. A total of 62% of charter operators reported that the NPZs would improve the marine environment (Figure 44), with no significant differences across networks (KW = 8.7, p = 0.1, Figure 146). Similarly, 62% of charter operators perceived that state no-take zones would improve the marine environment (Figure 147). Charter operators were similarly optimistic about the environmental benefits of HPZs, with 66% perceiving these areas would improve the marine environment (Figure 148).

Charter operators were less convinced that the other zone types would deliver environmental benefits. Belief in environmental benefits was found in 41% of charter operators for the MUZs, 33% for RUZs and 46% for SPZs (MUZ Figure 148, RUZ: Figure 150 and SPZ: Figure 151). No significant differences were found across networks.

Charter operators were also asked about how zoning affected their charter businesses. In terms of impacts of Commonwealth NPZs on the overall profitability of their business, 68% reported no impacts whilst 28% reported a decrease in profitability (Figure 44). No significant differences in impacts of NPZs on profitability were found across networks (*KW* = 5, p = 0.5, Figure 152). Charter operators were somewhat more divided about the impacts of state no-take marine reserves, with 39% reporting decreased profits, 47% reporting no impacts and 14% reporting increased profits (Figure 153). The remaining zone types were typically viewed to have very little impact on profitability. This included reports of no impacts on profits by 77% of charter operators due to HPZs (Figure 154), 63% of charter operators due to MUZs (Figure

155), 63% of charter operators due to RUZs (Figure 156) and 82% of charter operators due to SPZs (Figure 157).

In terms of the ability of charter operators to access quality sites, 54% perceived that the Commonwealth NPZs had no impact (Figure 44), with no significant differences across networks (KW = 3, p = 0.5, Figure 158). In comparison, charter operators were divided about the impacts of state no-take marine reserves on their access to quality sites, with 34.8% reporting negative impacts, 38% reporting no impacts, 38% reporting negative impacts and 24% reporting positive impacts (Figure 44 and see Figure 159 for confidence intervals). In terms of site access, charter operators generally perceived no impacts from the remaining zone types (78% for HPZs: Figure 160, 76% for MUZs: Figure 161, 50% for RUZs: Figure 162 and 90% for SPZs: Figure 163).

Charter operators for the most part reported no impacts of zones on their operating costs, with 70% of charter operators reported no-impacts on costs from NPZs (Figure 44). Some significant differences were found across networks (KW = 13, p = 0.02, Figure 164). In comparison, 56% of charter operators indicated no impacts of state no-take marine reserves on operating costs, but 36% reported an increase in costs (Figure 165). No change in operating costs were generally found for HPZs (76%, Figure 166), MUZs (83%, Figure 167), SPZs (87%, Figure 168) and RUZs (70%, Figure 169).

3.5 Economic value

3.5.1 General Public

The economic value that the AMPs provide to the general public was measured using the choice experiment task in the general public survey. A total of 19% of the responses were removed on account of being identified as protest responses.[17]

The conditional logit model suggested significant differences in responses between fishers and the rest of the sample (labelled non-fishers). The entire model is described here. A separate model simulation has been conducted to understand the value of the AMPs for fishers and is reported on in the recreational fishers section below.

The positive coefficients on all zone attributes indicate that (all else equal) people prefer more protection than less (Table 3). For non-fishers, NPZs were the most valued zone type ($7.52 CI: $6.26 – $8.80) followed by HPZs ($3.58 CI: $2.68 – $4.48) and MUZs ($1.92 CI: $1.30 – $2.54). For fishers, NPZs were valued similarly to MUZs ($2.71 CI: $0.05 – $5.38 and $2.58 CI: $1.23 – $3.93 respectively). The value of NPZs was not significantly different from $0.

[17] See methods for how protest responses were identified.

Table 3: Estimated conditional logit model for the choice experiment. Part-worth's provide the Willingness To Pay (in AU$s) annually over 10 years for a 1% increase in each zone type. Part-worth calculations are based on average reported income for fishers and non-fishers.

Attribute	Coefficient	P-value	Part-worth (95% CI)
Non-fishers:			
National Park Zones	0.014***	0.000	$7.52 ($6.26 – $8.80)
Habitat Protection Zones	0.007***	0.000	$3.58 ($2.68 – $4.48)
Multiple Use Zones	0.004***	0.000	$1.92 ($1.30 – $2.54)
Status quo	0.796***	0.000	
Fishers:			
National Park Zones	0.005*	0.045	$2.71 ($0.05 – $5.38)
Habitat Protection Zones	0.002	0.274	$1.13 (–$0.89 – $3.14)
Multiple Use Zones	0.005***	0.000	$2.58 ($1.23 – $3.93)
Status quo	0.561***	0.000	
Cost	–0.002***	0.000	
CostxIncome	$5.74x10^{-9}$**	0.001	
Number of observations	40,356		
Number of respondents	2,242		
Log-likelihood	–12,997.63		

* = p < 0.05; ** = p < 0.01; *** = p <0.001

Based on the conditional logit model in Table 3, the Net Present Value of the AMPs to the general public was estimated at between $6.2 billion and $8.7 billion.[18] As a point of comparison, Deloitte Access Economics (2018) estimated the value of ensuring the existence of the Great Barrier Reef for future generations for Australians at $24 billion.

3.5.2 Recreational fishers

Based on the conditional logit model in Table 3, recreational fishers held positive value for the AMPs. We estimated that the Net Present Value of the AMPs for the recreational fishing population of Australia is between $208 million and $1.1 billion.

The national model of recreational fishing provides a complementary estimate of the impacts of the AMPs on recreational fishers. Whilst the general public survey aims to estimate the total value recreational fishers hold for the AMPs, the national recreational fishing model estimates the value associated with lost site access for recreational fishers specifically in terms of their fishing experiences. Nationally, we estimate these impacts to be $121 (CI: $85 – $168)

[18] This calculation assumes that respondents answered the choice experiment on behalf of their household, and that 13.5% of households have fishers in them based on the incidence of fishing in the general public survey. Net Present Value was estimated using a 7% discount rate and an estimated 8.28 million households in Australia based on the 2016 Australian census.

thousand annually. This figure reflects recreational fishers' willingness to pay to avoid the restriction on their site access specifically in terms of their fishing experiences.

Notably, this estimate is orders of magnitude below the value recreational fishers indicated holding for the AMPs overall. Whilst the NPZs may impose some restrictions on recreational fishing activities, most recreational fishers still positively value the AMPs.

As discussed in the methods, the site choice model was calibrated to predict trip numbers more accurately in the offshore locations of the AMPs. This was done by modifying the travel

cost parameter in the trip utility function. The travel cost parameter has a key role to play in calculating welfare impacts, and as such non-conventional manipulation of the travel cost parameter in this study requires that the welfare impacts calculated here be treated with caution and should be interpreted as indicative.

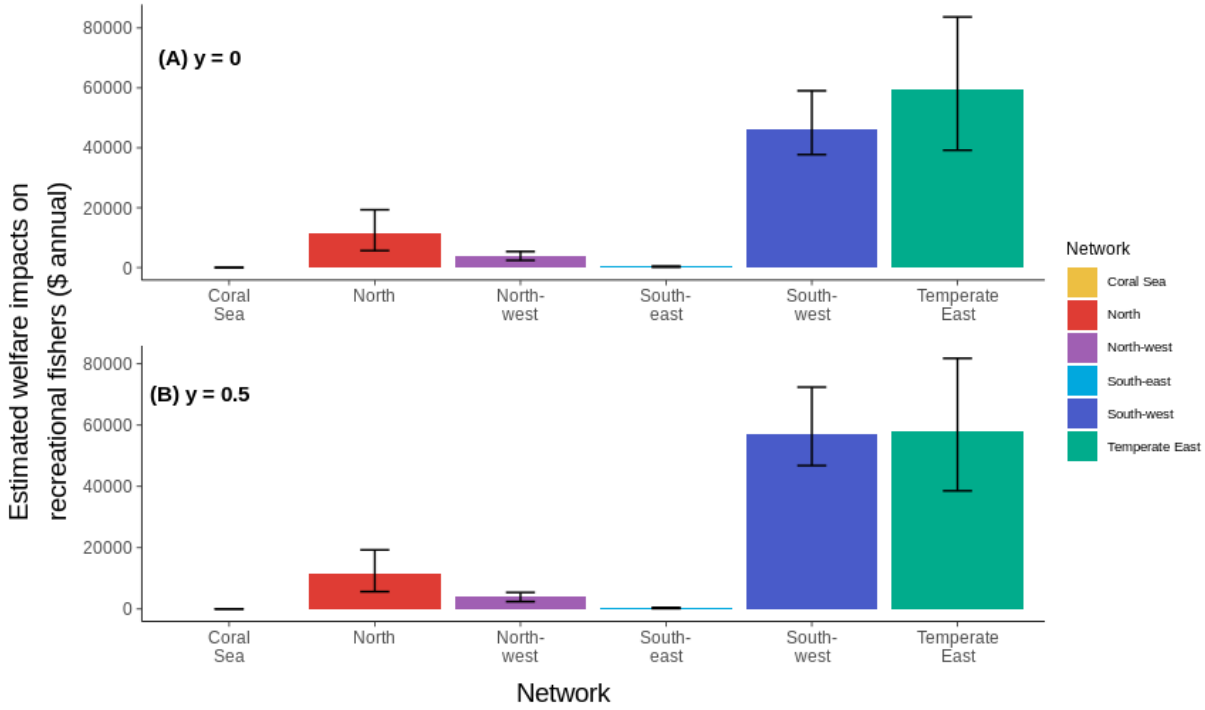

Figure 45. Estimated welfare impacts of lost site access due to implementation of National Park Zones in the Australian Marine Parks. (A) shows scenario with no competition between adjacent ramps and (B) relaxes this assumption.

3.5.3 Charter operators

The revenue associated with charter trips was estimated based on the number of client's operators indicated taking on each type of trip, and the list of average charter prices in Table 2. This was then apportioned into the AMPs based on the percentage of charter trips operators indicated taking inside the AMPs in 2019 within the sub-network they operated in most. Using this method, we estimated that 27% of charter operators revenues on average are generated by trips to the AMPs (Figure 46). No significant differences were detected in the proportion of revenue generated in the AMPs across networks (X^2 = 0.07, p-value = 1). For fishing operators specifically, 25% of revenues on average were generated inside the AMPs, with no significant differences across networks (X^2 = 0.08, p-value = 1). Finally, for non-extractive operators, 24% of revenue was generated inside the AMPs with no significant

differences across networks (X^2 = 0.03, p-value = 1). The wide confidence intervals on these estimates signals the wide variability in responses (making accurate predictions difficult) and relatively low sample sizes.

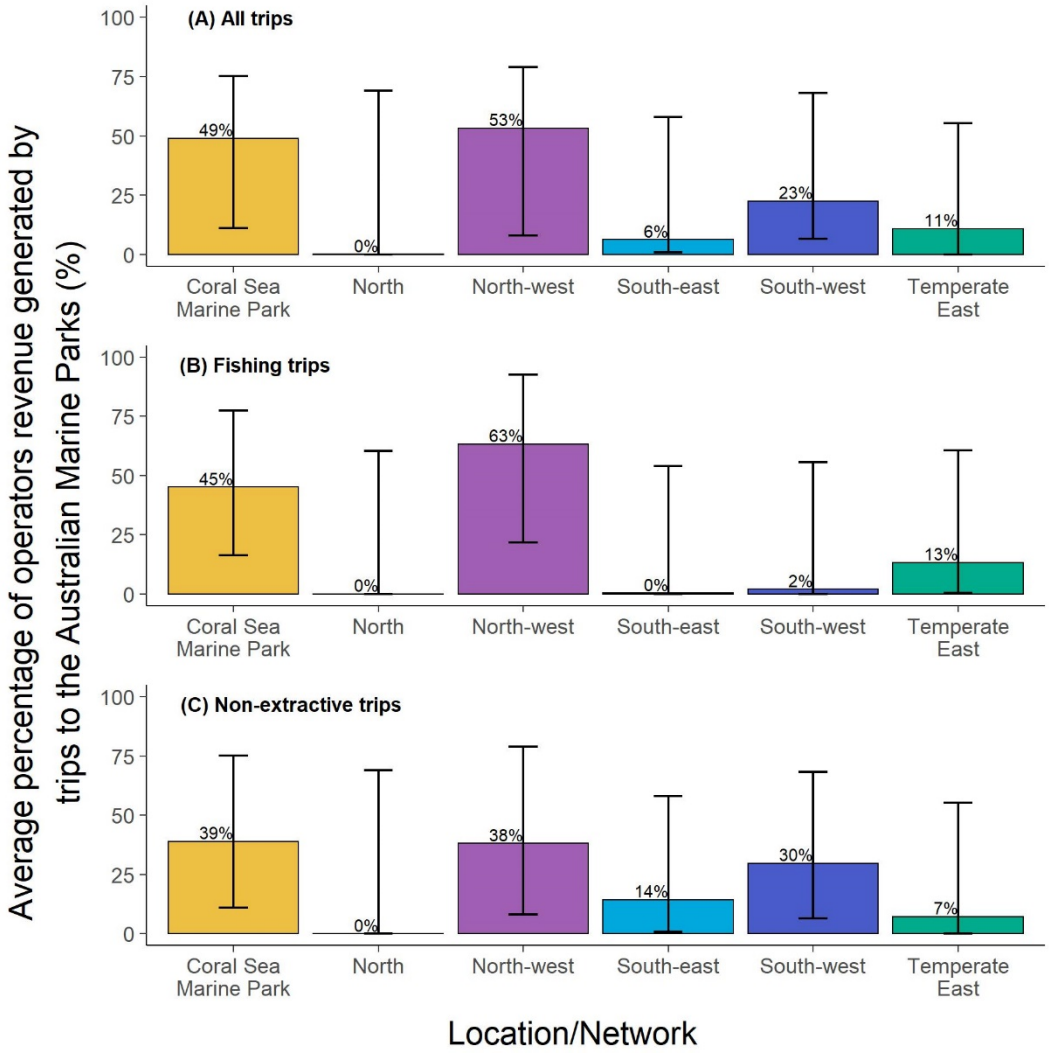

Figure 46. Average percentage of total revenue for charter operators generated by visiting the Australian Marine Parks for: (A) all charter trip types, (B) fishing trips and (C) non-extractive trips. Note that the average percentage of revenue reported in the AMPs can be higher than the corresponding percentages for both fishing trips and non-extractive trips when operators that only conduct fishing or non-extractive trips (not both) have high proportions of their trips in the AMPs.

4. DISCUSSION

In this report we present a national social and economic benchmark for the AMPs focussing on four key groups: the general public, recreational fishers, non-extractive recreational users, and charter operators. Establishing this benchmark involved conducting four integrated surveys nationally reaching approximately 4,000 respondents. The social and economic benchmarks for the AMPs established here are amongst the most comprehensive globally in terms of the spatial extent and stakeholder groups considered.

The surveys highlight relatively positive views about the AMPs amongst all surveyed groups. Support for NPZs in the AMPs was expressed by 75% of the general public, 80% of recreational fishers, 86% of non-extractive recreational users and 57% of charter operators. Similarly high levels of support were found for other zone types including state no-take marine reserves, HPZs, MUZs, RUZs and SPZs. The surveys also revealed some nuances in attitudes. For example, exceptionally high levels of support were found amongst recreational fishers for RUZs in the boat ramp survey (94%) whilst support for SPZs was relatively low (57%). Cross-jurisdiction, cross-stakeholder and cross-regional differences in support for zoning provide a rich basis for identifying priorities for any programs aimed at increasing or further understanding support levels.

The surveys also suggest that the AMPs have relatively little (though varied) impact on activities conducted by the surveyed stakeholders. Just 4% of recreational fishers indicated that the NPZs had decreased the quality of their fishing. In contrast, 28% of charter operators indicated that the NPZs had decreased the profitability of their charter business. The surveys allow comparisons across jurisdictions and locations, helping target management efforts related to impacts on activities.

Broadly, the benchmark surveys serve to highlight the substantial value associated with the AMPs. In addition to high levels of support, a choice experiment exercise with the general public revealed a Net Present Value of the AMPs between $6.2 and $8.7 billion. This value far exceeds estimates of the costs of the AMPs, including those associated with displaced commercial catch, estimated at $4.2 million (Parks Australia 2018). This result provides strong support for the AMPs from a cost-benefit perspective, highlighting the substantial value that the general public hold for marine environments and their conservation.

The social and economic benchmark presented here was developed to inform Parks Australia's MERI program and related adaptive management of the AMPs. Numerous indicators could be drawn from these surveys for this purpose—e.g., the percentage of the general public aware of the AMPs, or the percentage of recreational fishers supportive of the NPZs in the AMPs. To operationalise indicators for this purpose will require repeating the benchmark surveys in a comparable way. Full details of the survey method, data analysis procedures and power analysis for survey repeats have been provided to Parks Australia.

Several recommendations for future repeat surveys emerged throughout the project. Firstly, some of the boat ramp survey locations received low sample sizes or had low visitation to the Australian Marine Parks. For these reasons, we suggest considering removal of Streaky Bay, Victor Harbor, Nhulunbuy and Cairns from the surveyed locations. The resources saved could be redirected to enhance survey lengths in other core areas (e.g., Ningaloo and Capes). The general public survey proved highly cost-effective, and we suggest repeating in its current form. The targeted survey and to a lesser extent charter operator survey received relatively low engagement. Parks Australia may be able to improve engagement in these surveys by utilising its regional networks (e.g., network managers) and their contacts within each region.

In addition to informing management of the AMPs, the national scope of the benchmark surveys provided here, as well as the collection of data within state jurisdictions provides a unique opportunity for state marine park agencies to draw insights. Collaboration between state and Commonwealth agencies on survey repeats is encouraged. Few respondents to the benchmark surveys recognised the distinction between state and Commonwealth waters and it is our view that management and extension efforts should (as much as possible) be collaborative between state and Commonwealth marine park agencies.

Overall, the social and economic benchmark presented here highlights the substantial value held for the AMPs as well as highlighting areas for improvement. Further, repeats of these surveys will likely generate more insights and enrich understanding of the social and economic dimensions of the AMPs. Ultimately, this information should be used to inform management and adaptation of the AMPs in ways that align with the preferences of society and individuals in it.

5. REFERENCES

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6. APPENDIX: SUPPLEMENTARY FIGURES

6.1 Sample descriptions

6.1.1 Recreational fishers

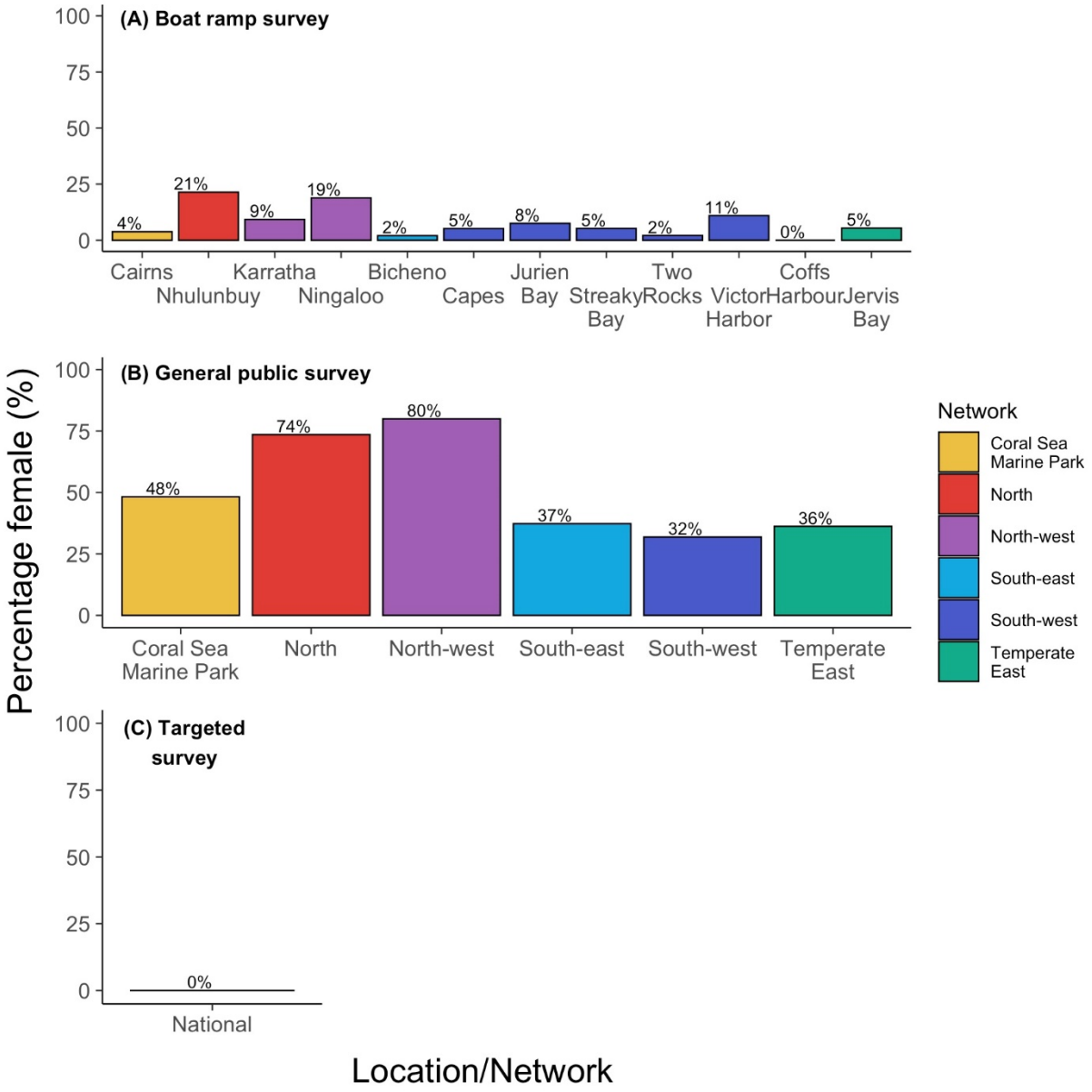

Figure 47. Percentage of boat-based recreational fishers that were female in (A) the boat ramp survey, (B) the general public survey and (C) the targeted survey.

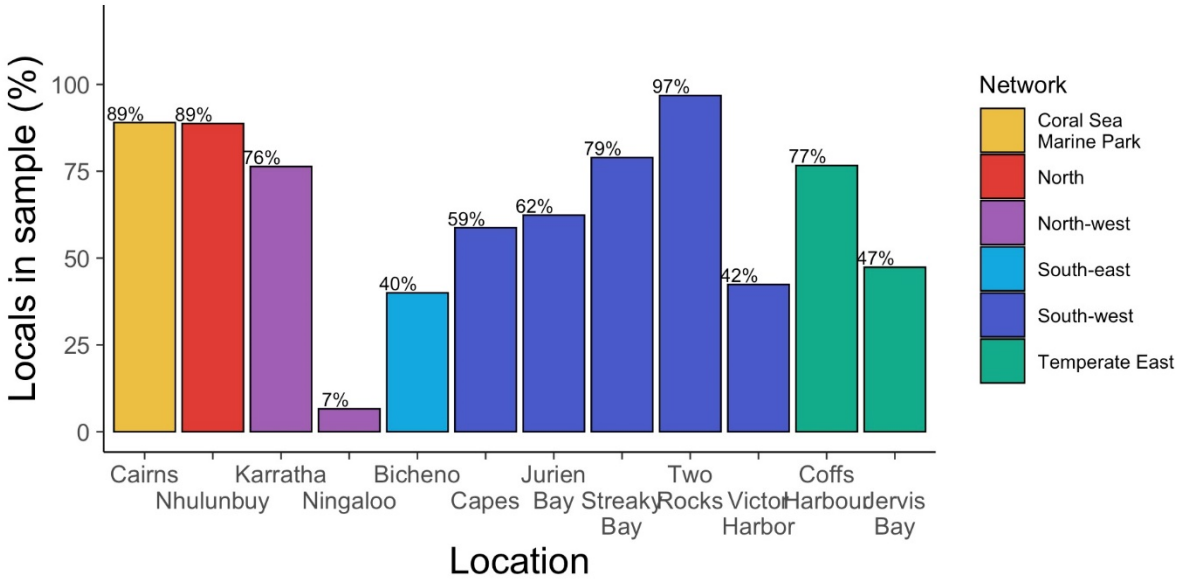

Figure 48. Percentage of boat-based recreational fishers that were locals in the boat ramp survey.

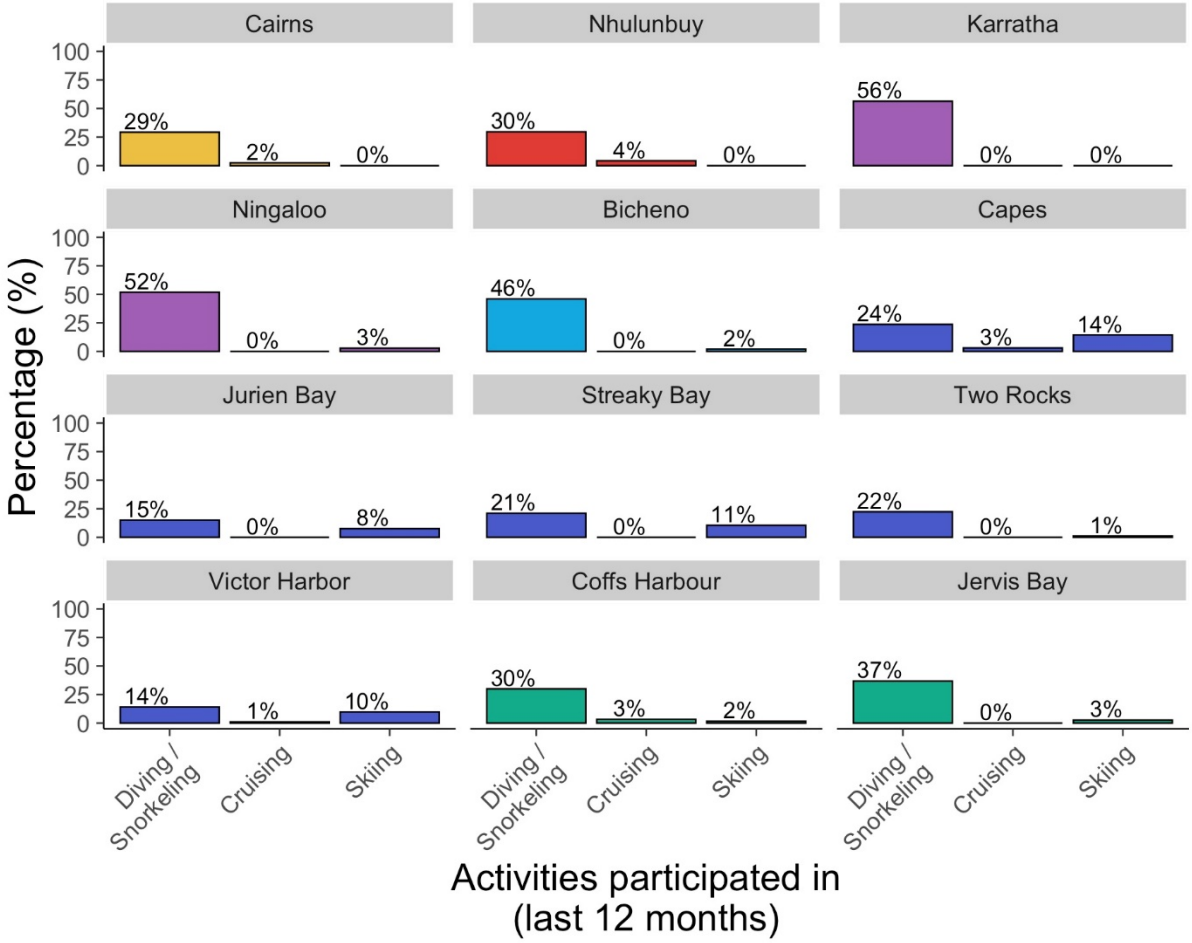

Figure 49. Percentage of boat-based recreational fishers in the boat ramp survey that participated in various non-extractive boat-based activities in the last 12 months.

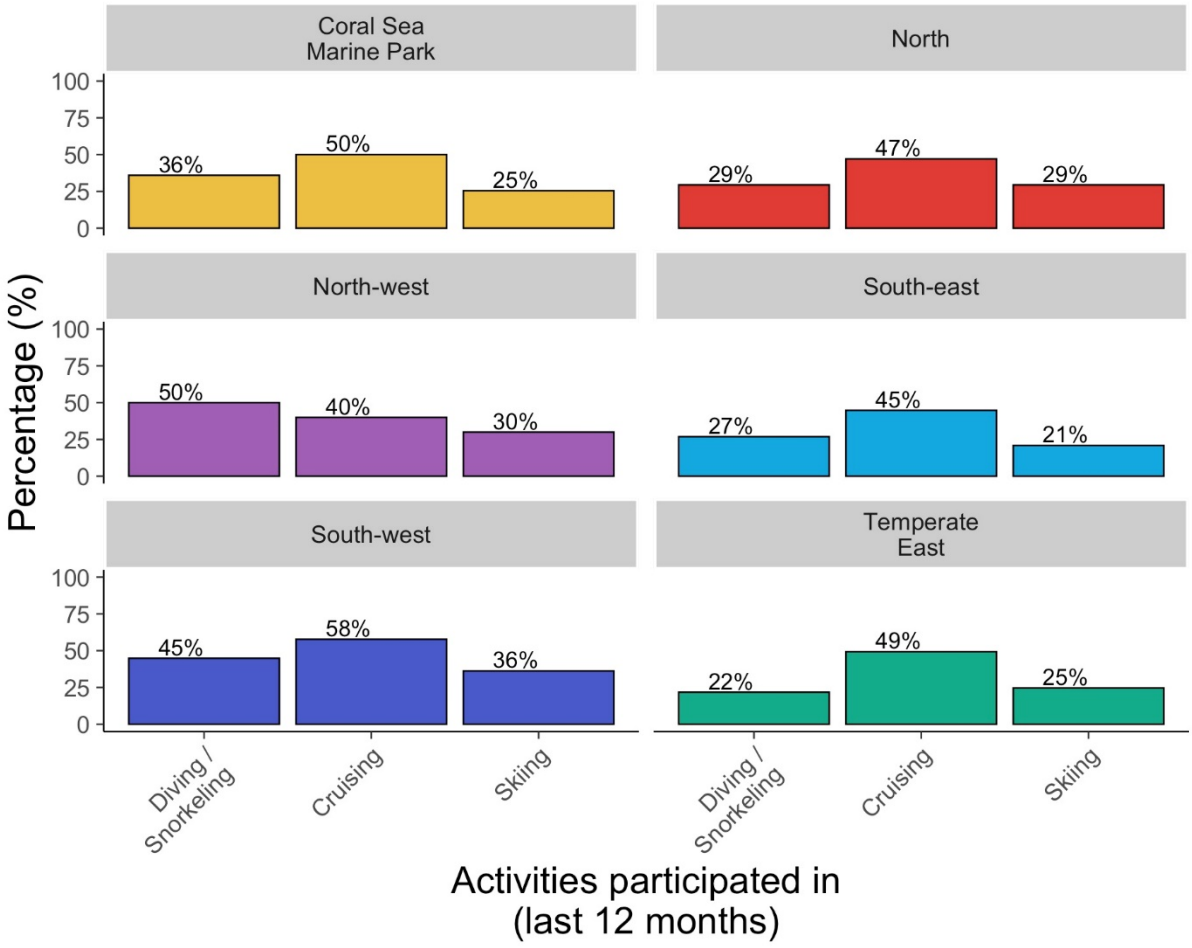

Figure 50. Percentage of boat-based recreational fishers in the general public survey that participated in various non-extractive boat-based activities in the last 12 months.

6.1.2 Non-extractive recreational users

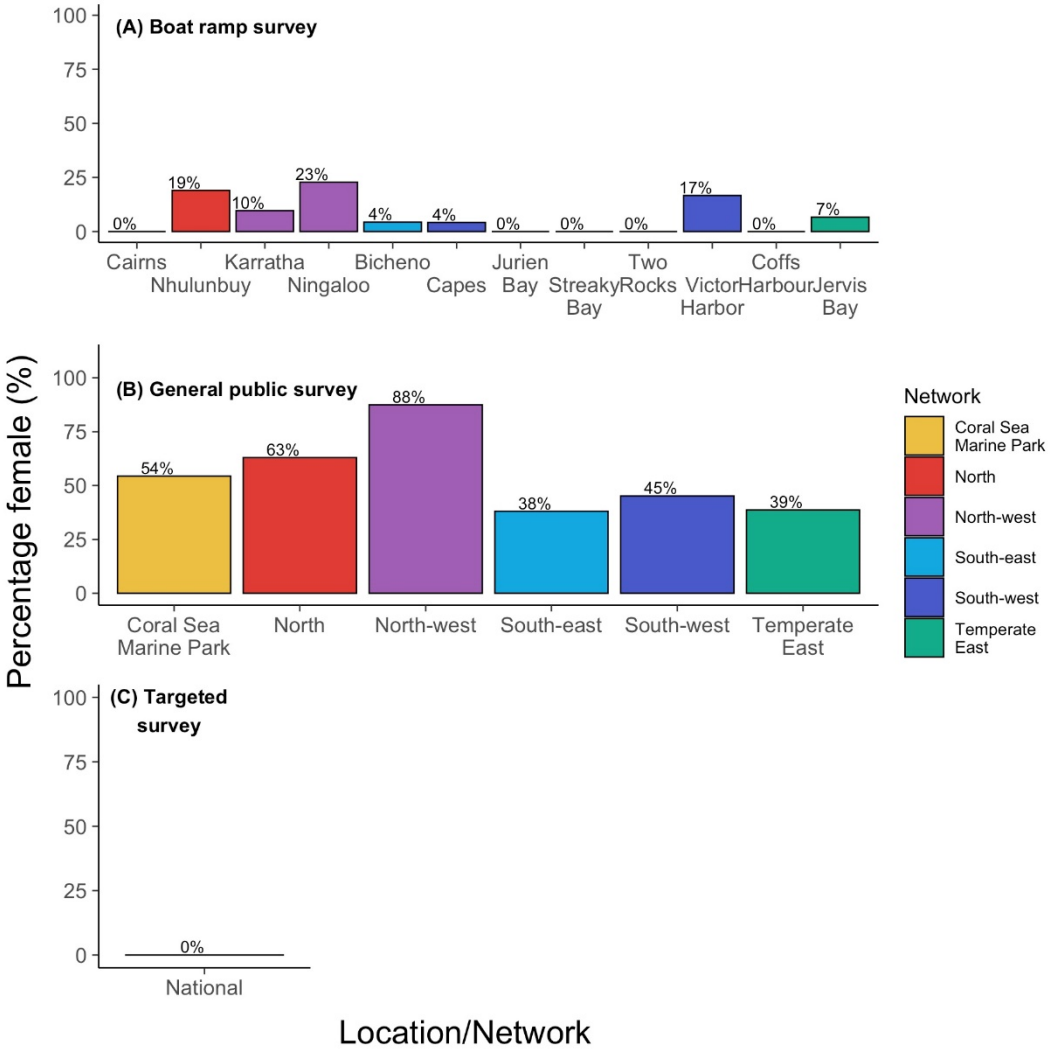

Figure 51. Percentage of boat-based non-extractive recreational users that were female in (A) the boat ramp survey, (B) the general public survey and (C) the targeted survey.

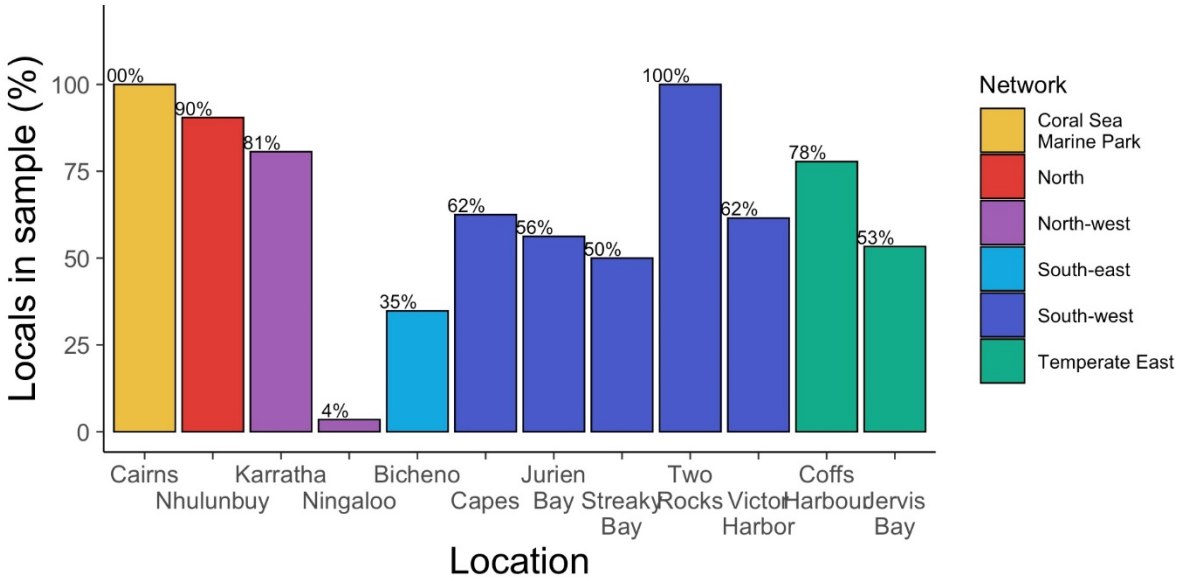

Figure 52. Percentage of boat-based non-extractive recreational users that were locals in the boat ramp survey.

6.1.3 Charter operators

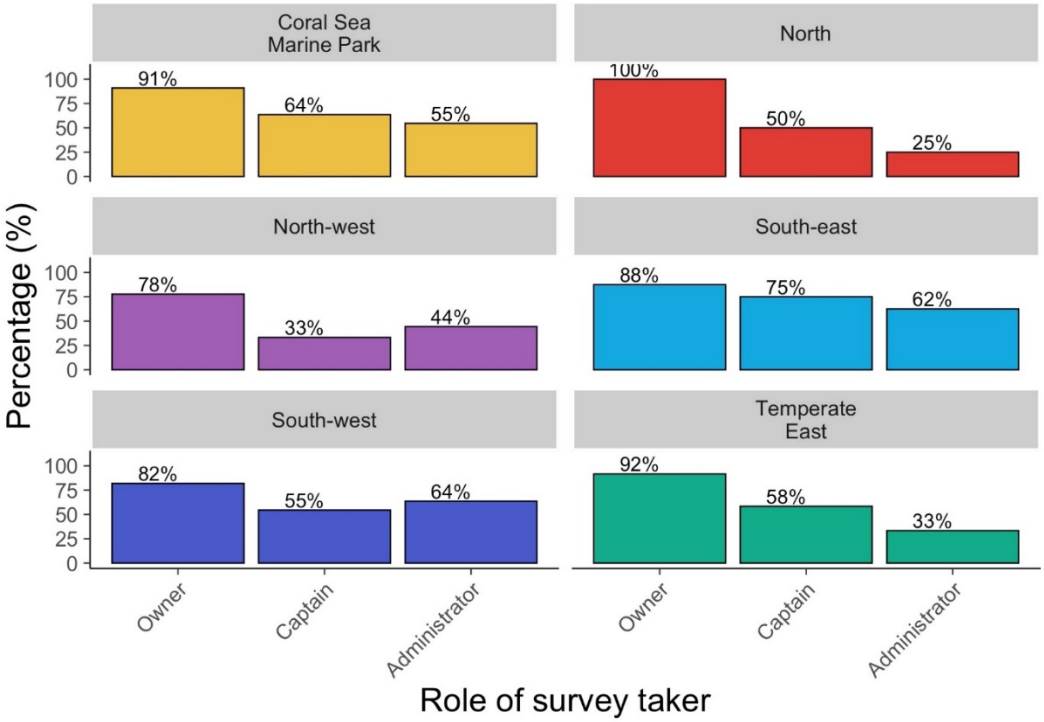

Figure 53. Role of the individual who completed the charter operator survey within the charter business. Note that an individual can have multiple roles (e.g., an owner and operator).

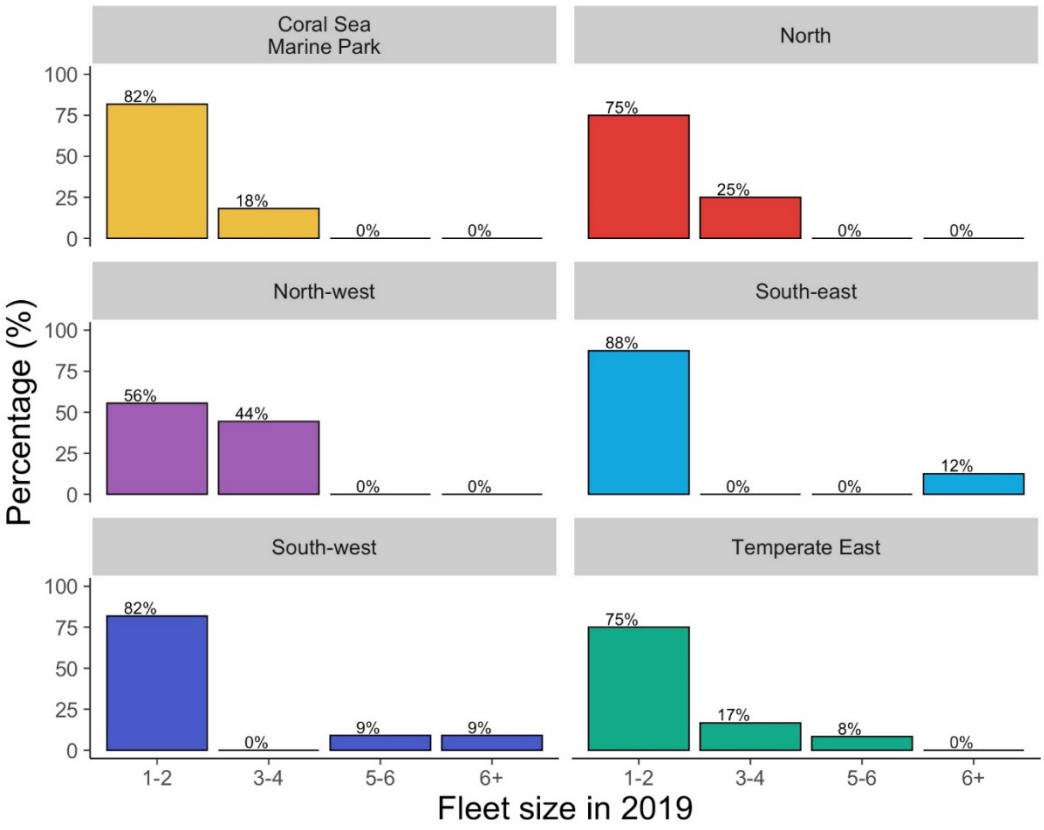

Figure 54. Size of fleet (number of vessels excluding tenders) of respondents to the charter operator survey.

6.2 Awareness

6.2.1 General public

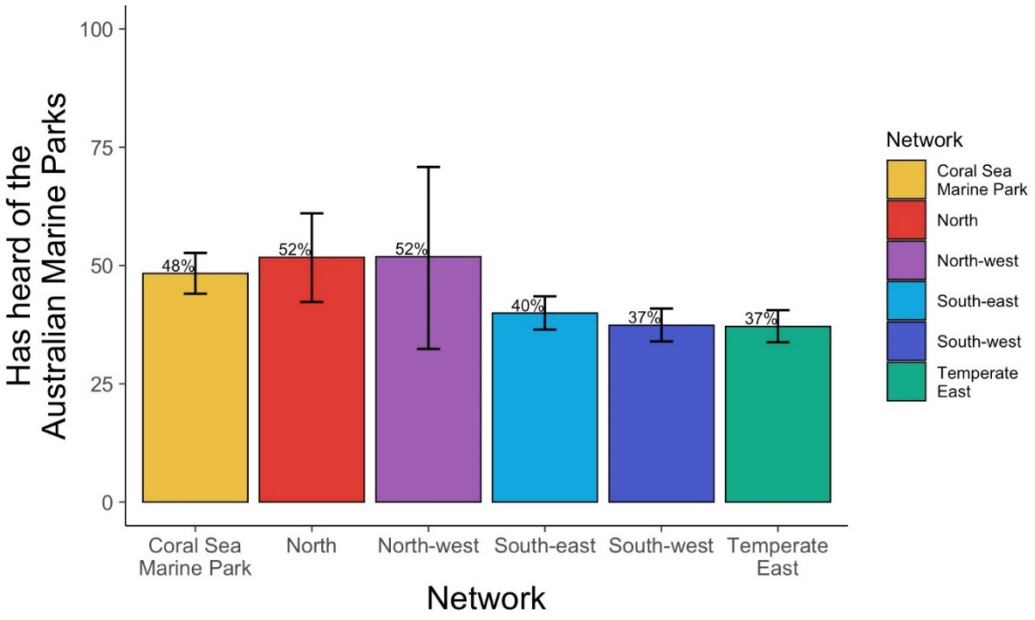

Figure 55. General public awareness of the Australian Marine Parks (AMPs). Respondents were deemed to have heard of the AMPS if they had heard of either the AMPs or the Commonwealth Marine Reserves.

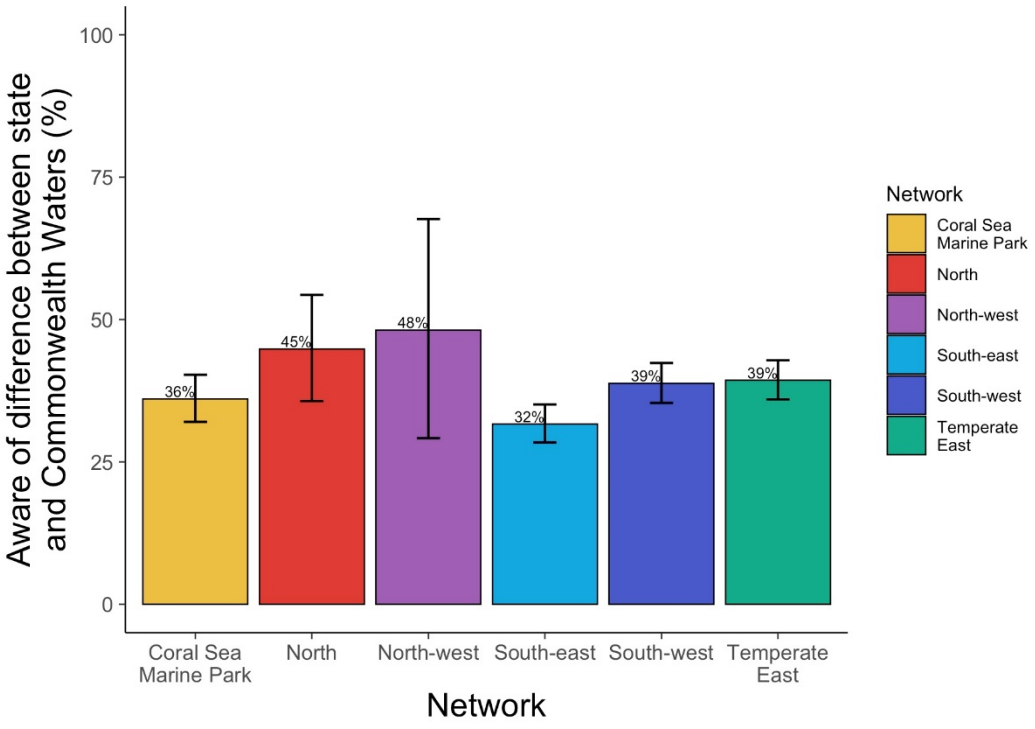

Figure 56. General public awareness of the difference between state and Commonwealth waters in Australia.

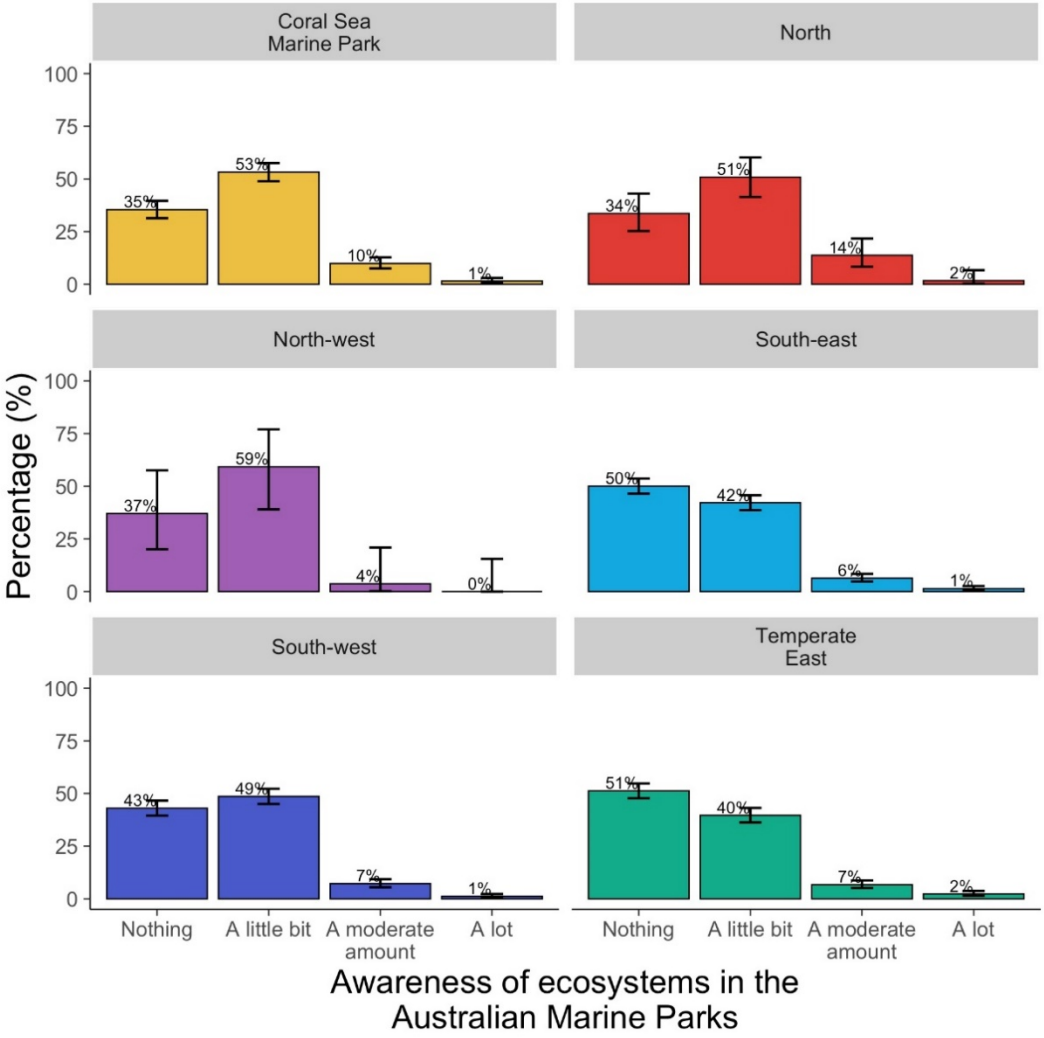

Figure 57. General public level of knowledge about the marine ecosystems inside the Australian Marine Parks.

6.2.2 Recreational fishers

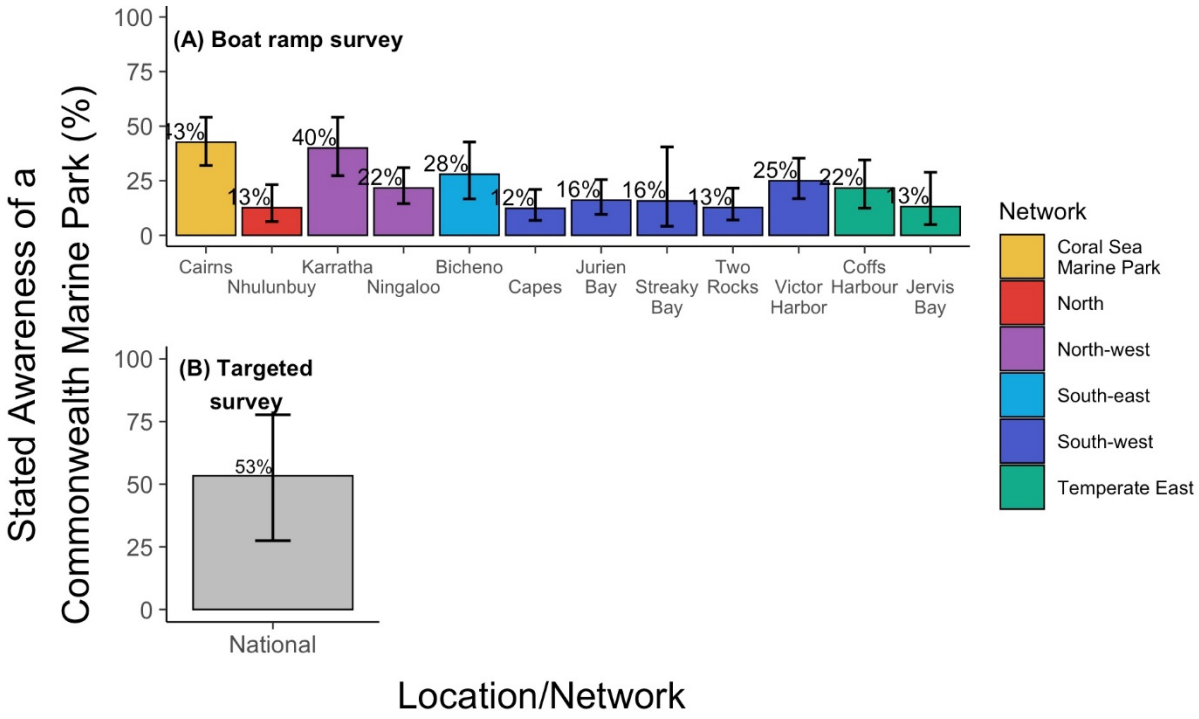

Figure 58. Recreational fishers stated awareness of an Australian Marine Park (AMP). In the boat ramp survey (A) this was awareness of an AMP in the boat ramp survey location, whilst in the targeted survey (B) this was awareness of an AMP in the region the respondent fished in most frequently.

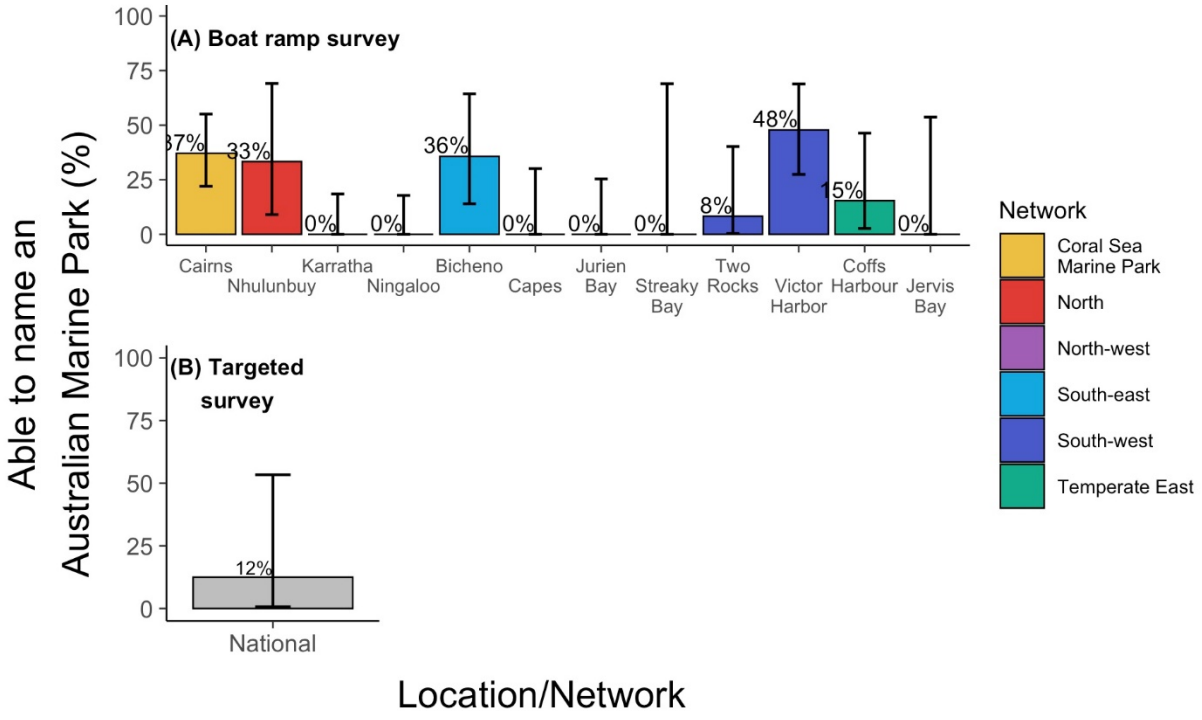

Figure 59. Percentage of recreational fishers able to name an Australian Marine Park (AMP). In the boat ramp survey (A) this was ability to name of an Australian Marine Park in the boat ramp survey location, whilst in the targeted survey (B) this was ability to name an Australian Marine Park in the region the respondent fished in most frequently.

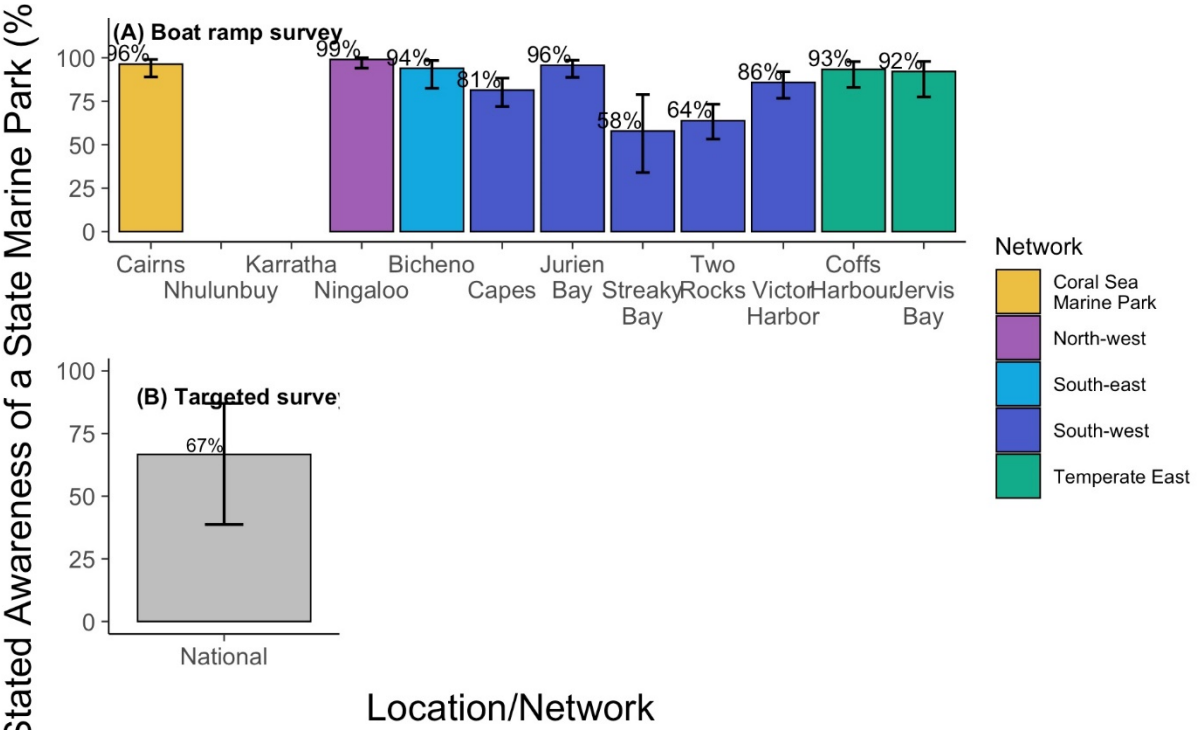

Figure 60. Recreational fishers' stated awareness of a state marine park. In the boat ramp survey (A) this was awareness of a state marine park in the boat ramp survey location, whilst in the targeted survey (B) this was awareness of a state marine park in the region the respondent operated in most frequently. This question was not asked in Nhulunbuy or Karratha due to a lack of adjacent state marine parks.

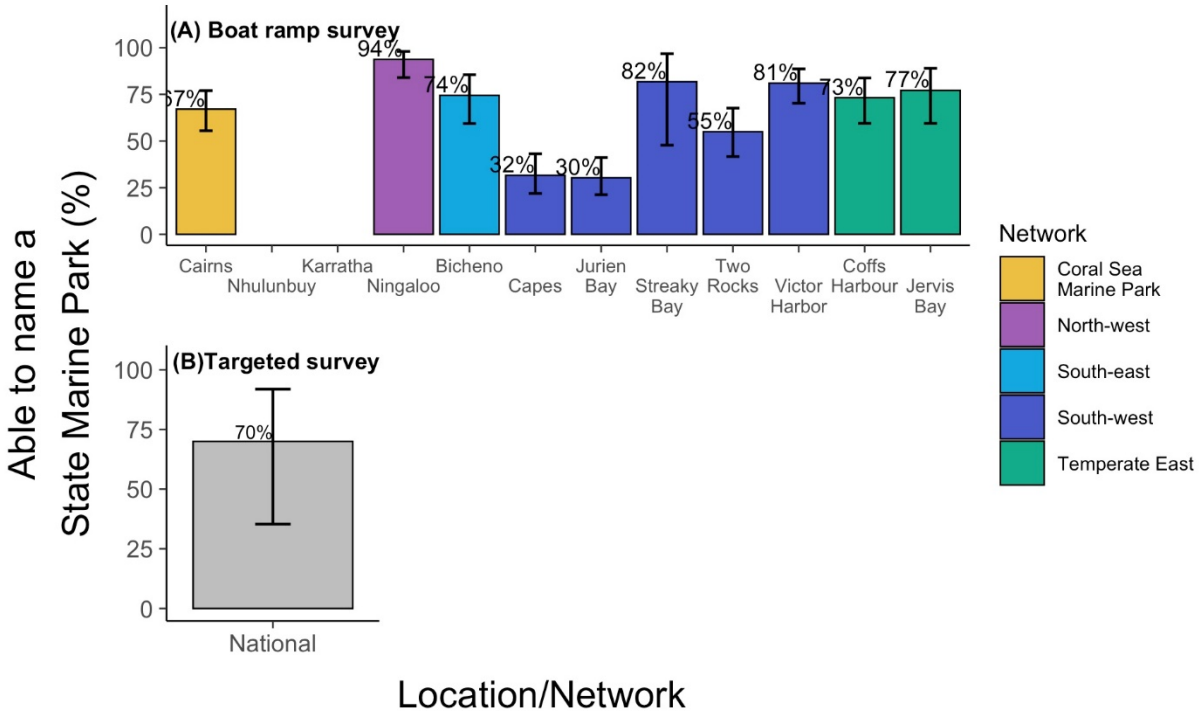

Figure 61. Percentage of recreational fishers able to name a state marine park. In the boat ramp survey (A) this was ability to name a state marine park in the boat ramp survey location, whilst in the targeted survey (B) this was ability to name a state marine park in the region they operate in most frequently. This question was not asked in Nhulunbuy or Karratha due to a lack of adjacent state marine parks.

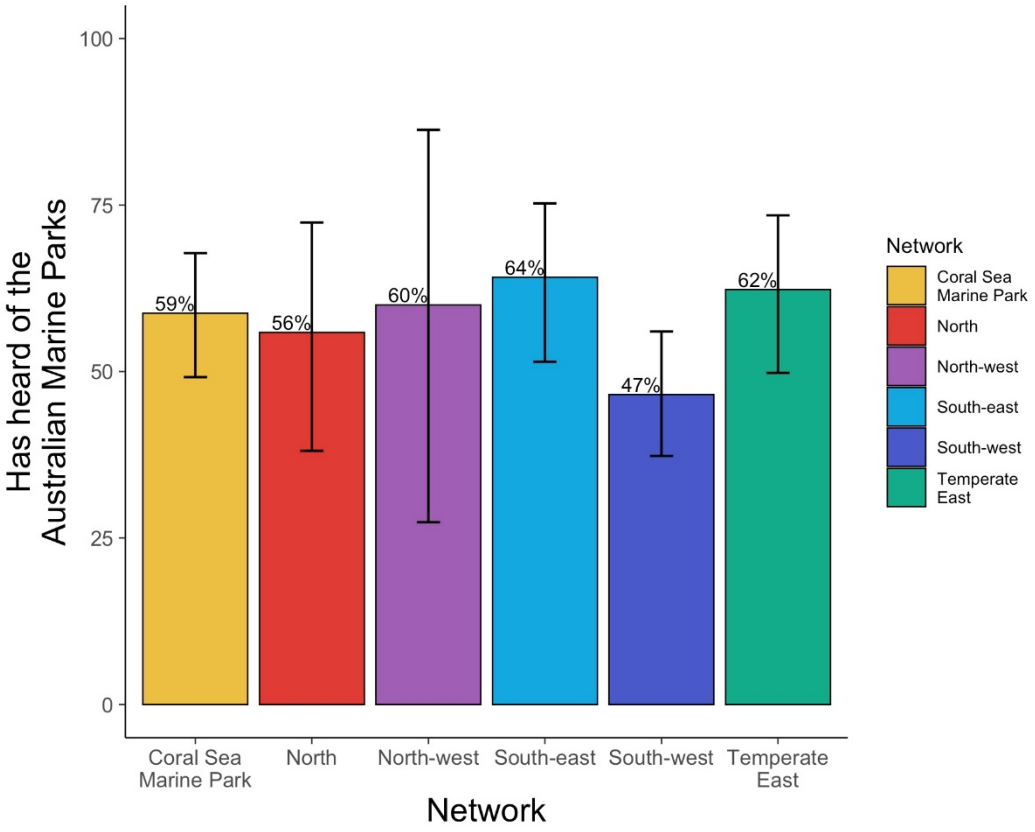

Figure 62. Recreational fishers' awareness of the Australian Marine Parks (AMPs) in the general public survey. Respondents were deemed to have heard of the AMPs if they had heard of either the AMPs or the Commonwealth Marine Reserves.

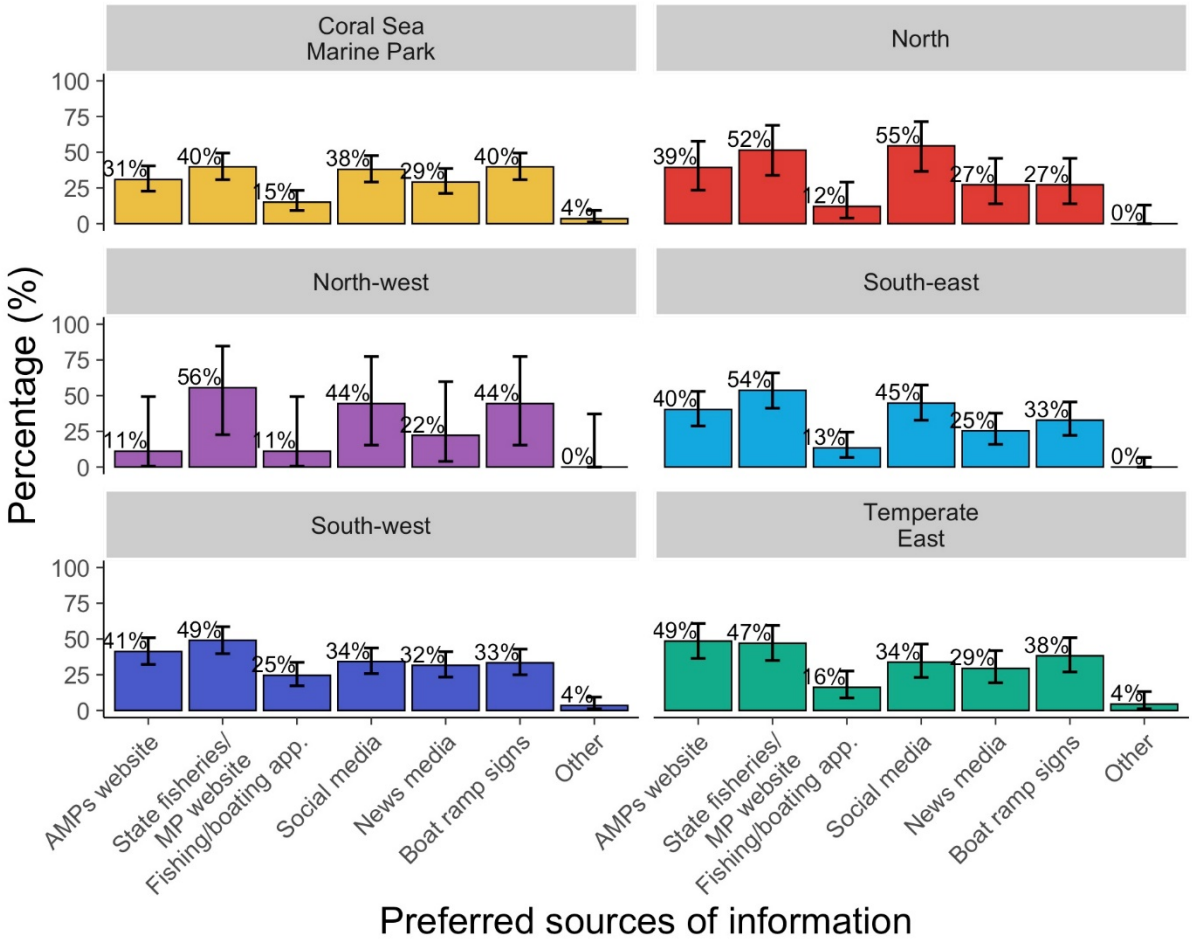

Figure 63. Recreational fishers preferred sources of information about the Australian Marine Parks in the general public survey.

6.2.3 Non-extractive recreational users

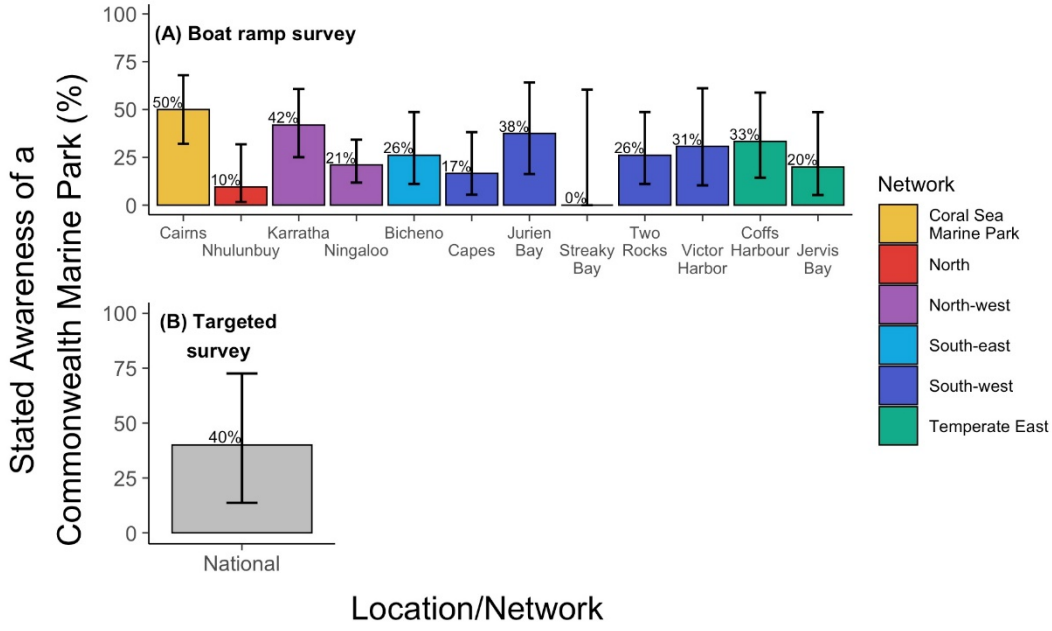

Figure 64. Non-extractive recreational users' stated awareness of an Australian Marine Park (AMP). In the boat ramp survey (A) this was awareness of an AMP in the boat ramp survey location, whilst in the targeted survey (B) this was awareness of an AMP in the region the respondent operated in most frequently.

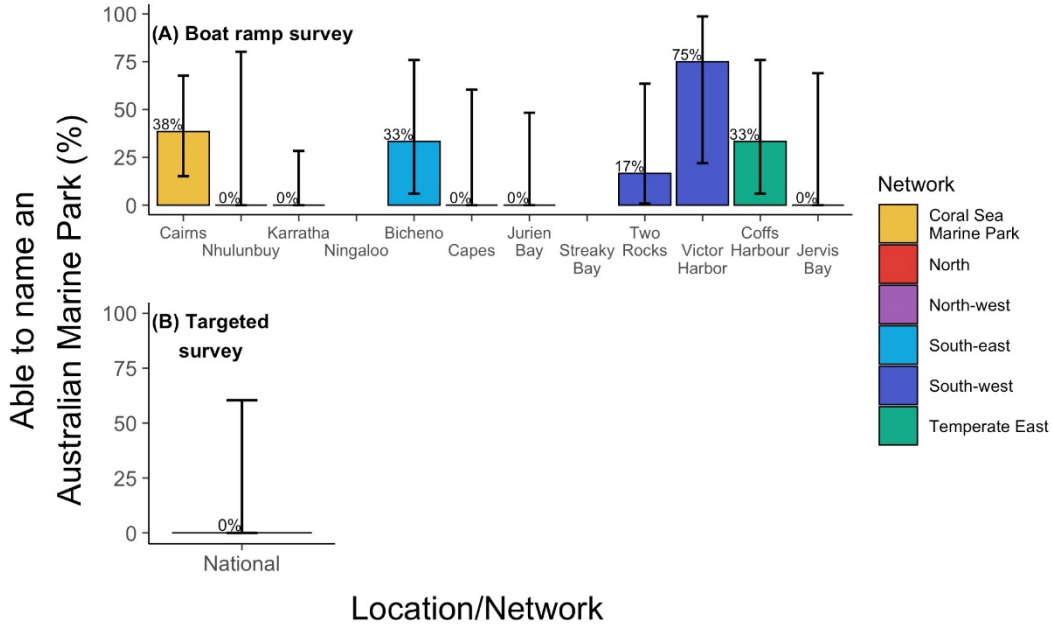

Figure 65. Percentage of non-extractive recreational users able to name an Australian Marine Park (AMP). In the boat ramp survey (A) this was ability to name of an Australian Marine Park in the boat ramp survey location, whilst in the targeted survey (B) this was ability to name an Australian Marine Park in the region the respondent operates in most frequently.

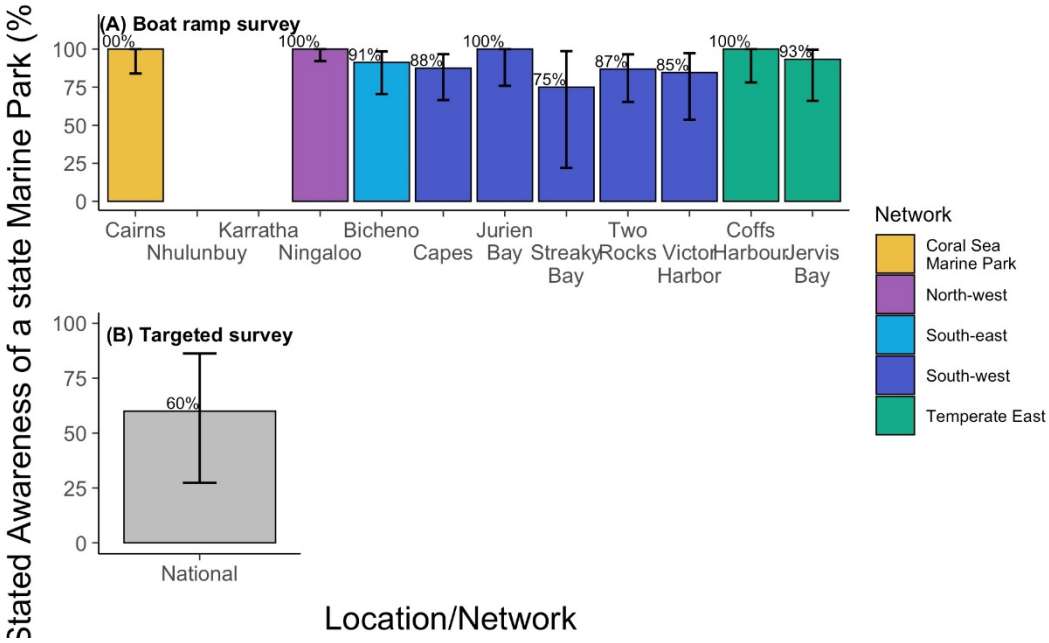

Figure 66. Non-extractive recreational users' stated awareness of a state marine park. In the boat ramp survey (A) this was awareness of a state marine park in the boat ramp survey location, whilst in the targeted survey (B) this was awareness of a state marine park in the region the respondent operated in most frequently. This question was not asked in Nhulunbuy or Karratha due to a lack of adjacent state marine parks.

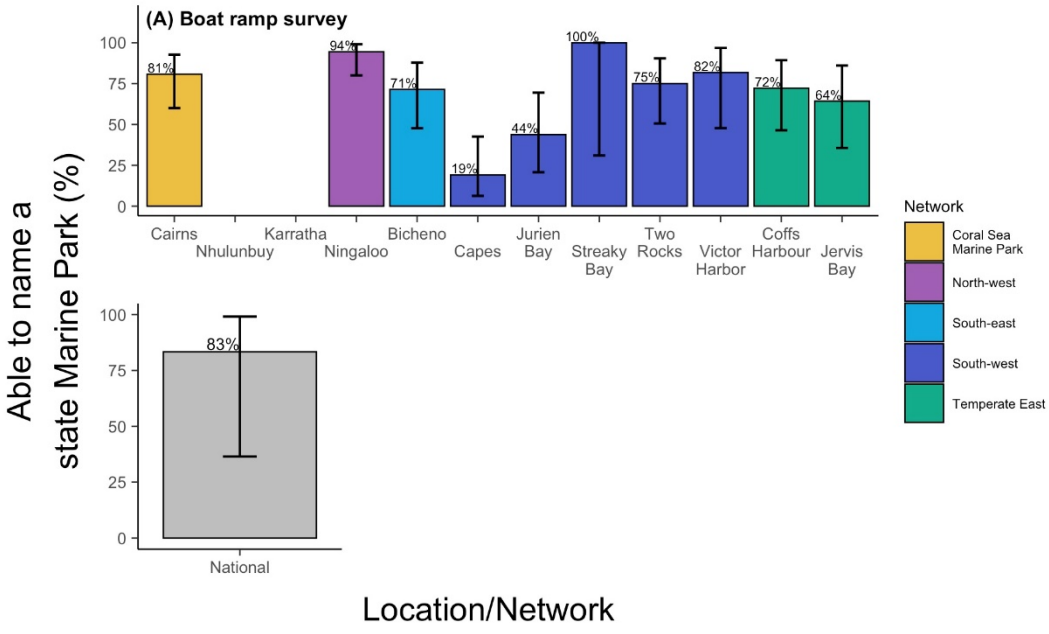

Figure 67. Percentage of non-extractive recreational users able to name a state marine park. In the boat ramp survey (A) this was ability to name a state marine park in the boat ramp survey location, whilst in the targeted survey (B) this was ability to name a state marine park in the region they operate in most frequently. This question was not asked in Nhulunbuy or Karratha due to a lack of adjacent state marine parks.

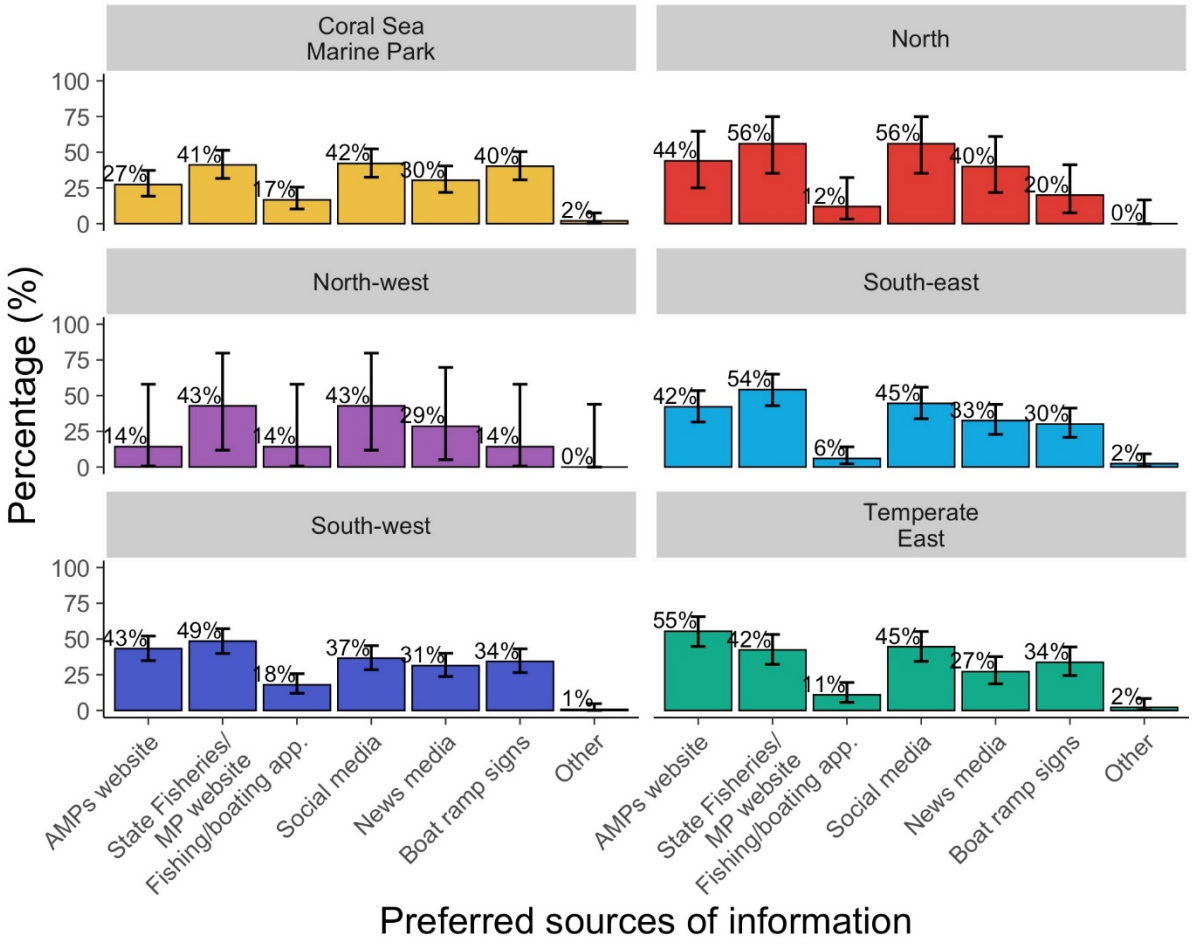

Figure 68. Non-extractive recreational users preferred sources of information about the Australian Marine Parks in the general public survey.

6.2.4 Charter operators

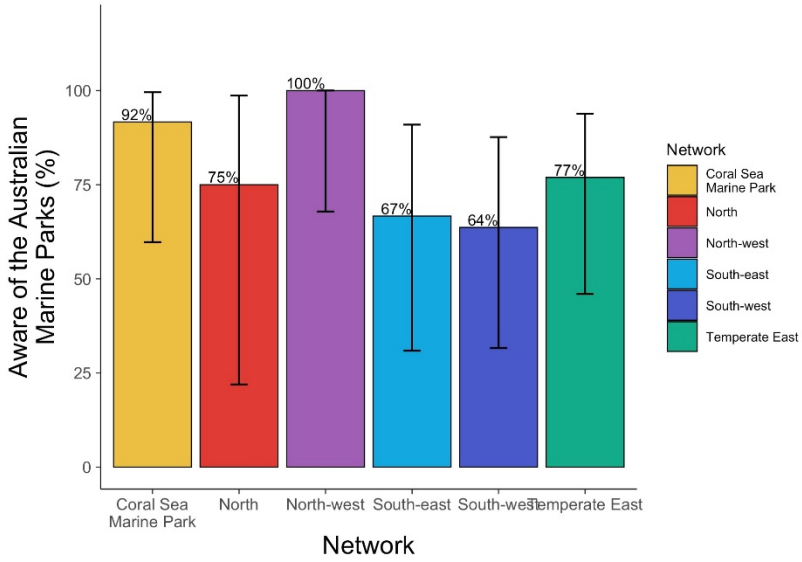

Figure 69. Charter operator stated awareness of the Australian Marine Parks.

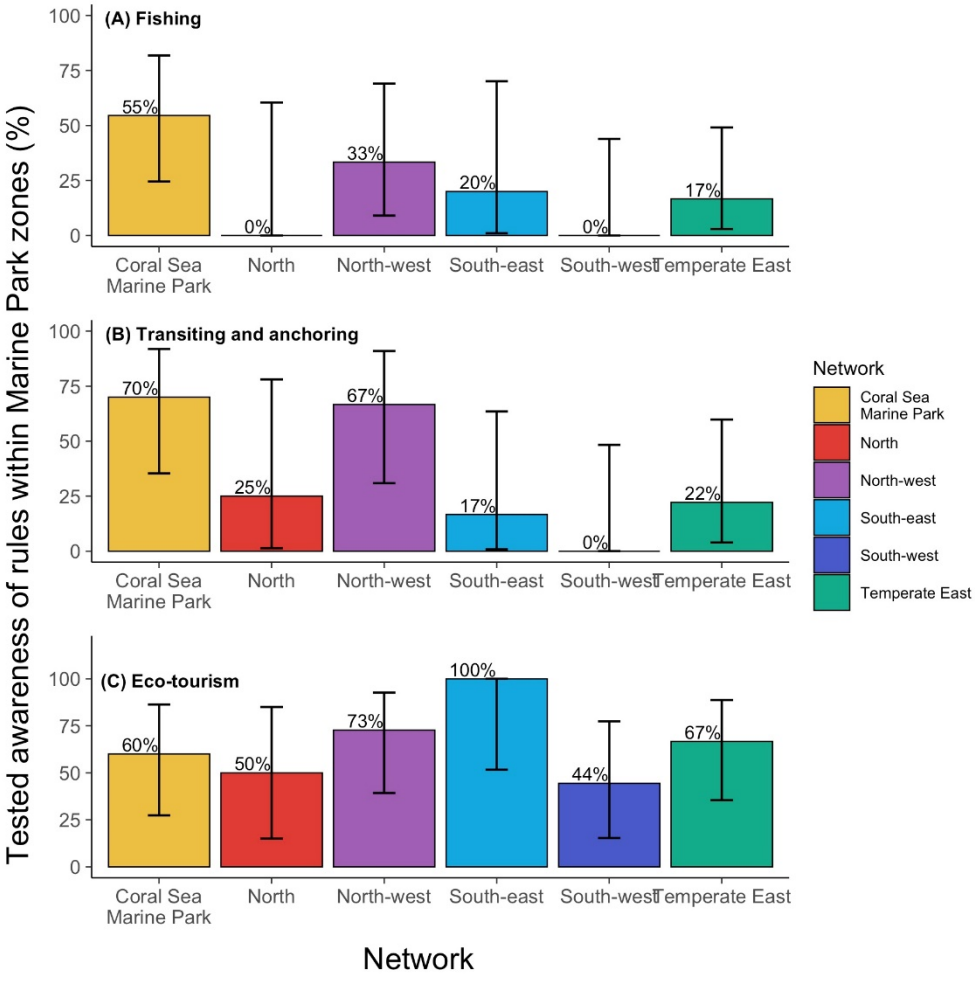

Figure 70. Tests of awareness of the activities allowable in different Australian Marine Parks.

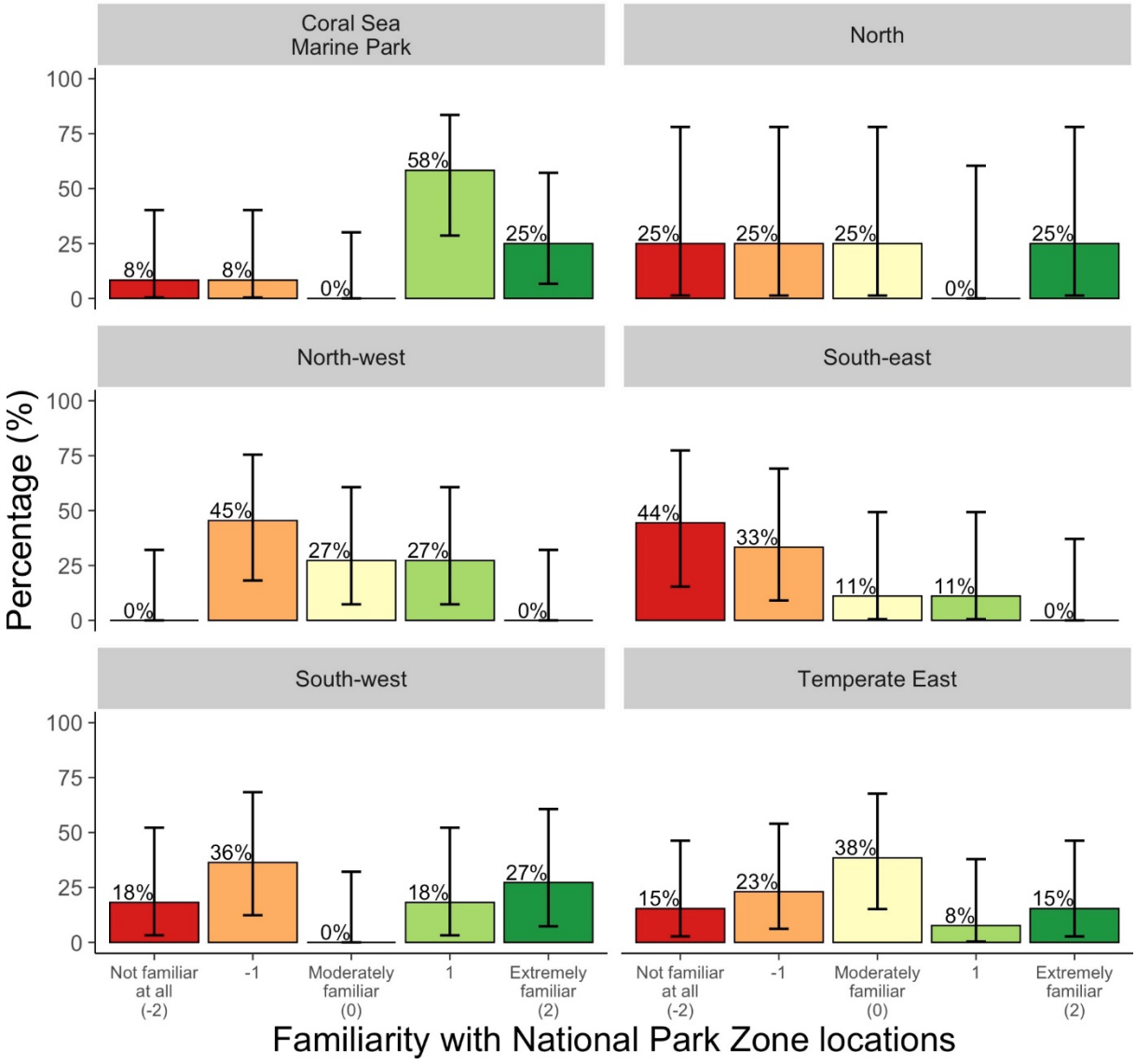

Figure 71. Charter operator's stated familiarity with the location of National Park Zones in the Australian Marine Parks.

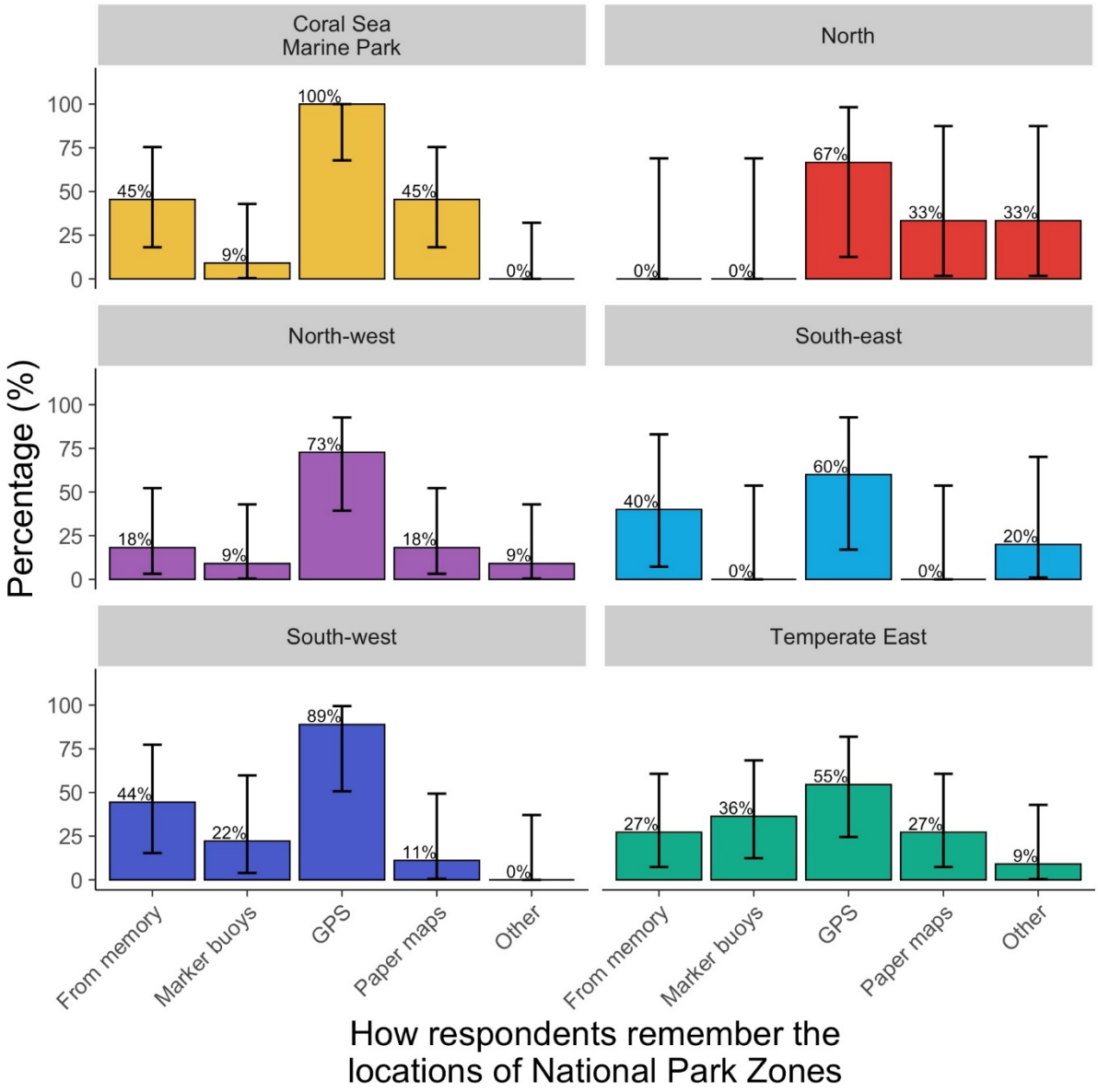

Figure 72. Method used by charter operators to remember the location of National Park Zones in the Australian Marine Parks.

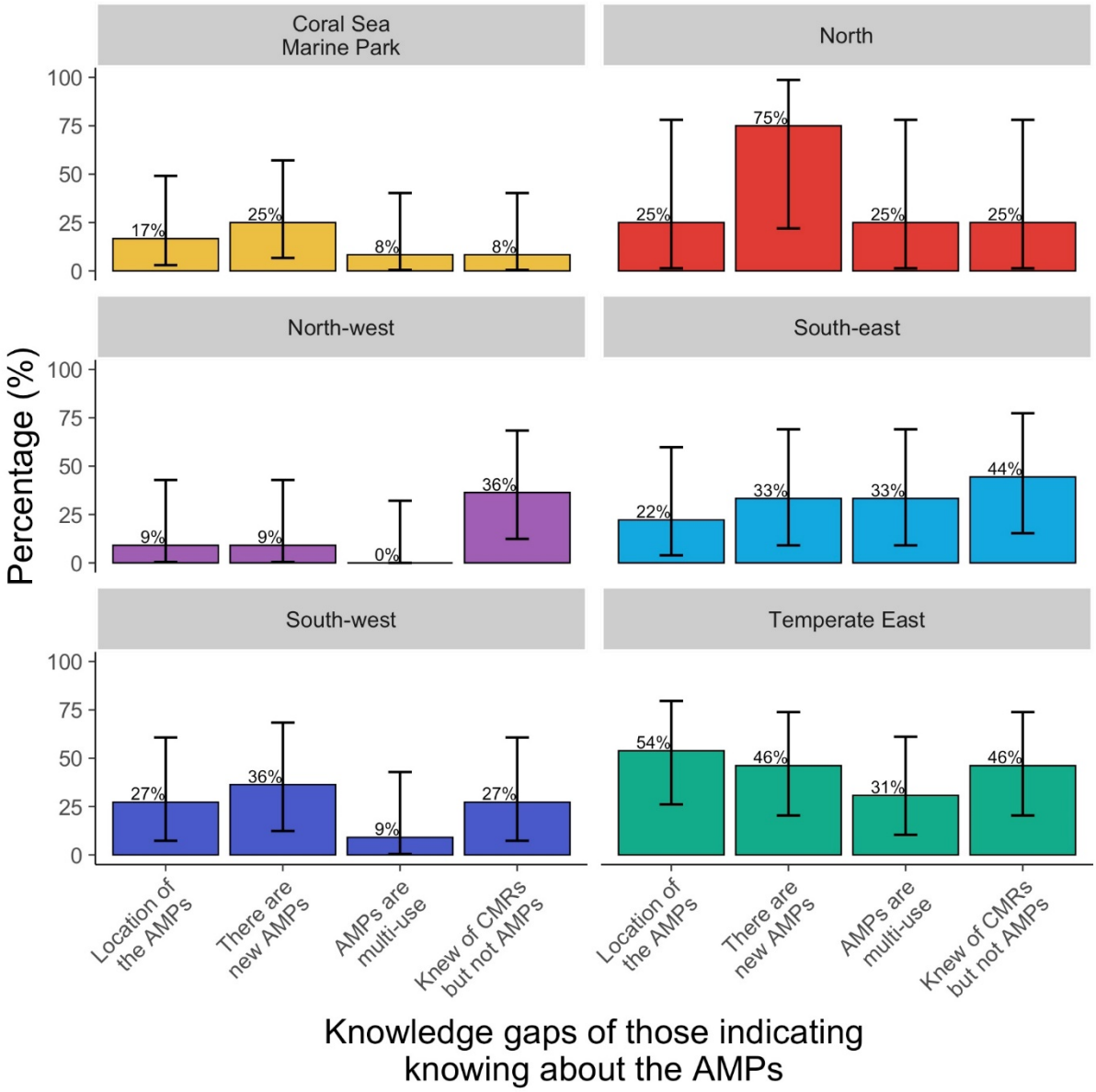

Figure 73. Knowledge gaps of charter operators about the Australian Marine Parks.

6.3 Attitudes and perceptions

6.3.1 General public

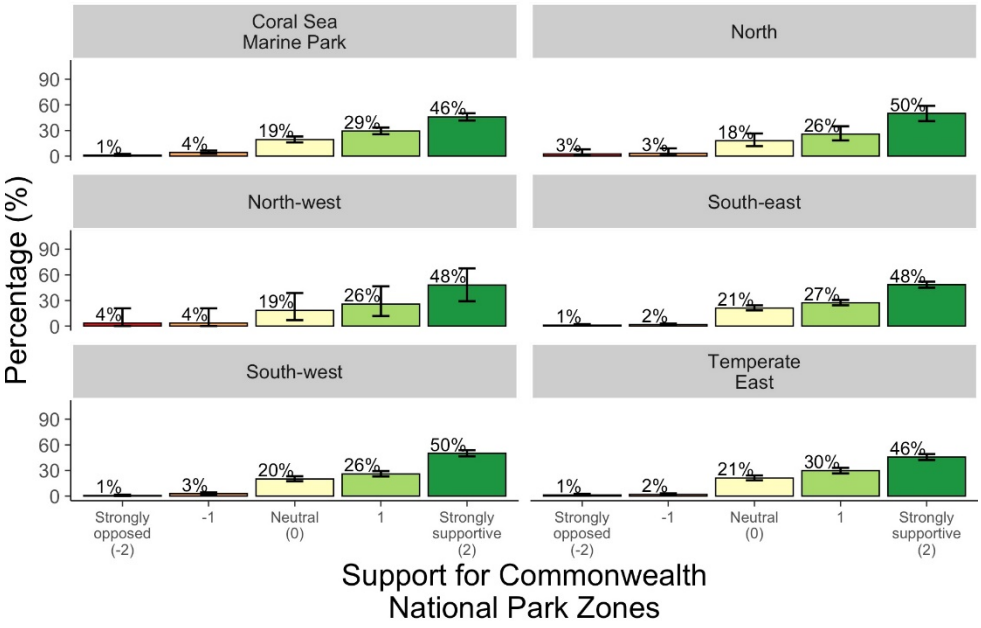

Figure 74. Support of the general public for the National Park Zones in the Australian Marine Parks.

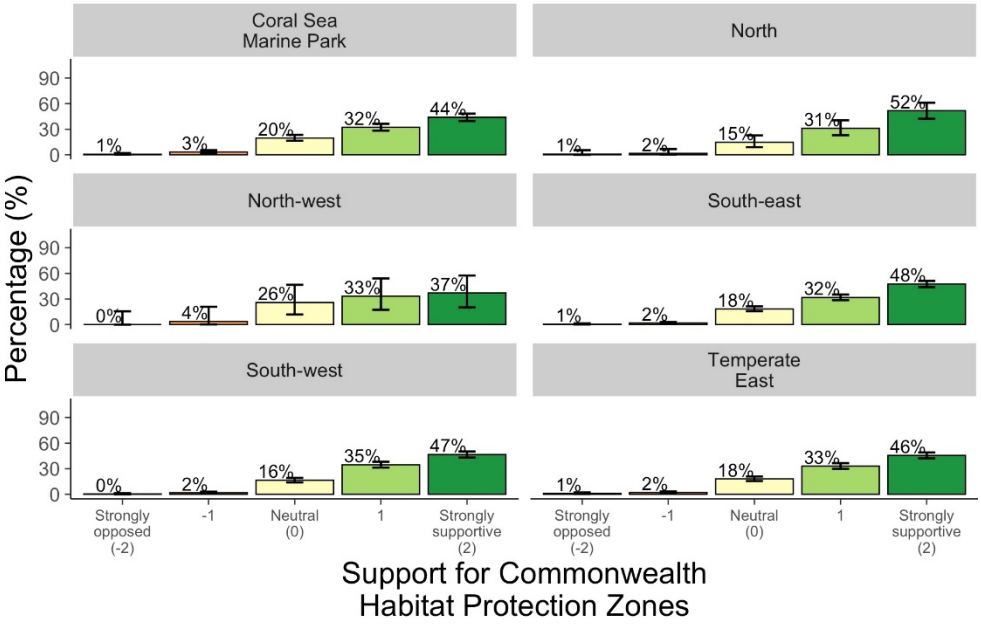

Figure 75. Support of the general public for the Habitat Protection Zones in the Australian Marine Parks. Note that for simplicity, in the general public survey this included Habitat Protection Zones and Recreational Use Zones.

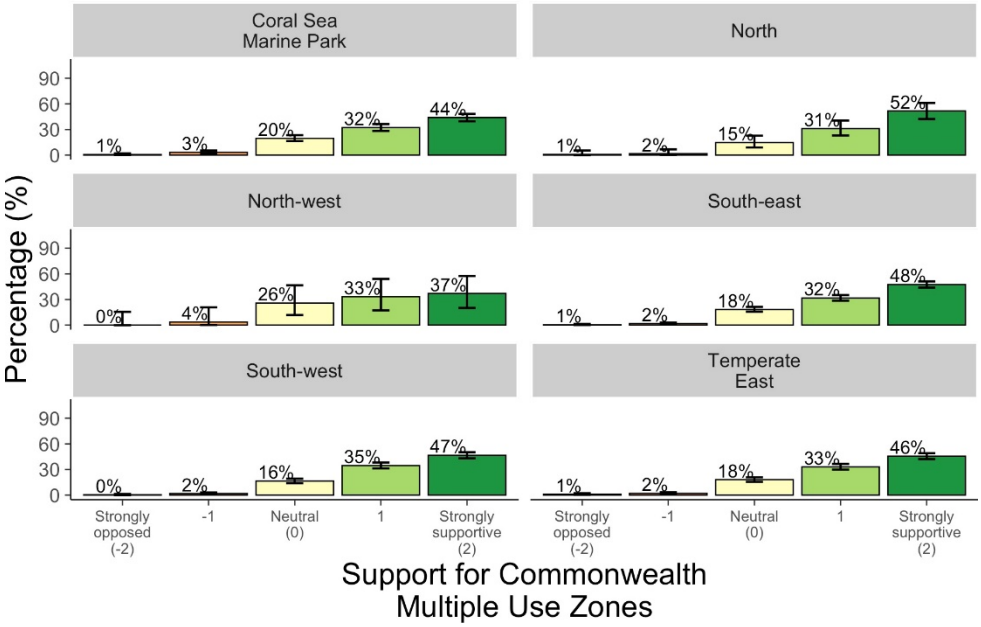

Figure 76. Support of the general public for the Multiple Use Zones in the Australian Marine Parks. Note that for simplicity, in the general public survey this included Special Purpose Zones and Multiple Use Zones.

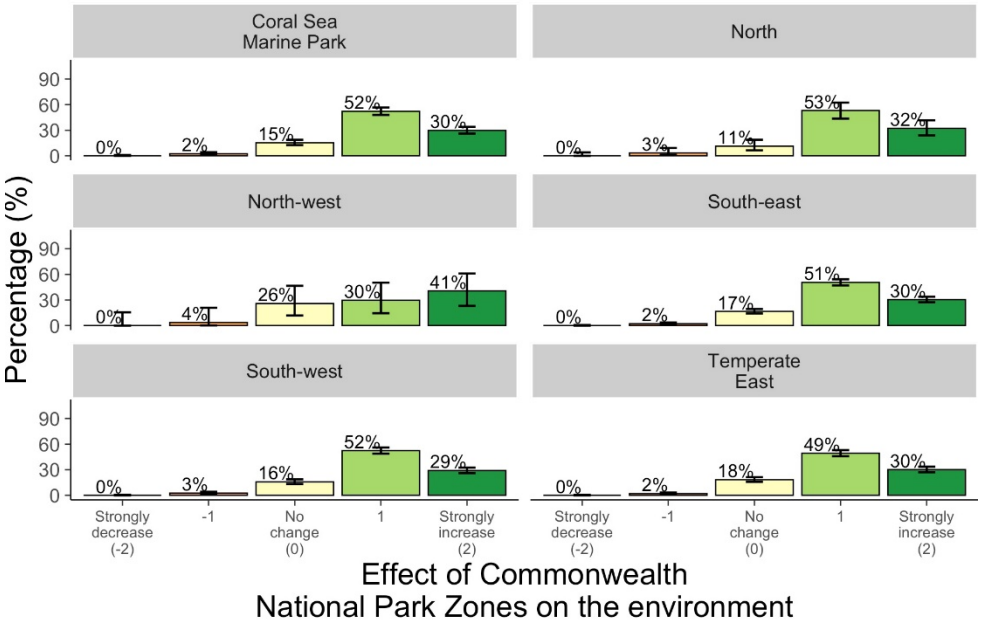

Figure 77. Perceived effect of the National Park Zones in the Australian Marine Parks on the health of marine ecosystems (defined as marine plants, animals, habitats, and their interactions).

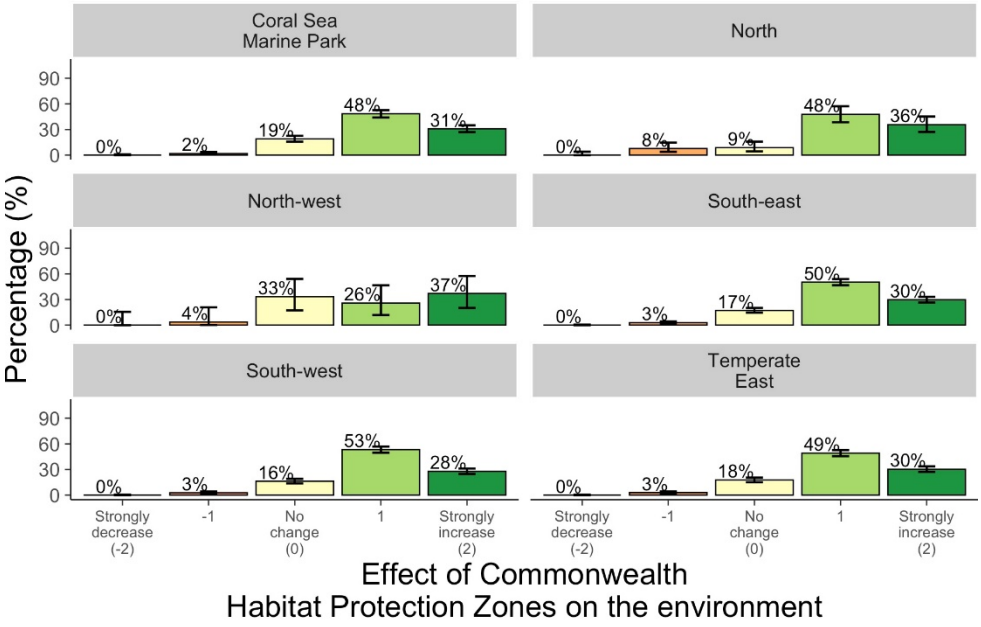

Figure 78. Perceived effect of the Habitat Protection Zones in the Australian Marine Parks on the health of marine ecosystems (defined as marine plants, animals, habitats, and their interactions). Note that for simplicity, in the general public survey this included Habitat Protection Zones and Recreational Use Zones.

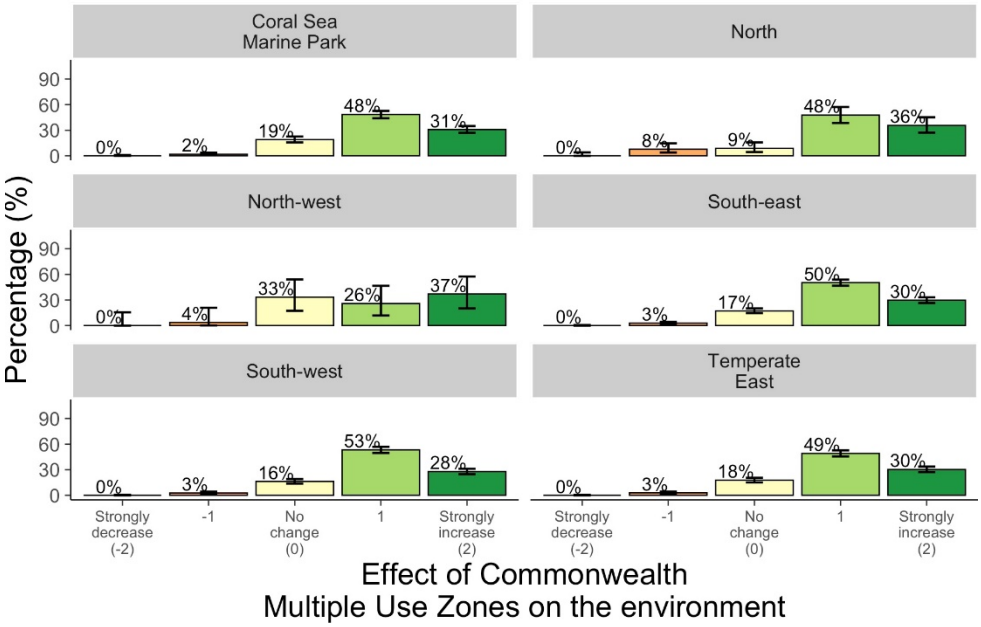

Figure 79. Perceived effect of the Multiple Use Zones in the Australian Marine Parks on the health of marine ecosystems (defined as marine plants, animals, habitats, and their interactions). Note that for simplicity, in the general public survey this included Special Purpose Zones and Multiple Use Zones.

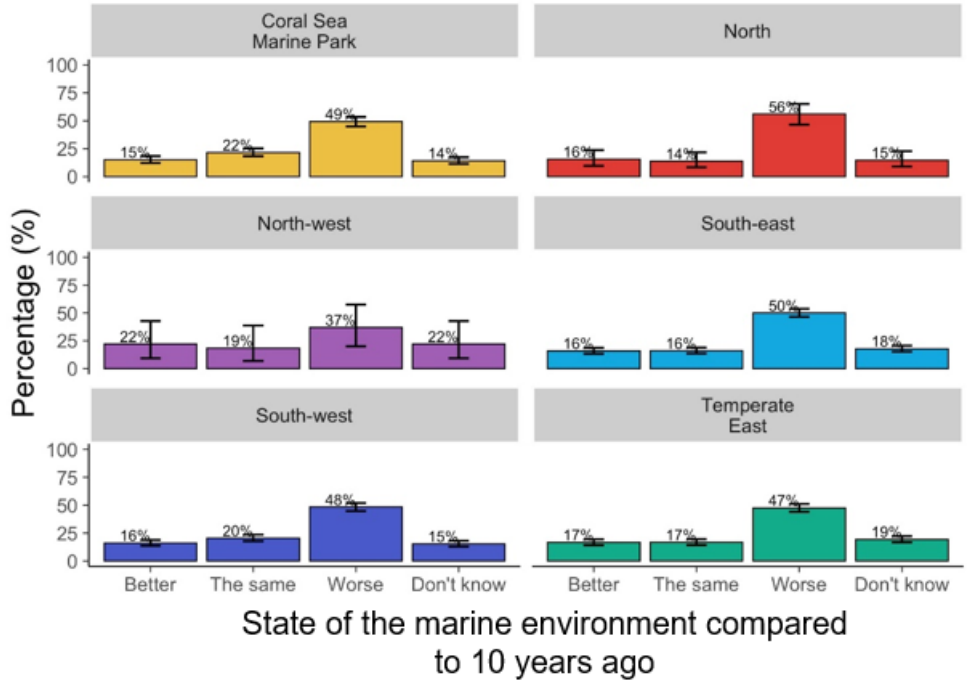

Figure 80. General public perceptions about whether marine ecosystems are better, the same or worse than ten years ago.

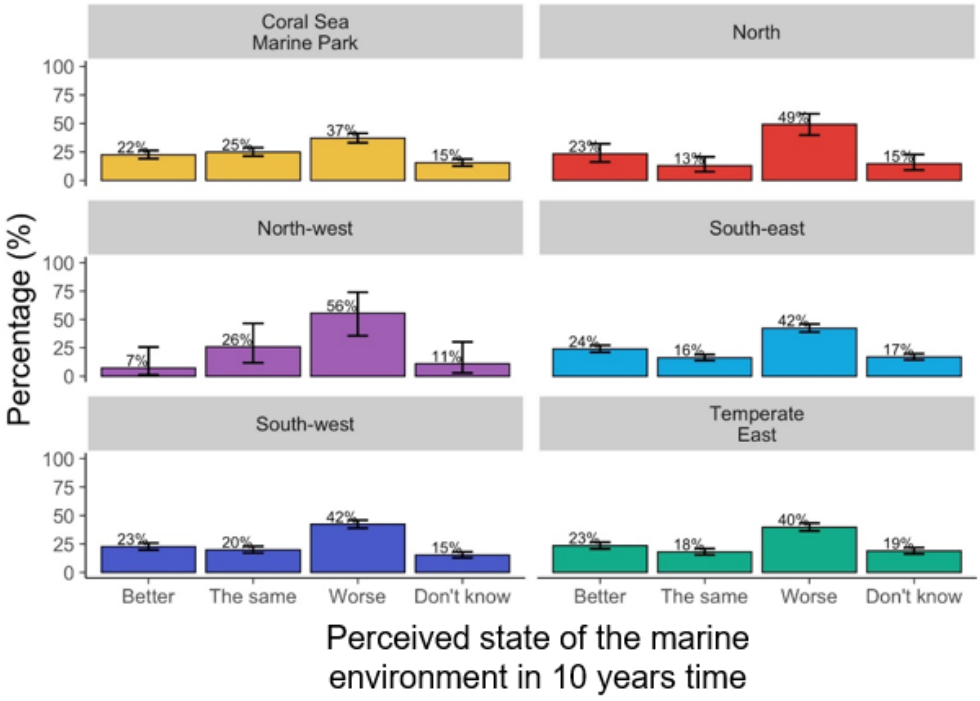

Figure 81. General public perceptions about whether marine ecosystems will be better, the same or worse in ten years.

6.3.2 Recreational fishers

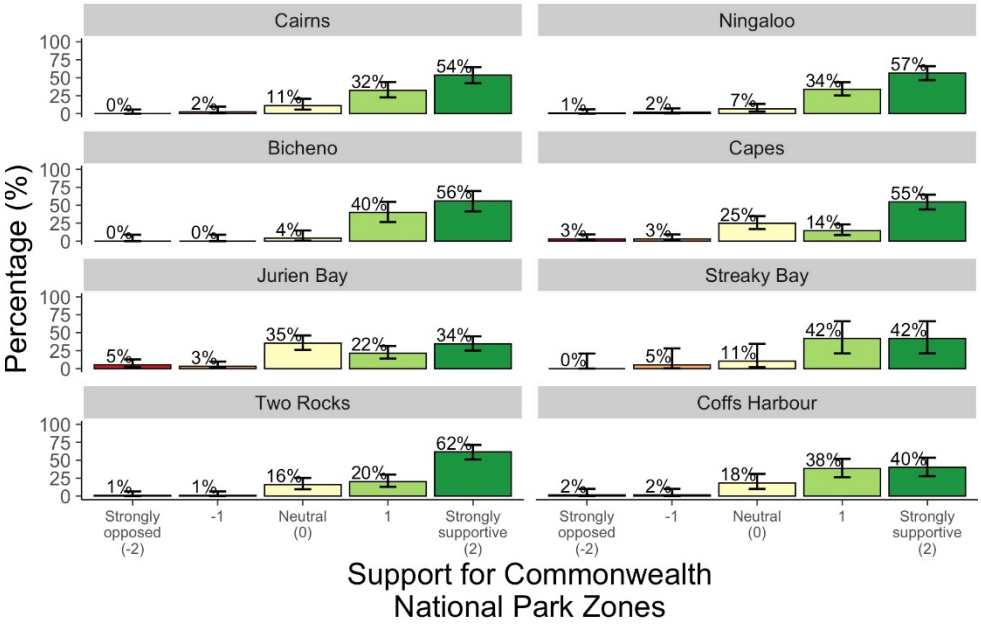

Figure 82. Support of recreational fishers in the boat ramp survey for the National Park Zones (NPZs) in the Australian Marine Parks. Note that recreational fishers were asked about the NPZs in the survey location.

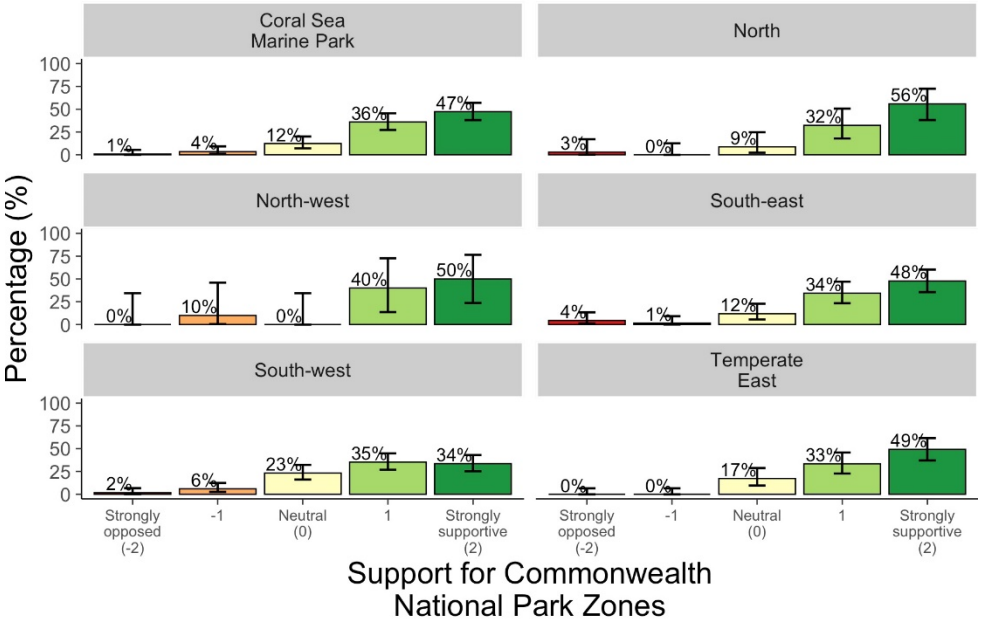

Figure 83. Support of recreational fishers in the general public survey for the National Park Zones (NPZs) in the Australian Marine Parks. Note that recreational fishers were asked about the NPZs at a national scale.

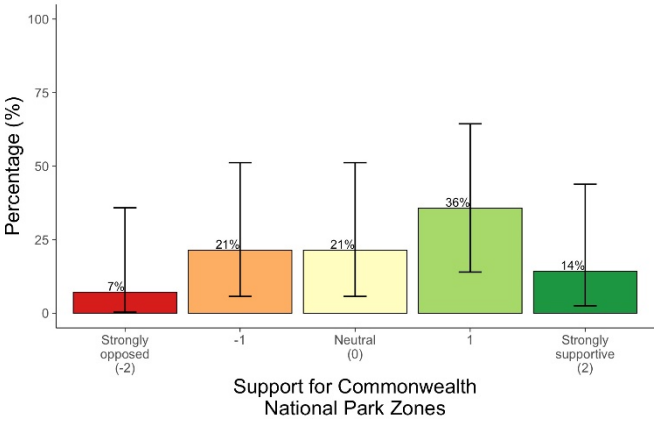

Figure 84. Support of recreational fishers in the targeted survey for the National Park Zones (NPZs) in the Australian Marine Parks. Note that recreational fishers were asked about the NPZs in the sub-network where they fished most.

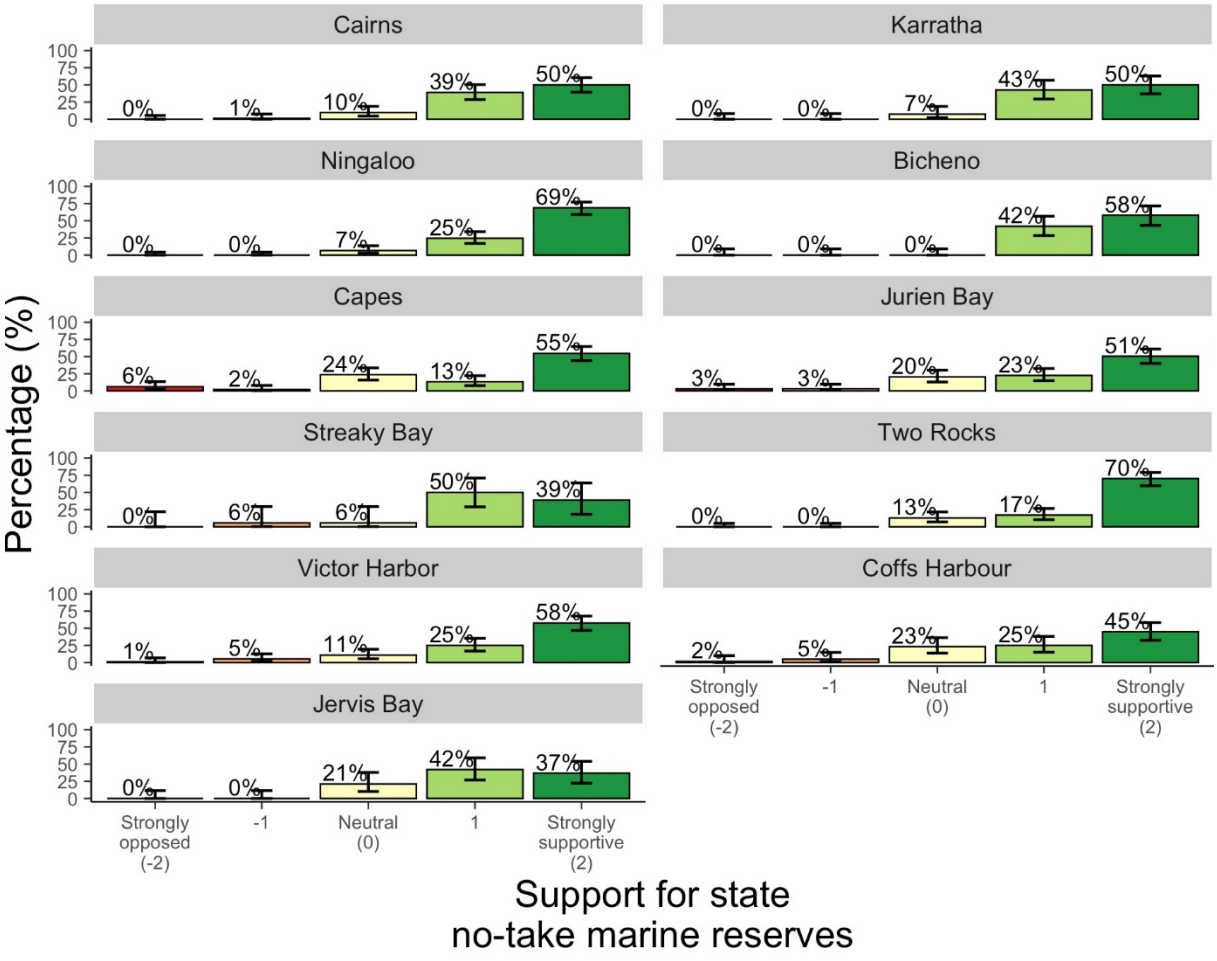

Figure 85. Support of recreational fishers in the boat ramp survey for state no-take marine reserves in the survey location.

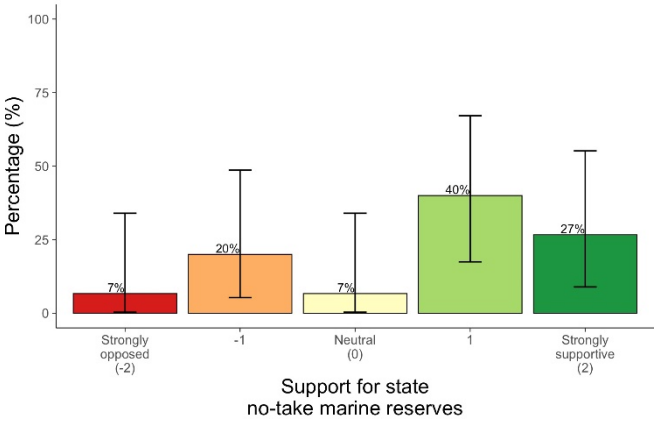

Figure 86. Support of recreational fishers in the targeted survey for the state no-take marine reserves in the sub-network where they fished most.

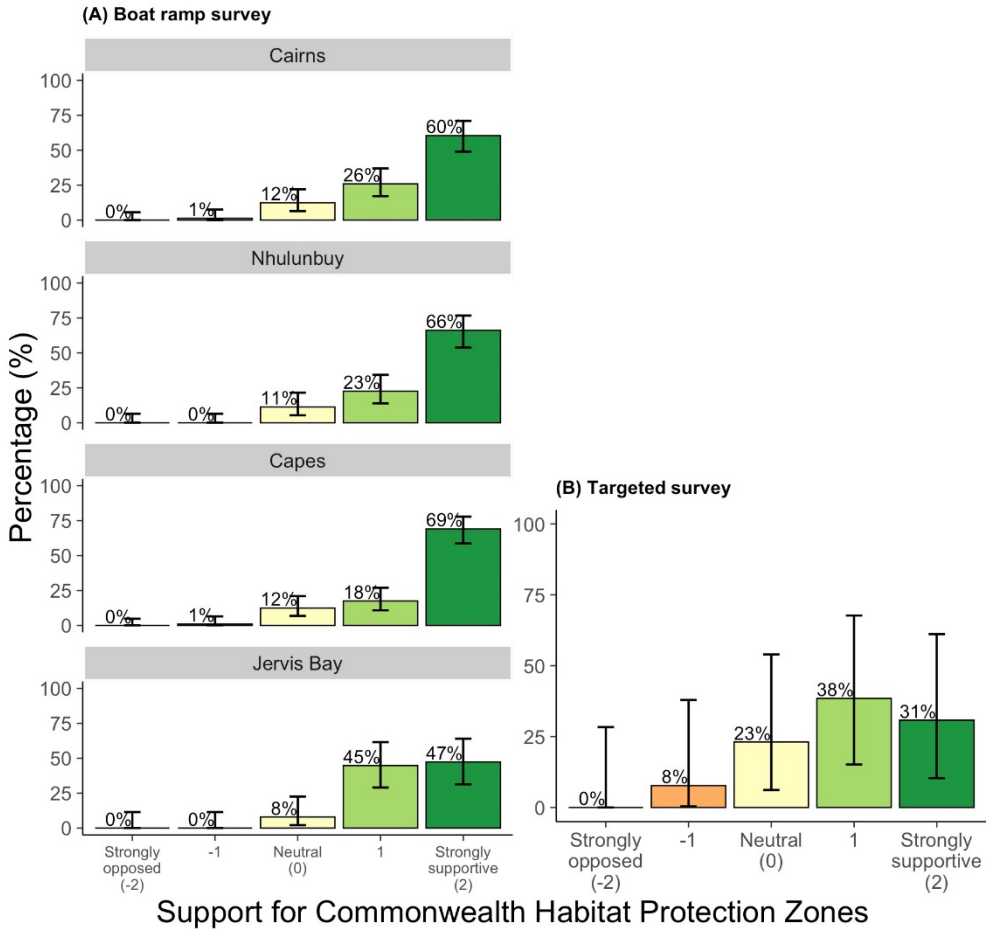

Figure 87. Support of recreational fishers in (A) the boat ramp survey and (B) the targeted survey for the Habitat Protection Zones (HPZs) in the Australian Marine Parks. Note that recreational fishers in the boat ramp survey were asked about HPZs in the survey location, while those in the targeted survey were asked about HPZs in the sub-network where they fished most.

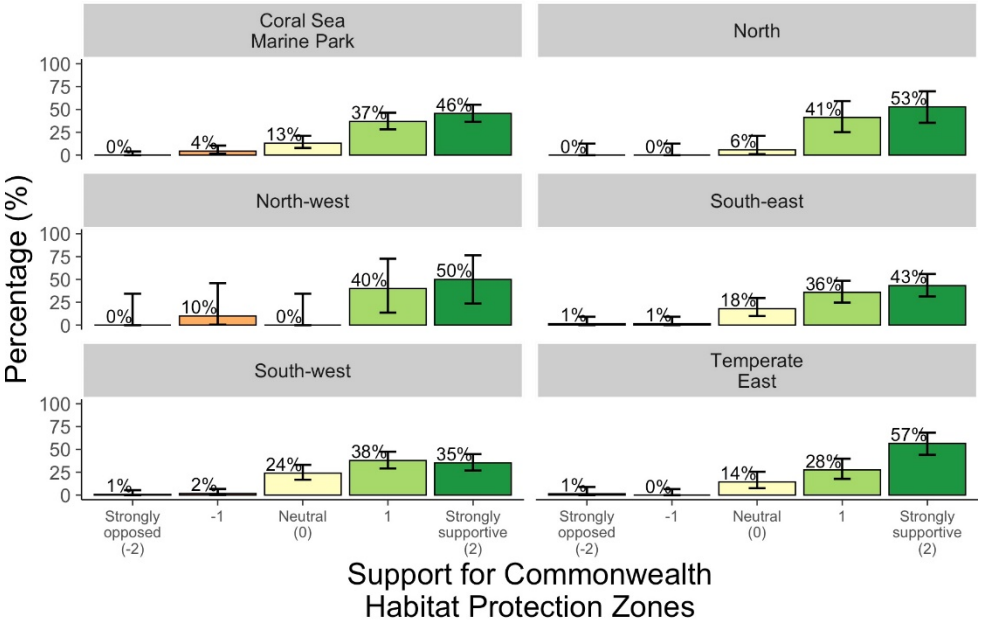

Figure 88. Support of recreational fishers in the general public survey for the Habitat Protection Zones (HPZs) in the Australian Marine Parks. Note that recreational fishers were asked about the HPZs at a national scale.

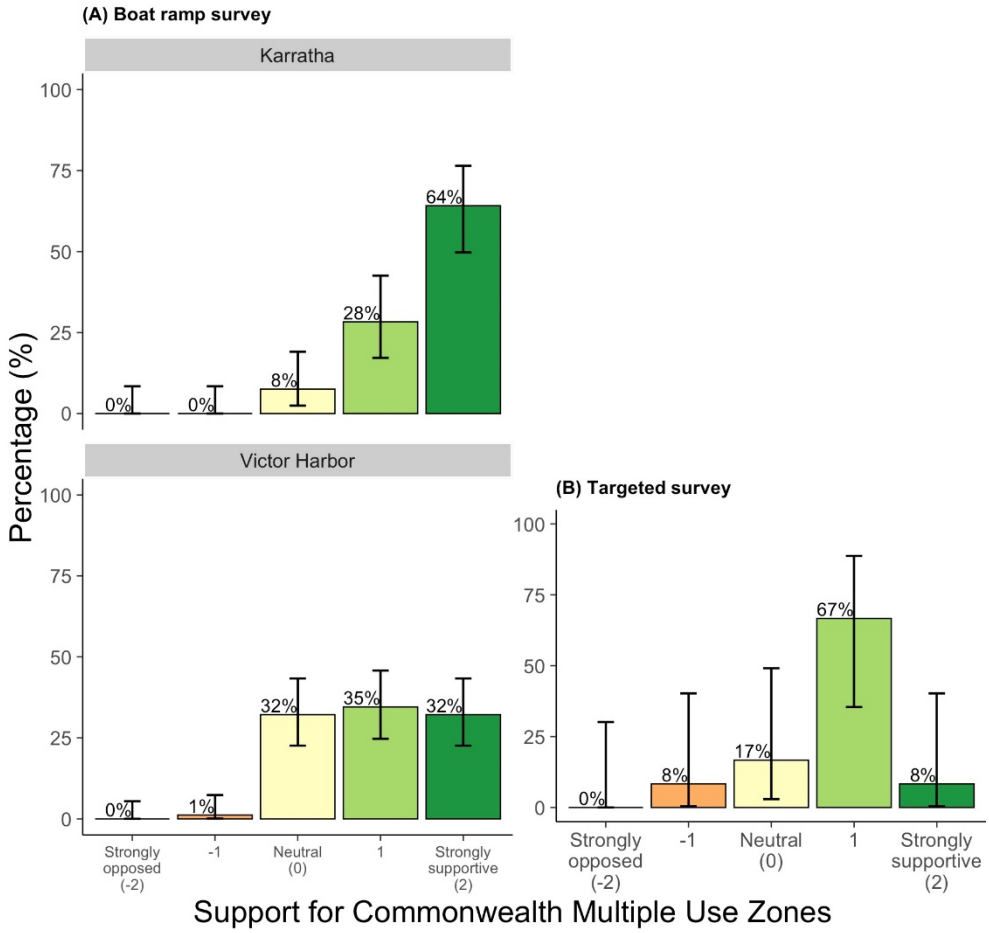

Figure 89. Support of recreational fishers in (A) the boat ramp survey and (B) the targeted survey for the Multiple Use Zones (MUZs) in the Australian Marine Parks. Note that recreational fishers in the boat ramp survey were asked about MUZs in the survey location, while those in the targeted survey were asked about MUZs in the sub-network where they fished most.

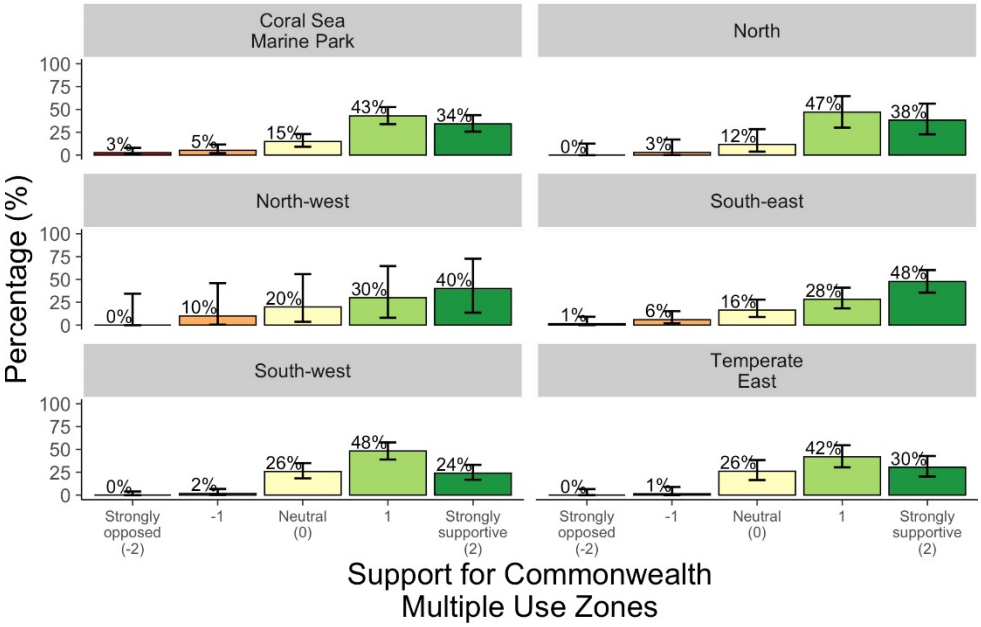

Figure 90. Support of recreational fishers in the general public survey for the Multiple Use Zones (MUZs) in the Australian Marine Parks. Note that recreational fishers were asked about the MUZs at a national scale.

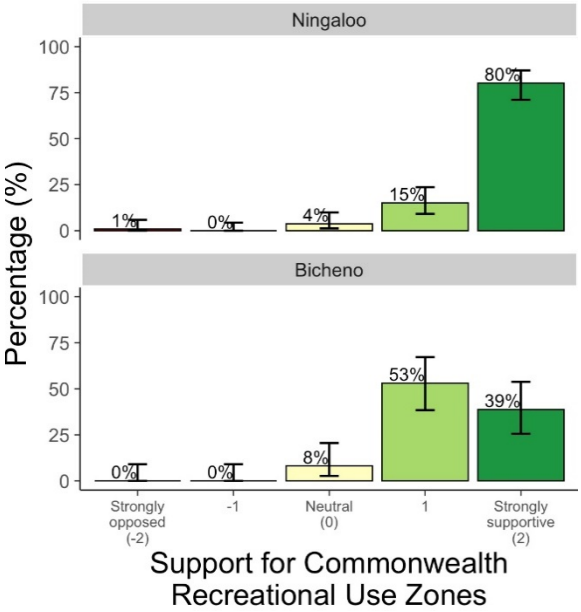

Figure 91. Support of recreational fishers in the boat ramp survey for the Recreational Use Zones (RUZs) in the Australian Marine Parks. Note that recreational fishers were asked about the RUZs in the survey location.

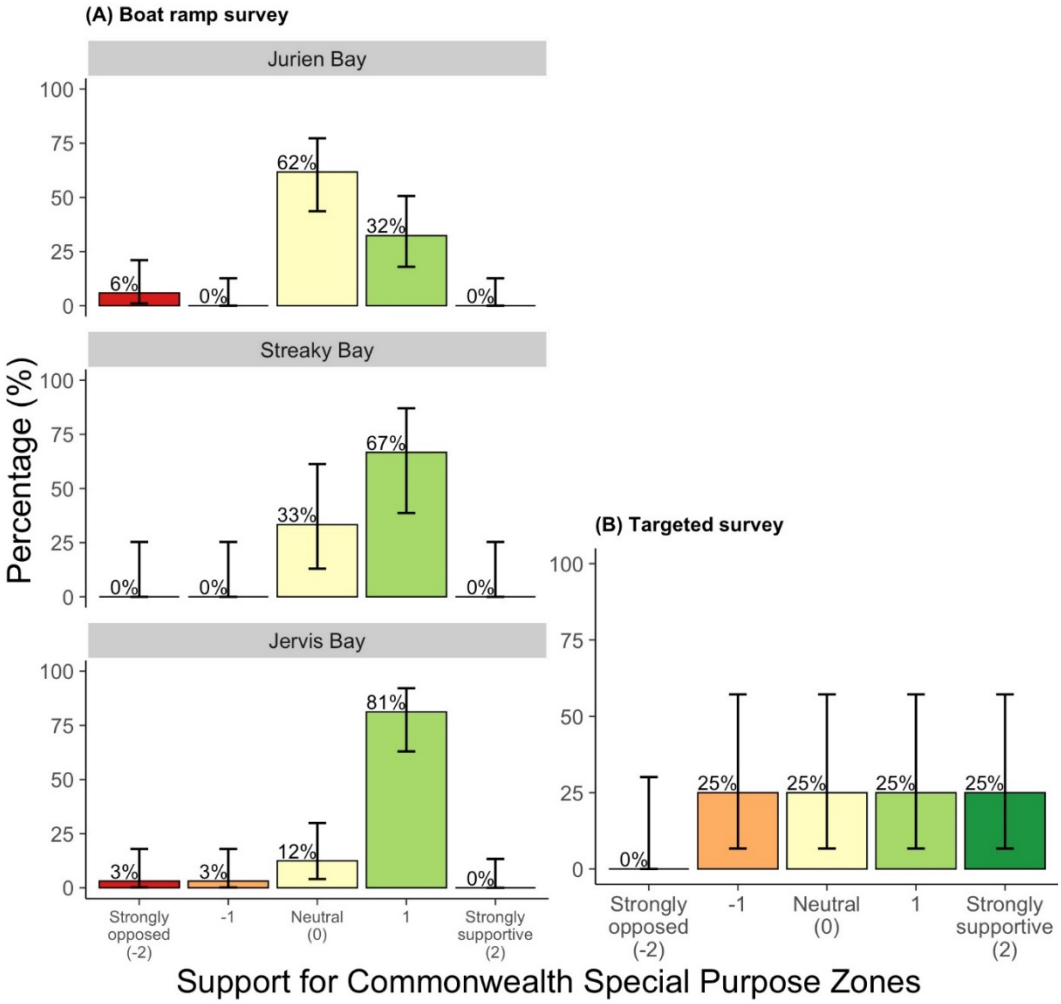

Figure 92. Support of recreational fishers in (A) the boat ramp survey and (B) the targeted survey for the Special Purpose Zones (SPZs) in the Australian Marine Parks. Note that recreational fishers in the boat ramp survey were asked about SPZs in the survey location, while those in the targeted survey were asked about SPZs in the sub-network where they fished most.

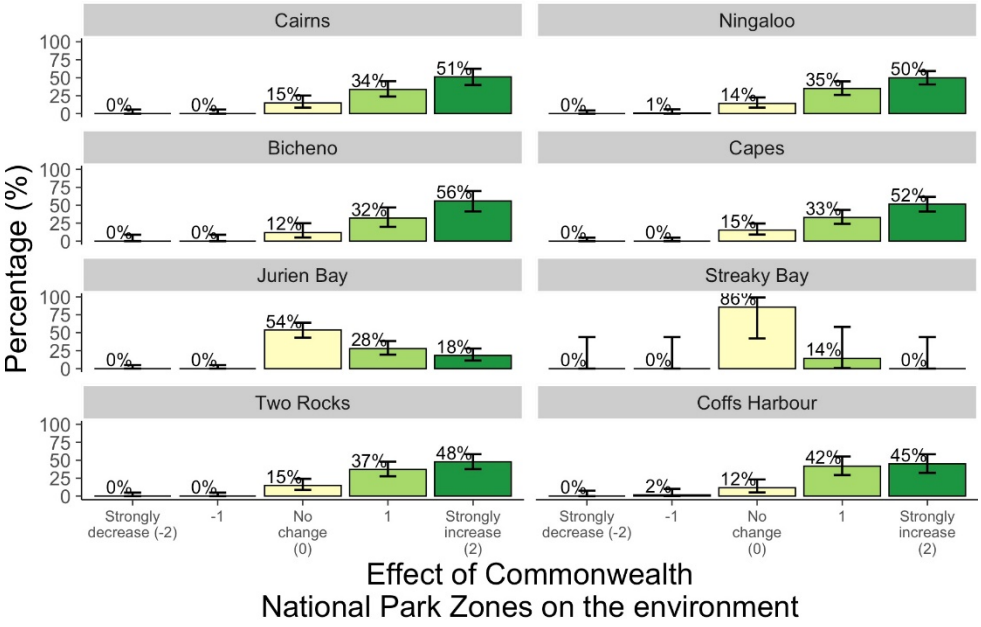

Figure 93. Recreational fishers in the boat ramp surveys' beliefs about the effect of National Park Zones (NPZs) in the Australian Marine Parks on the health of the marine environment. Note that recreational fishers were asked about the NPZs in the survey location.

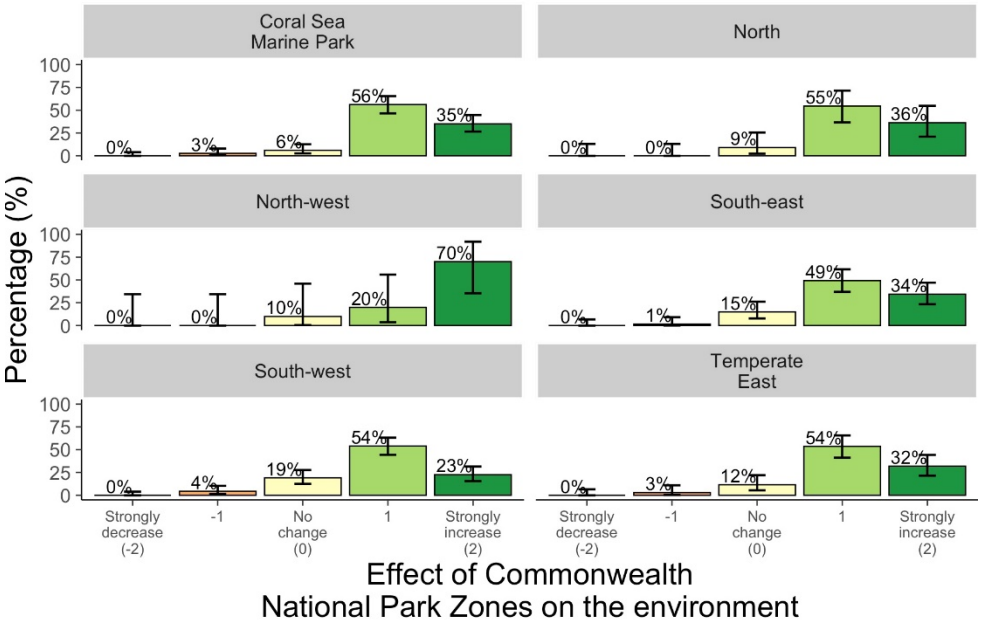

Figure 94. Recreational fishers in the general public surveys' beliefs about the effect of National Park Zones (NPZs) in the Australian Marine Parks on the health of the marine environment. Note that recreational fishers were asked about the NPZs at a national scale.

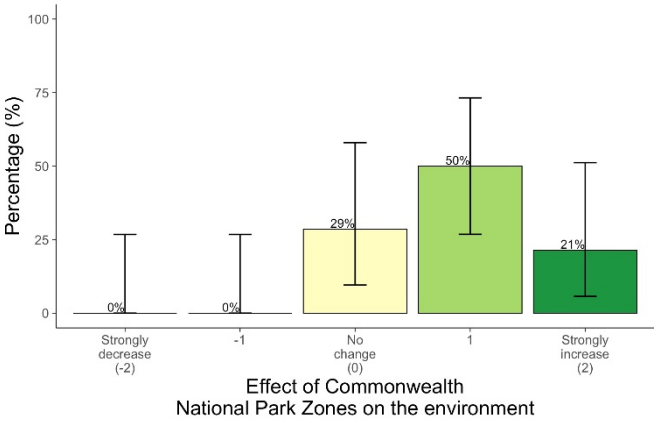

Figure 95. Recreational fishers in the targeted surveys' beliefs about the effect of National Park Zones (NPZs) in the Australian Marine Parks on the health of the marine environment. Note that recreational fishers were asked about the NPZs in the sub-network where they fished most.

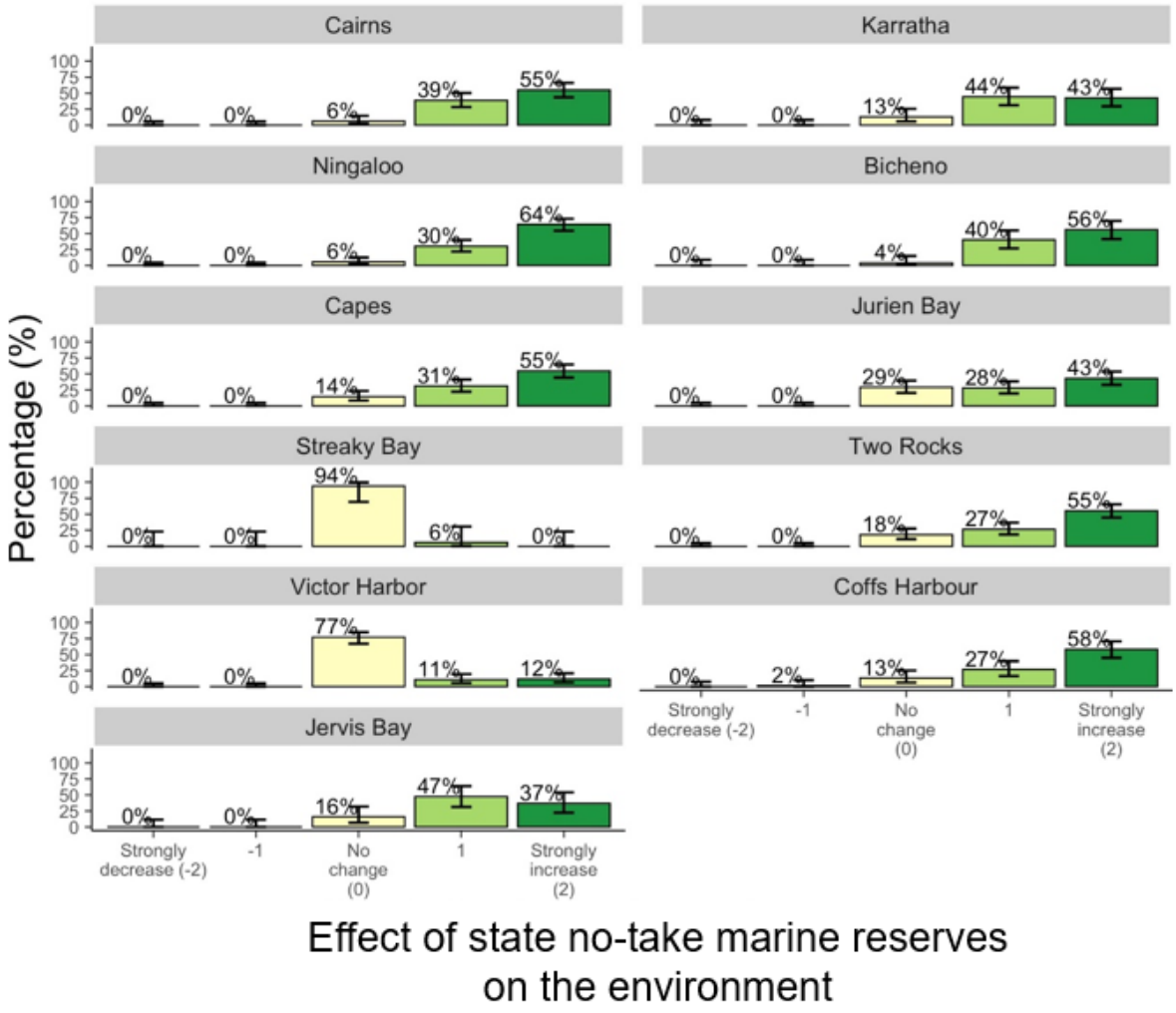

Figure 96. Recreational fishers in the boat ramp surveys' beliefs about the effect of state no-take marine reserves on the health of the marine environment. Note that recreational fishers were asked about the state no-take marine reserves in the survey location.

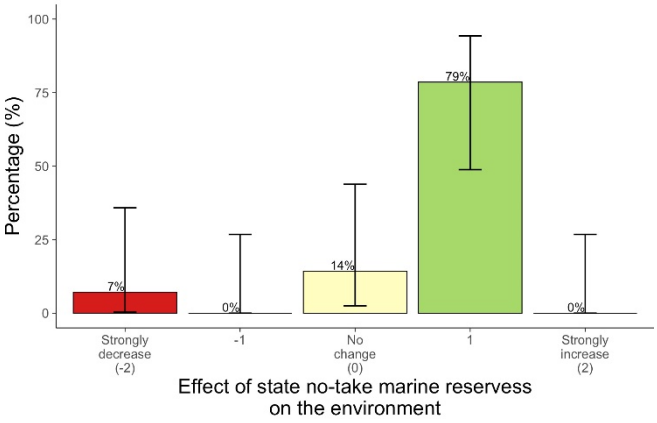

Figure 97. Recreational fishers in the targeted surveys' beliefs about the effect of state no-take marine reserves on the health of the marine environment. Note that recreational fishers were asked about the state no-take marine reserves in the sub-network where they fished most.

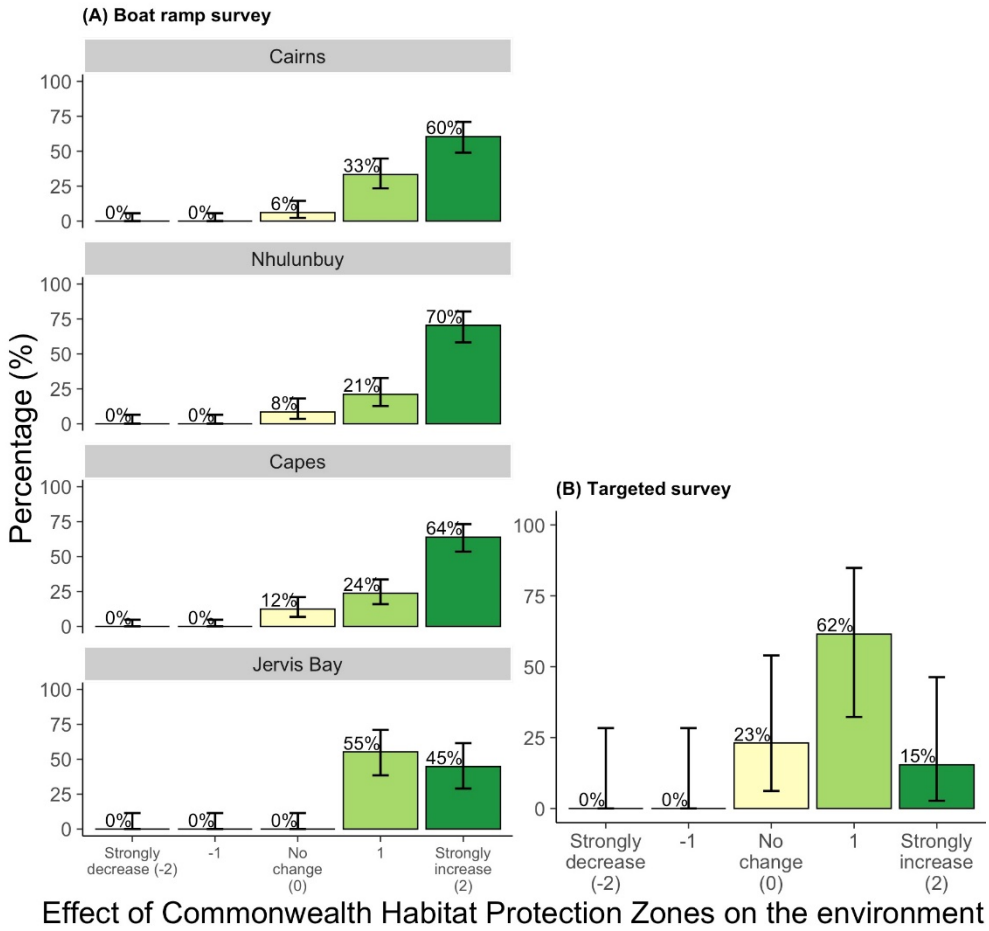

Figure 98. Beliefs of recreational fishers in (A) the boat ramp survey and (B) the targeted survey about the effect of Habitat Protection Zones (HPZs) in the Australian Marine Parks on the health of the marine environment. Note that recreational fishers in the boat ramp survey were asked about HPZs in the survey location, while those in the targeted survey were asked about HPZs in the sub-network where they fished most.

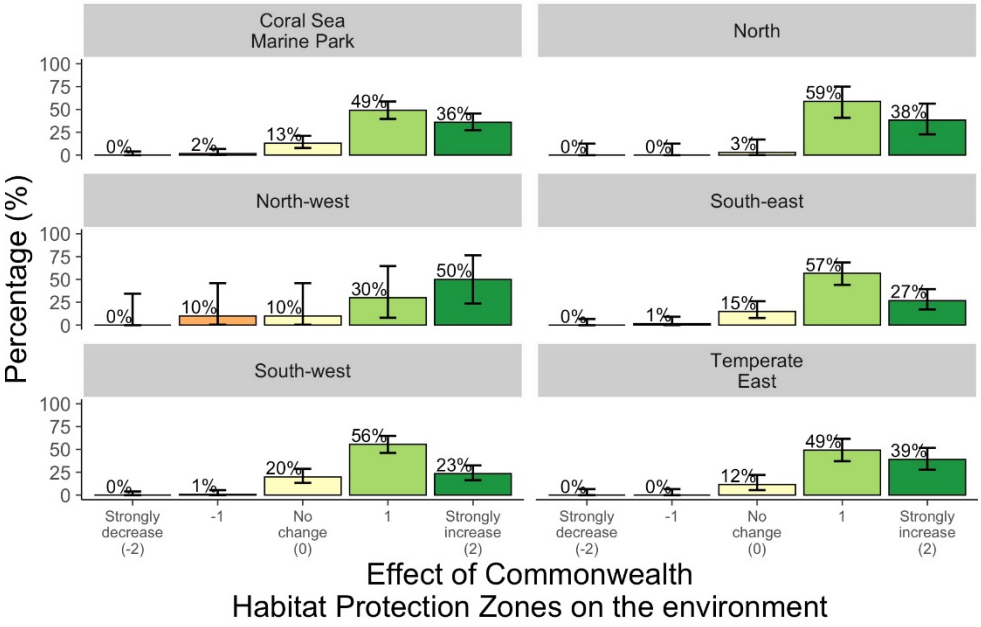

Figure 99. Recreational fishers in the general public surveys' beliefs about the effect of Habitat Protection Zones (HPZs) in the Australian Marine Parks on the health of the marine environment. Note that recreational fishers were asked about the HPZs at a national scale.

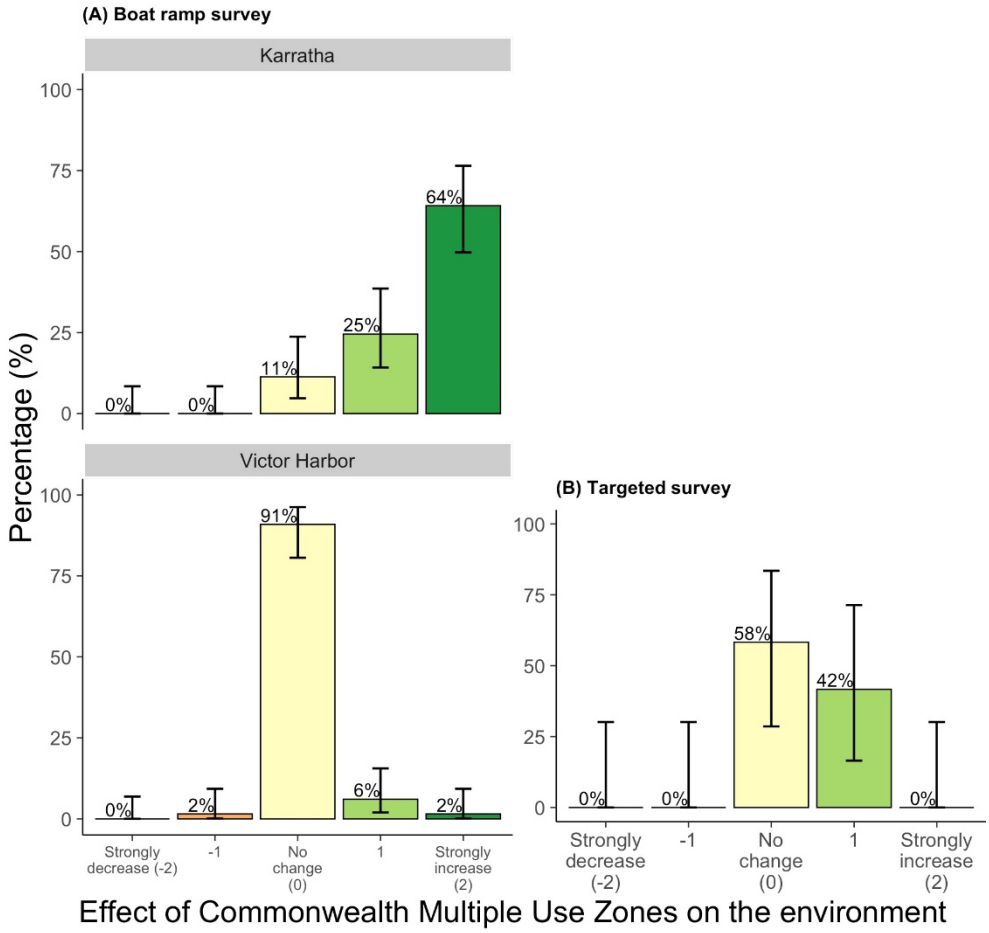

Figure 100. Beliefs of recreational fishers in (A) the boat ramp survey and (B) the targeted survey about the effect of Multiple Use Zones (MUZs) in the Australian Marine Parks on the health of the marine environment. Note that recreational fishers in the boat ramp survey were asked about the MUZs in the survey location, while those in the targeted survey were asked about the MUZs in the sub-network where they fished most.

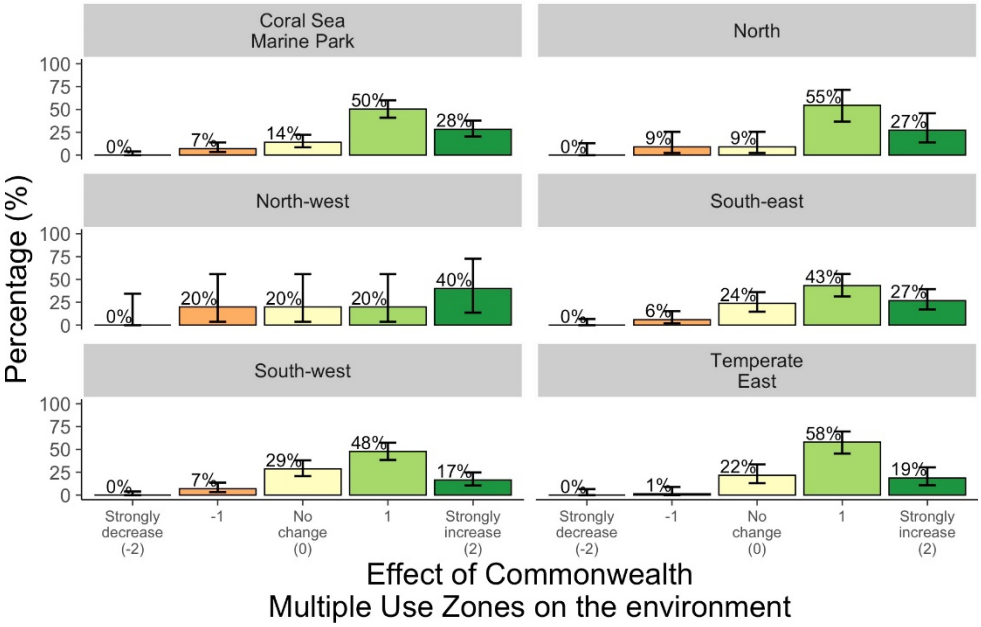

Figure 101. Recreational fishers in the general public surveys' beliefs about the effect of Multiple Use Zones (MUZs) in the Australian Marine Parks on the health of the marine environment. Note that recreational fishers were asked about the MUZs at a national scale.

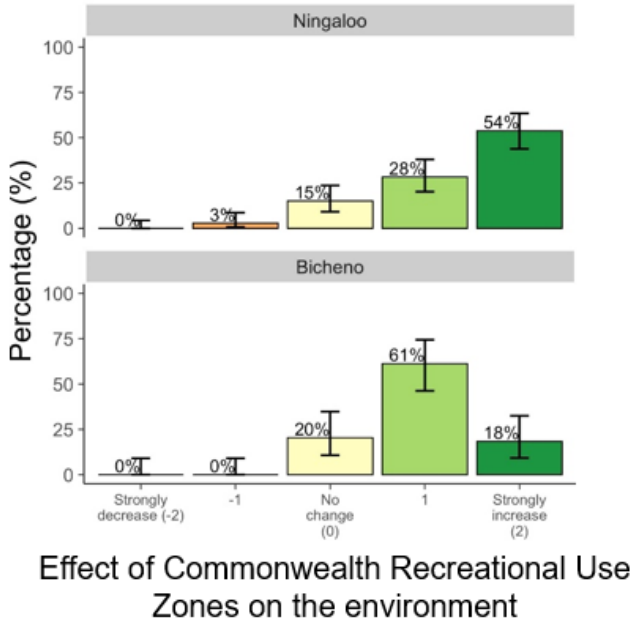

Figure 102. Recreational fishers in the boat ramp surveys' beliefs about the effect of Recreational Use Zones (RUZs) in the Australian Marine Parks on the health of the marine environment. Note that recreational fishers were asked about the RUZs in the survey location.

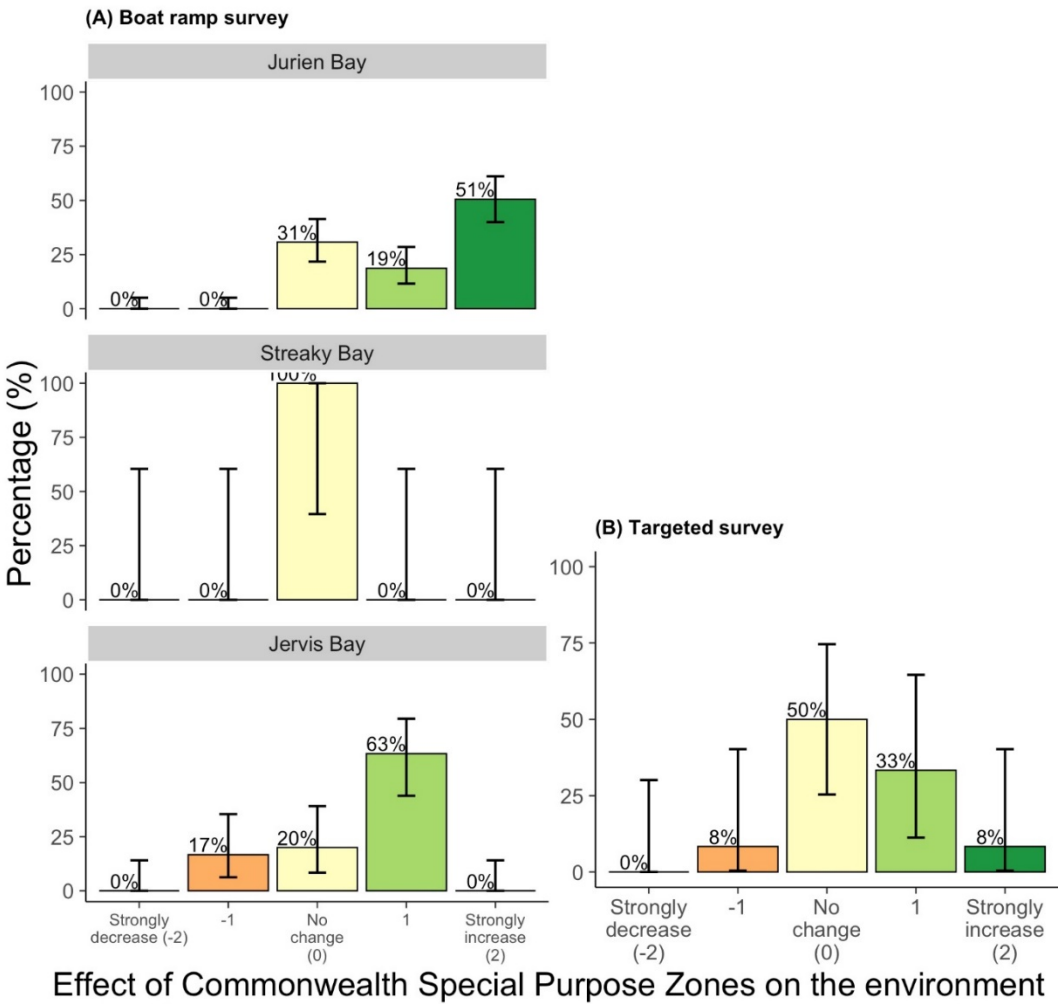

Figure 103. Beliefs of recreational fishers in (A) the boat ramp survey and (B) the targeted survey about the effect of Special Purpose Zones (SPZs) in the Australian Marine Parks on the health of the marine environment. Note that recreational fishers in the boat ramp survey were asked about the SPZs in the survey location, while those in the targeted survey were asked about the SPZs in the sub-network where they fished most.

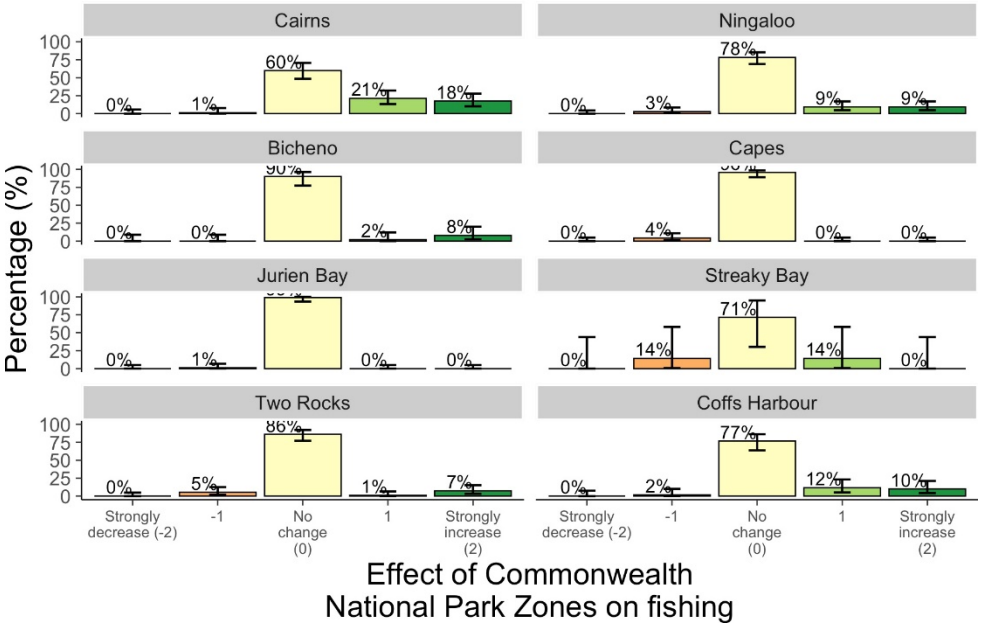

Figure 104. Recreational fishers in the boat ramp surveys' beliefs about the effect of National Park Zones (NPZs) in the Australian Marine Parks on their fishing. Note that recreational fishers were asked about the NPZs in the survey location.

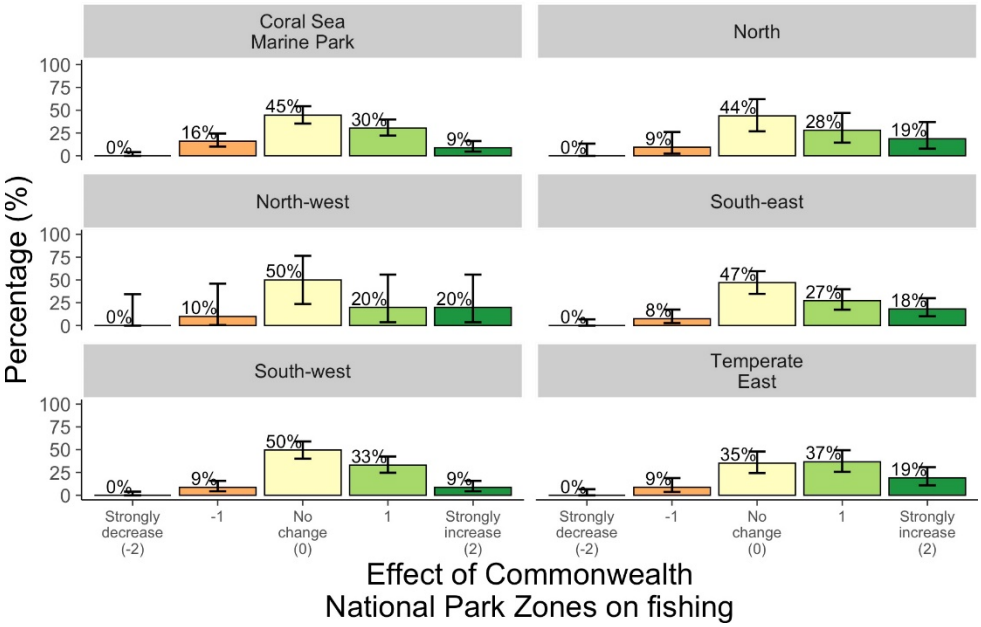

Figure 105. Recreational fishers in the general public surveys' beliefs about the effect of National Park Zones (NPZs) in the Australian Marine Parks on their fishing. Note that recreational fishers were asked about the NPZs at a national scale.

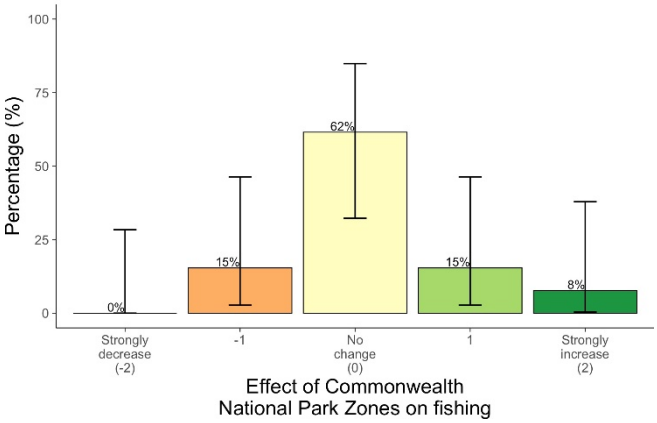

Figure 106. Recreational fishers in the targeted surveys' beliefs about the effect of National Park Zones (NPZs) in the Australian Marine Parks on their fishing. Note that recreational fishers were asked about the NPZs in the sub-network where they fished most.

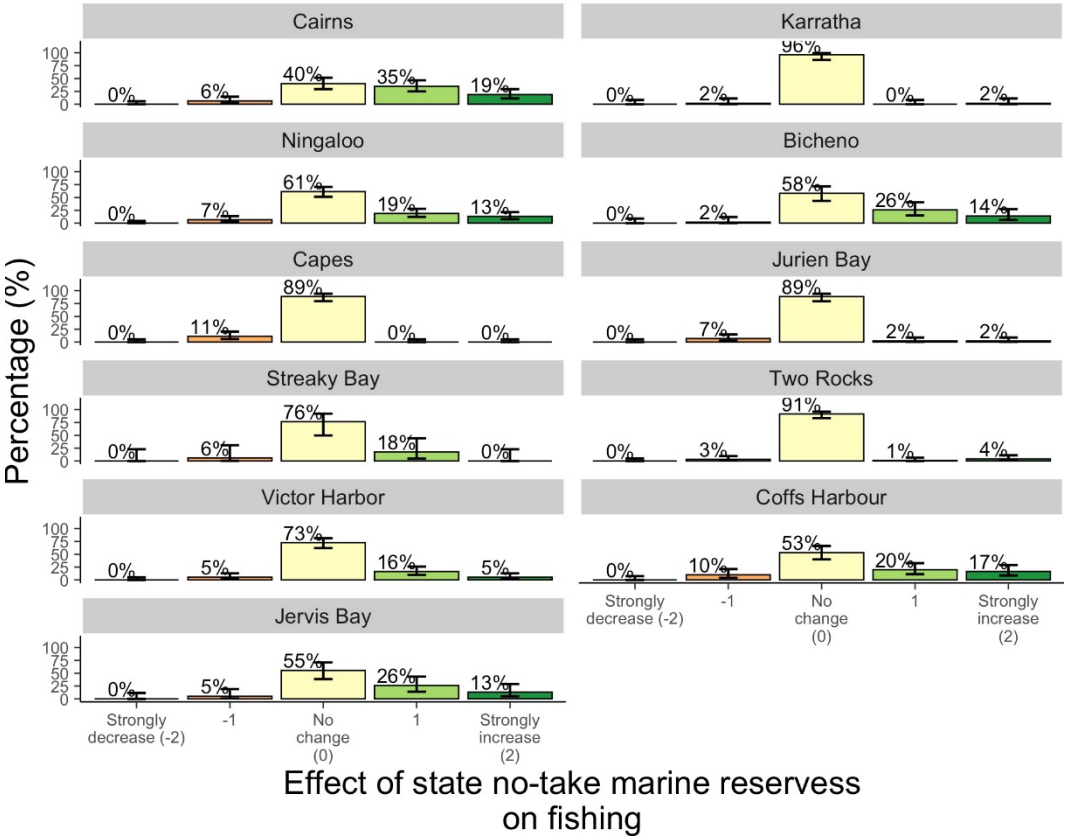

Figure 107. Recreational fishers in the boat ramp surveys' beliefs about the effect of state no-take marine reserves on their fishing. Note that recreational fishers were asked about the state no-take marine reserves in the survey location.

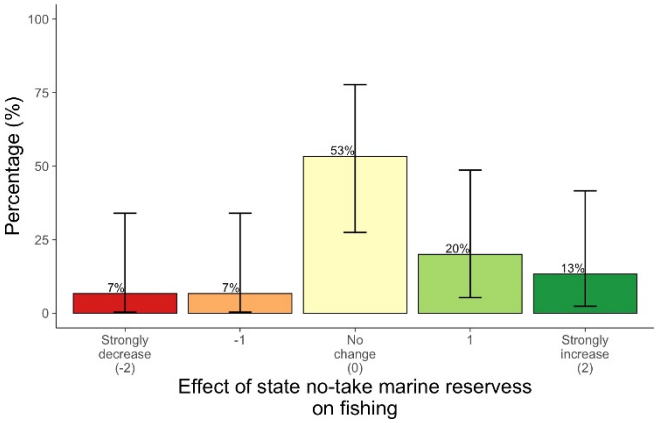

Figure 108. Recreational fishers in the targeted surveys' beliefs about the effect of state no-take marine reserves on their fishing. Note that recreational fishers were asked about the state no-take marine reserves in the sub-network where they fished most.

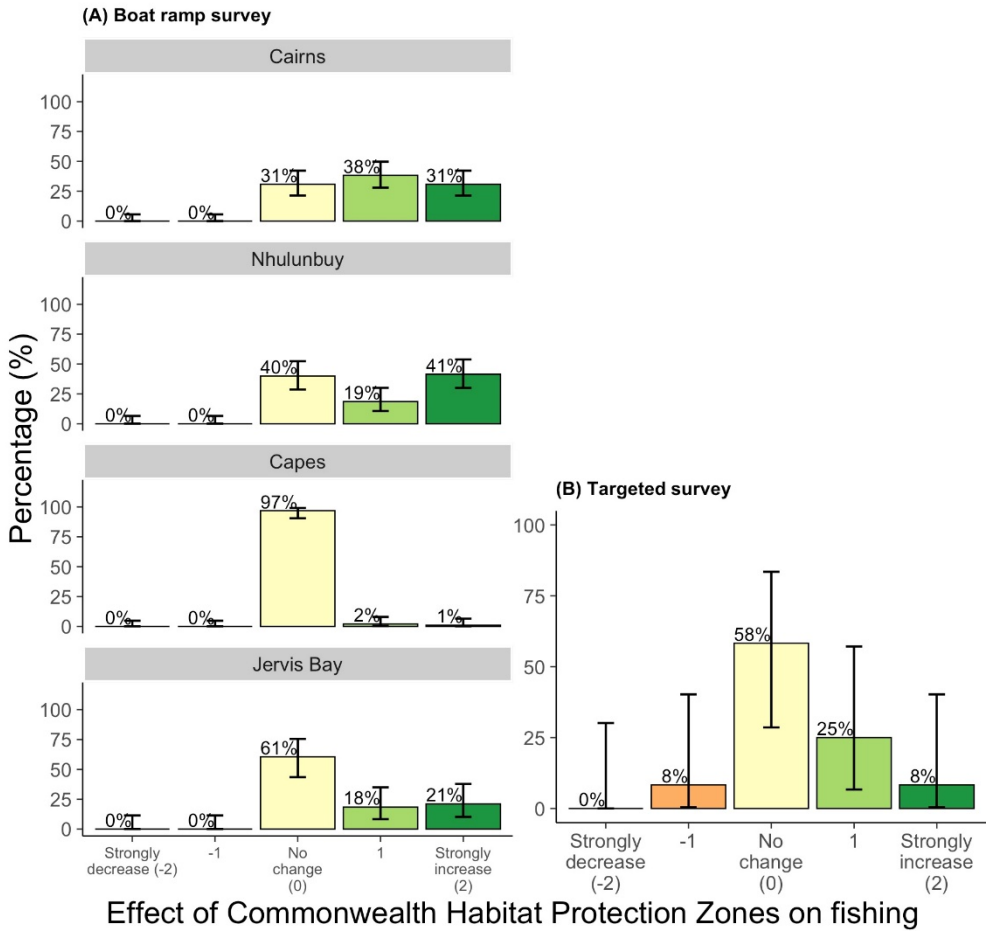

Figure 109. Beliefs of recreational fishers in (A) the boat ramp survey and (B) the targeted survey about the effect of Habitat Protection Zones (HPZs) in the Australian Marine Parks on their fishing. Note that recreational fishers in the boat ramp survey were asked about HPZs in the survey location, while those in the targeted survey were asked about HPZs in the sub-network where they fished most.

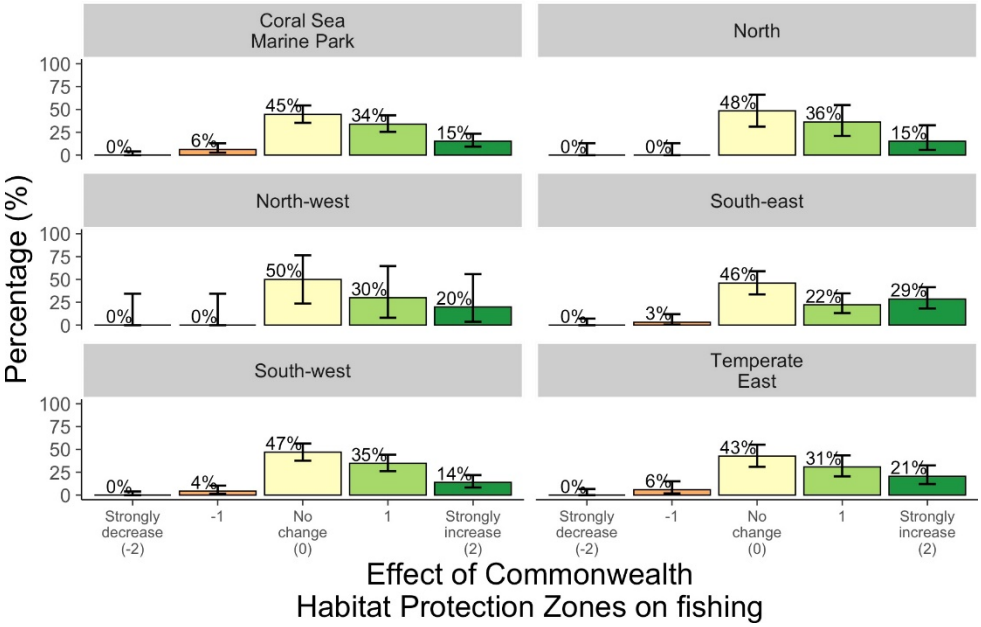

Figure 110. Recreational fishers in the general public surveys' beliefs about the effect of Habitat Protection Zones (HPZs) in the Australian Marine Parks on their fishing. Note that recreational fishers were asked about the HPZs at a national scale.

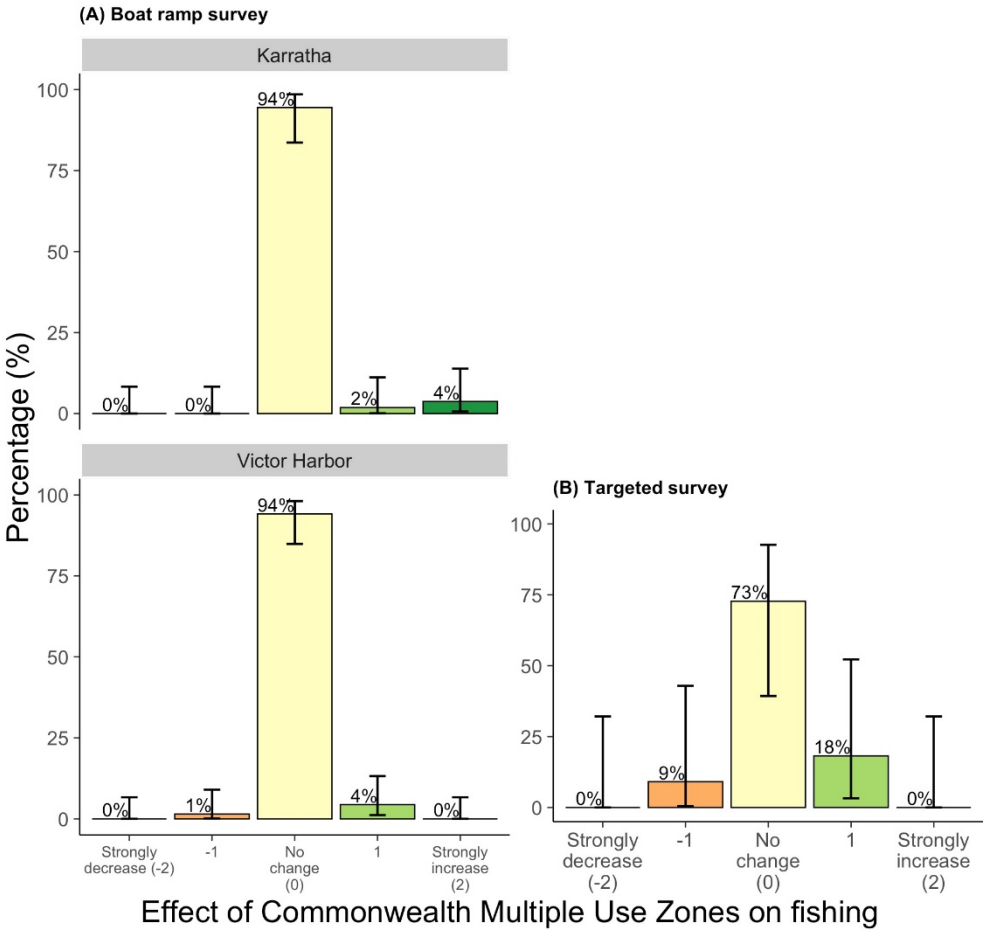

Figure 111. Beliefs of recreational fishers in (A) the boat ramp survey and (B) the targeted survey about the effect of Multiple Use Zones (MUZs) in the Australian Marine Parks on their fishing. Note that recreational fishers in the boat ramp survey were asked about the MUZs in the survey location, while those in the targeted survey were asked about the MUZs in the sub-network where they fished most.

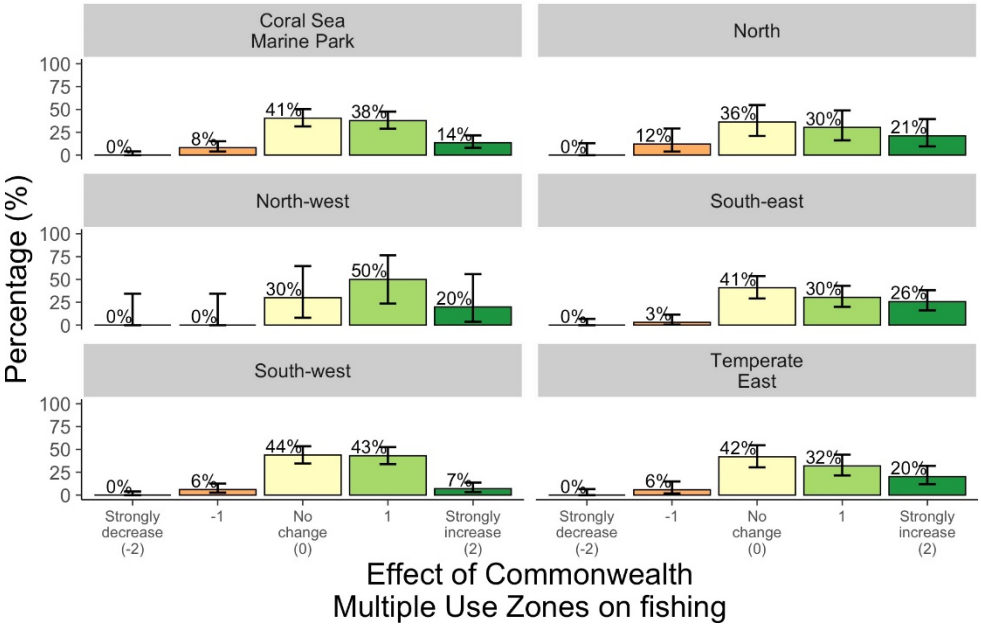

Figure 112. Recreational fishers in the general public surveys' beliefs about the effect of Multiple Use Zones (MUZs) in the Australian Marine Parks on their fishing. Note that recreational fishers were asked about the MUZs at a national scale.

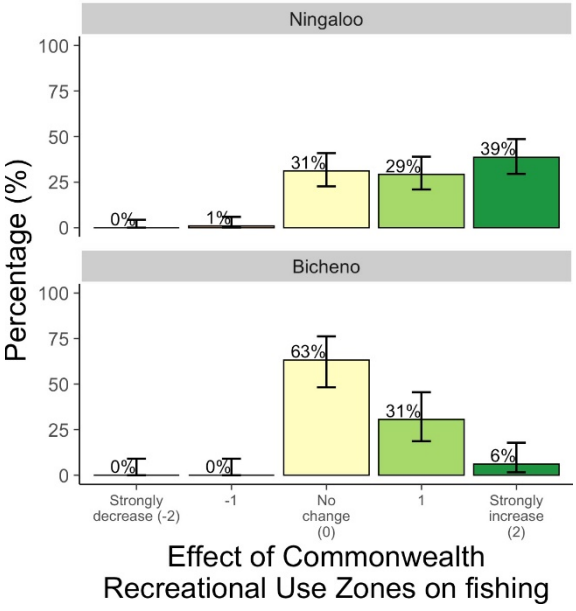

Figure 113. Recreational fishers in the boat ramp surveys' beliefs about the effect of Recreational Use Zones (RUZs) in the Australian Marine Parks on their fishing. Note that recreational fishers were asked about the RUZs in the survey location.

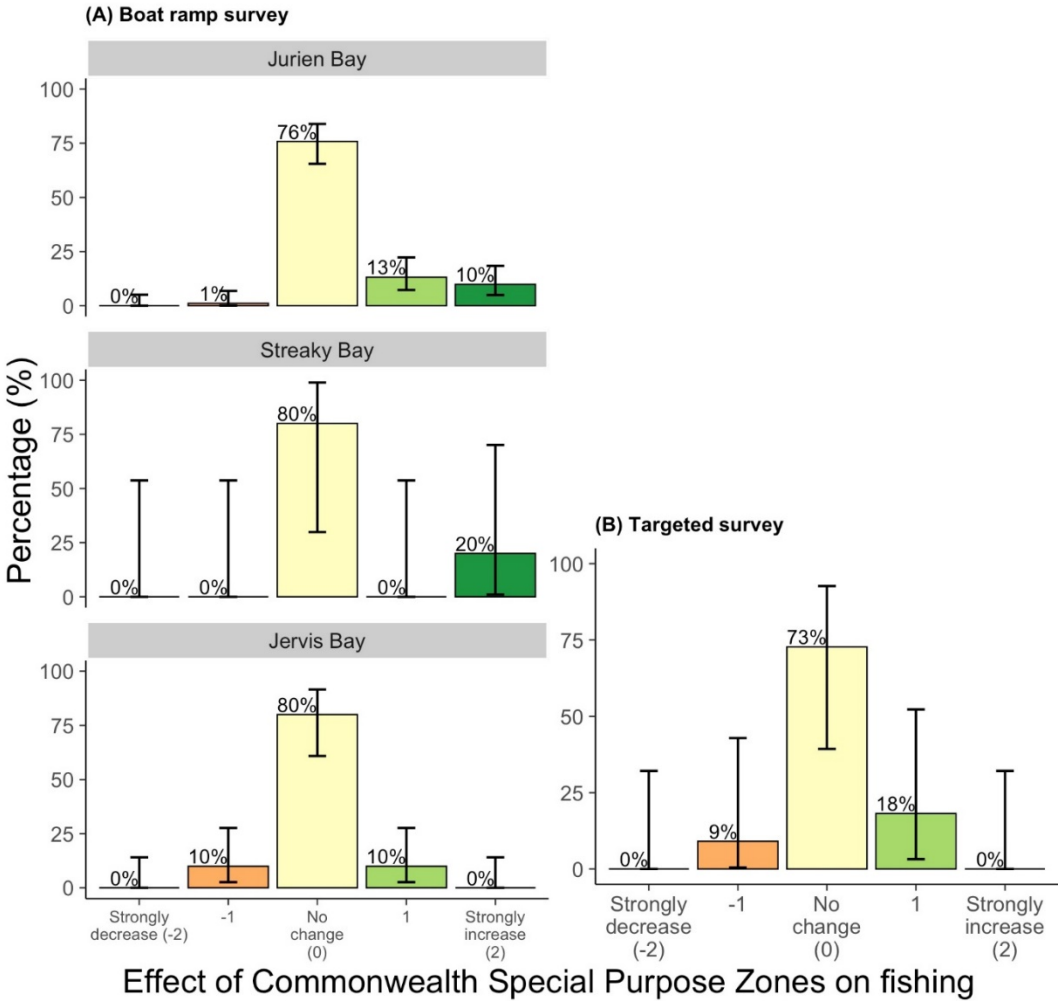

Figure 114. Beliefs of recreational fishers in (A) the boat ramp survey and (B) the targeted survey about the effect of Special Purpose Zones (SPZs) in the Australian Marine Parks on the health of their fishing. Note that recreational fishers in the boat ramp survey were asked about the SPZs in the survey location, while those in the targeted survey were asked about the SPZs in the sub-network where they fished most.

6.3.3 Non-extractive recreational users

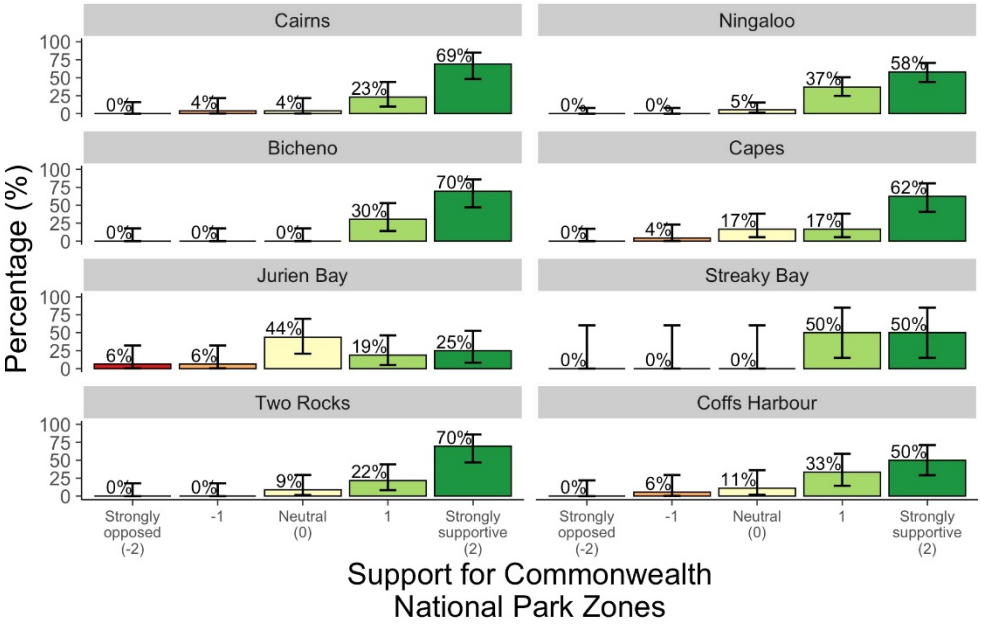

Figure 115. Support of non-extractive recreational users in the boat ramp survey for the National Park Zones (NPZs) in the Australian Marine Parks. Note that non-extractive recreational users were asked about the NPZs in the survey location.

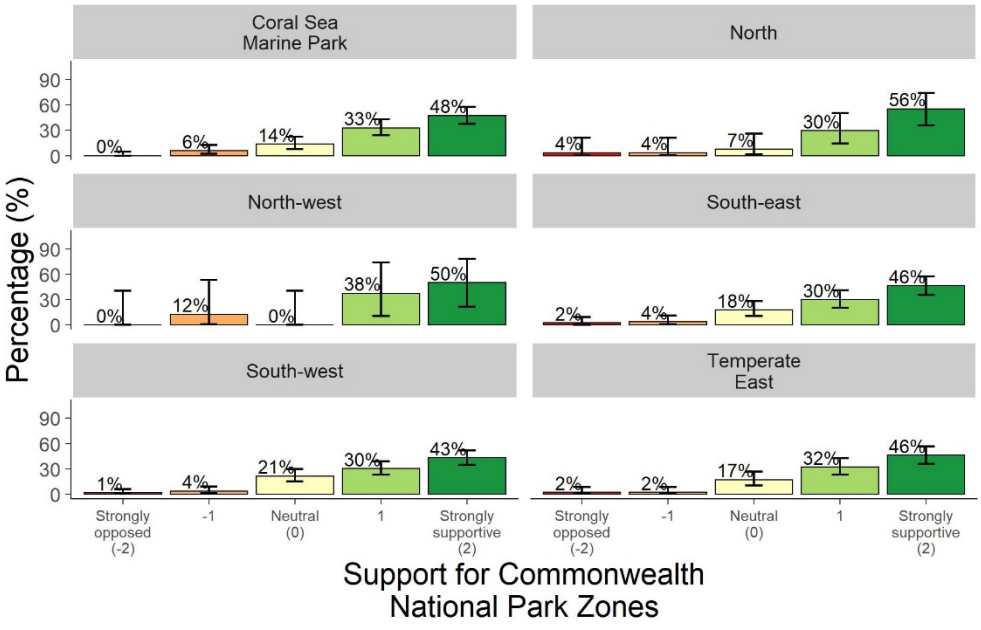

Figure 116. Support of non-extractive recreational users in the general public survey for the National Park Zones (NPZs) in the Australian Marine Parks. Note that non-extractive recreational users were asked about the NPZs at a national scale.

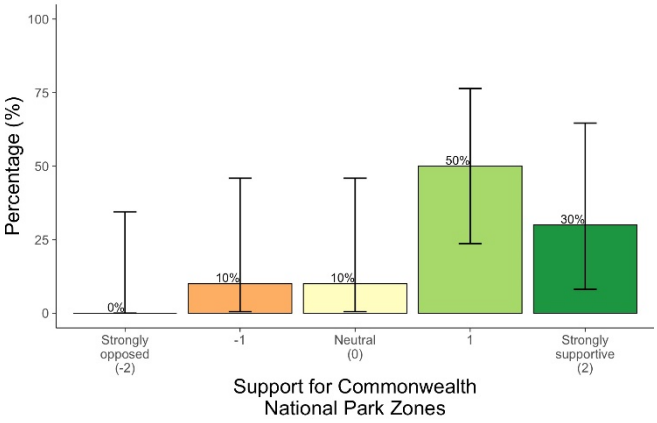

Figure 117. Support of non-extractive recreational users in the targeted survey for the National Park Zones (NPZs) in the Australian Marine Parks. Note that non-extractive recreational users were asked about the NPZs in the sub-network they visited most.

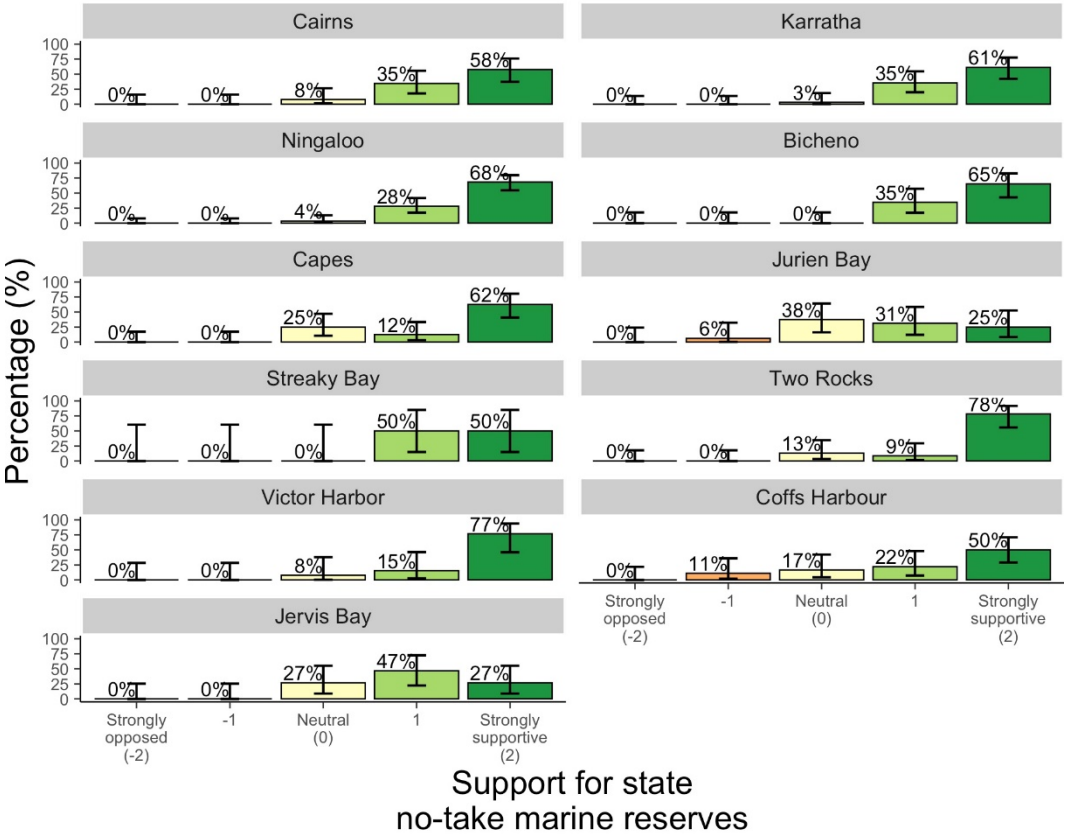

Figure 118. Support of non-extractive recreational users in the boat ramp survey for state no-take marine reserves in the survey location.

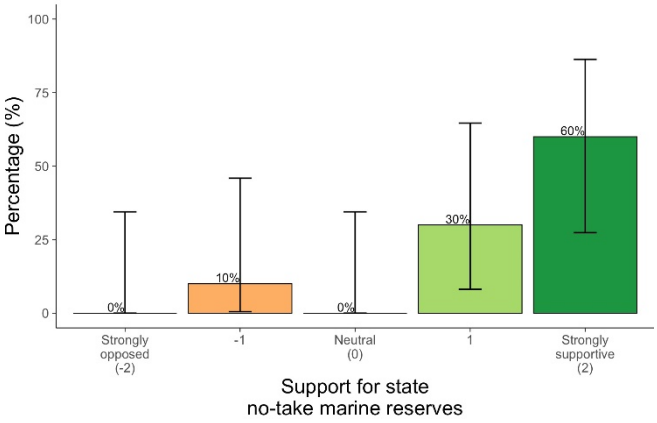

Figure 119. Support of non-extractive recreational users in the targeted survey for the state no-take marine reserves in the sub-network they visited most.

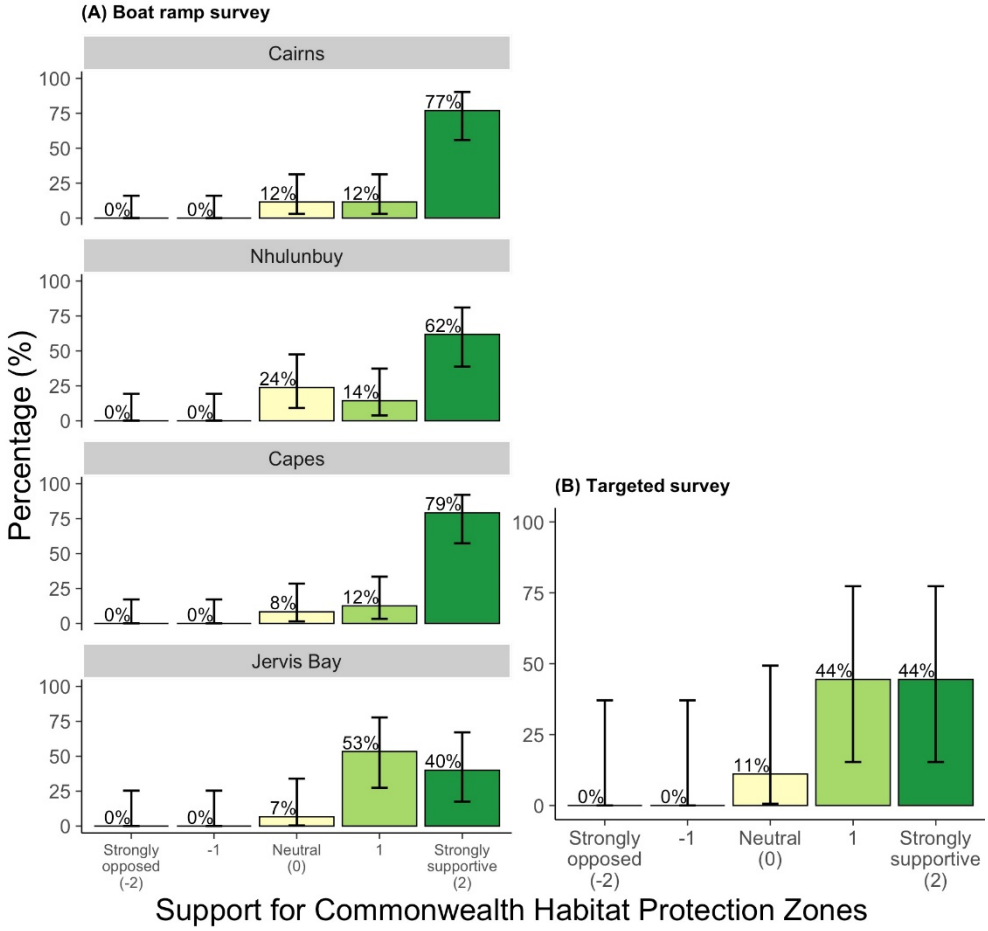

Figure 120. Support of non-extractive recreational users in (A) the boat ramp survey and (B) the targeted survey for the Habitat Protection Zones (HPZs) in the Australian Marine Parks. Note that non-extractive recreational users in the boat ramp survey were asked about HPZs in the survey location, while those in the targeted survey were asked about HPZs in the sub-network where they visited most.

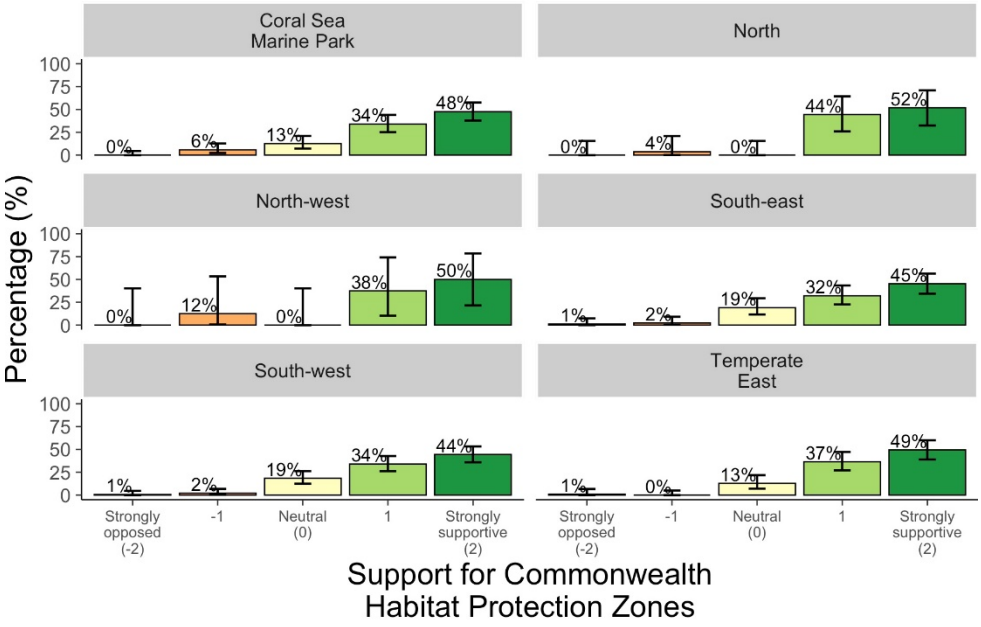

Figure 121. Support of non-extractive recreational users in the general public survey for the Habitat Protection Zones (HPZs) in the Australian Marine Parks. Note that non-extractive recreational users were asked about the HPZs at a national scale.

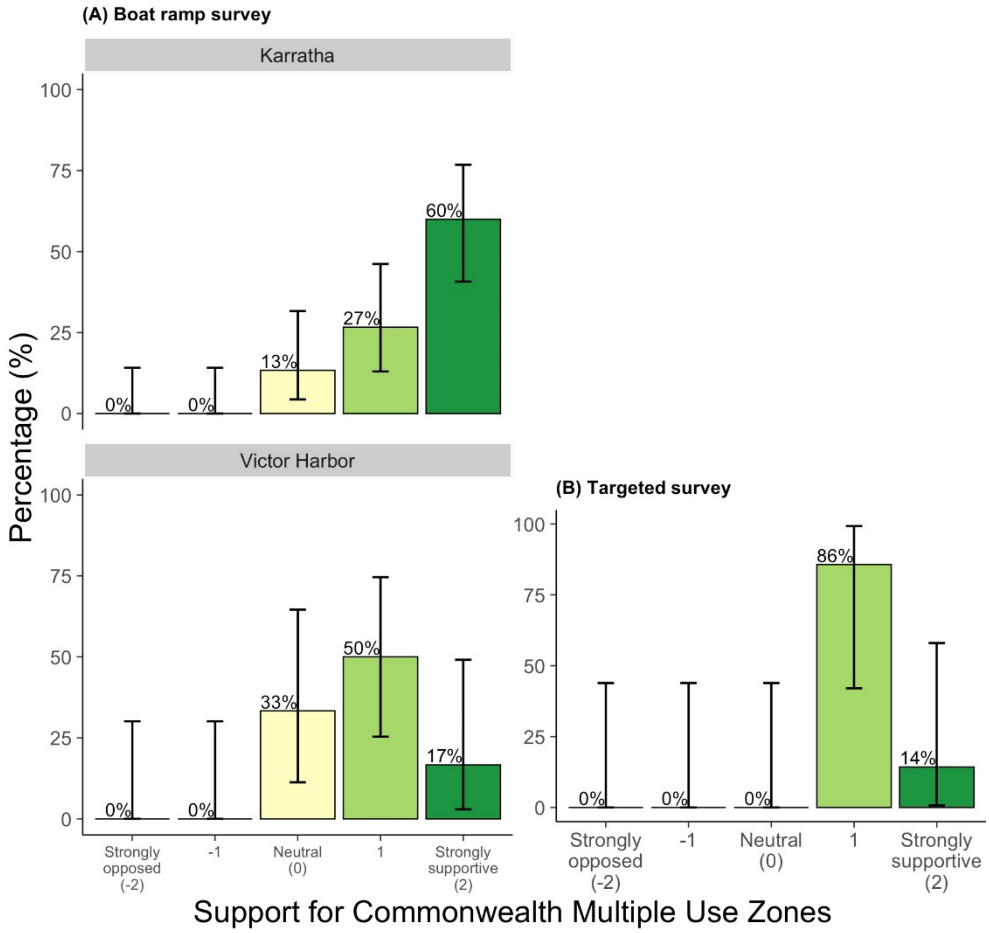

Figure 122. Support of non-extractive recreational users in (A) the boat ramp survey and (B) the targeted survey for the Multiple Use Zones (MUZs) in the Australian Marine Parks. Note that non-extractive recreational users in the boat ramp survey were asked about MUZs in the survey location, while those in the targeted survey were asked about MUZs in the sub-network they visited most.

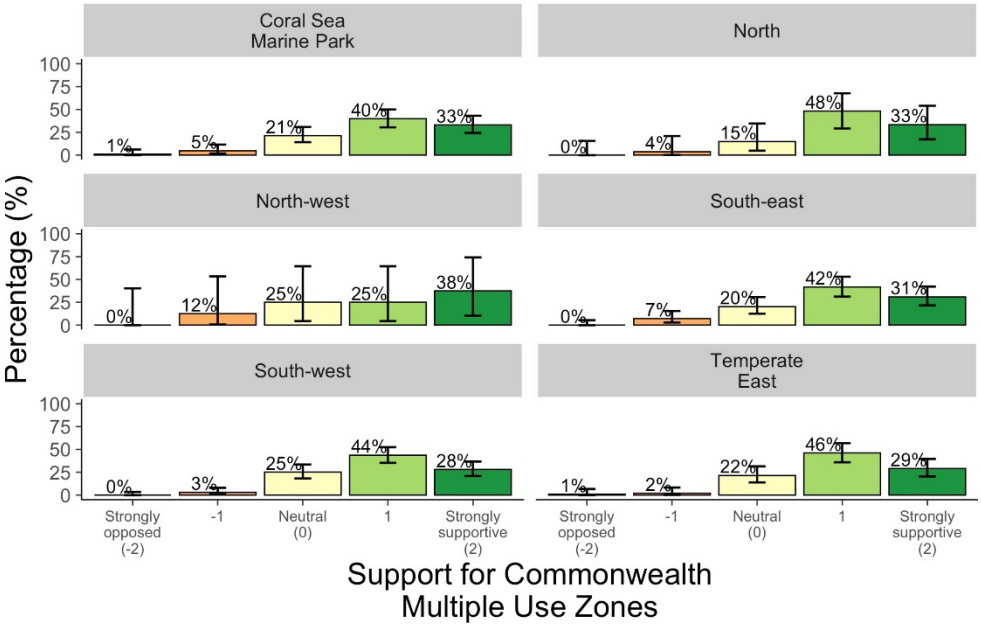

Figure 123. Support of non-extractive recreational users in the general public survey for the Multiple Use Zones (MUZs) in the Australian Marine Parks. Note that non-extractive recreational users were asked about the MUZs at a national scale.

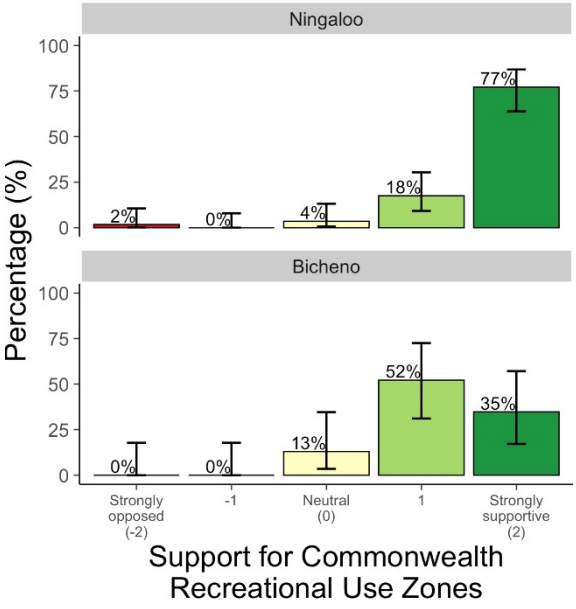

Figure 124. Support of non-extractive recreational users in the boat ramp survey for the Recreational Use Zones (RUZs) in the Australian Marine Parks. Note that non-extractive recreational users were asked about the RUZs in the survey location.

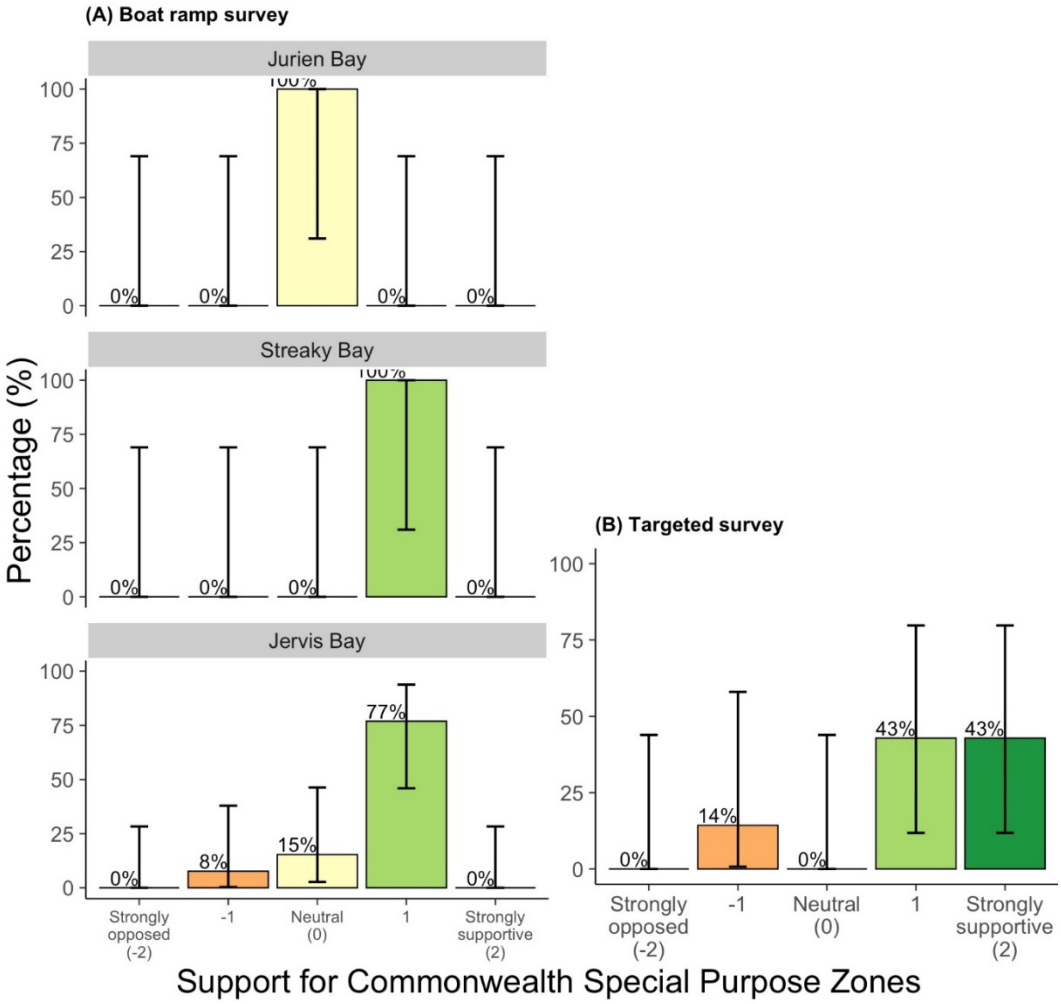

Figure 125. Support of non-extractive recreational users in (A) the boat ramp survey and (B) the targeted survey for the Special Purpose Zones (SPZs) in the Australian Marine Parks. Note that non-extractive recreational users in the boat ramp survey were asked about SPZs in the survey location, while those in the targeted survey were asked about SPZs in the sub-network they visited most.

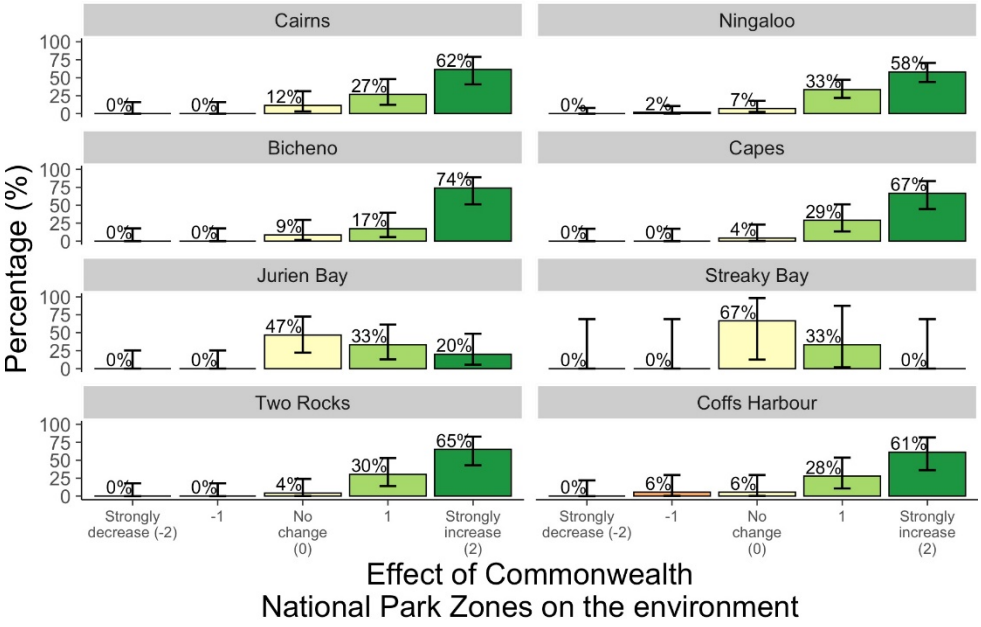

Figure 126. Non-extractive recreational users in the boat ramp surveys' beliefs about the effect of National Park Zones (NPZs) in the Australian Marine Parks on the health of the marine environment. Note that non-extractive recreational users were asked about the NPZs in the survey location.

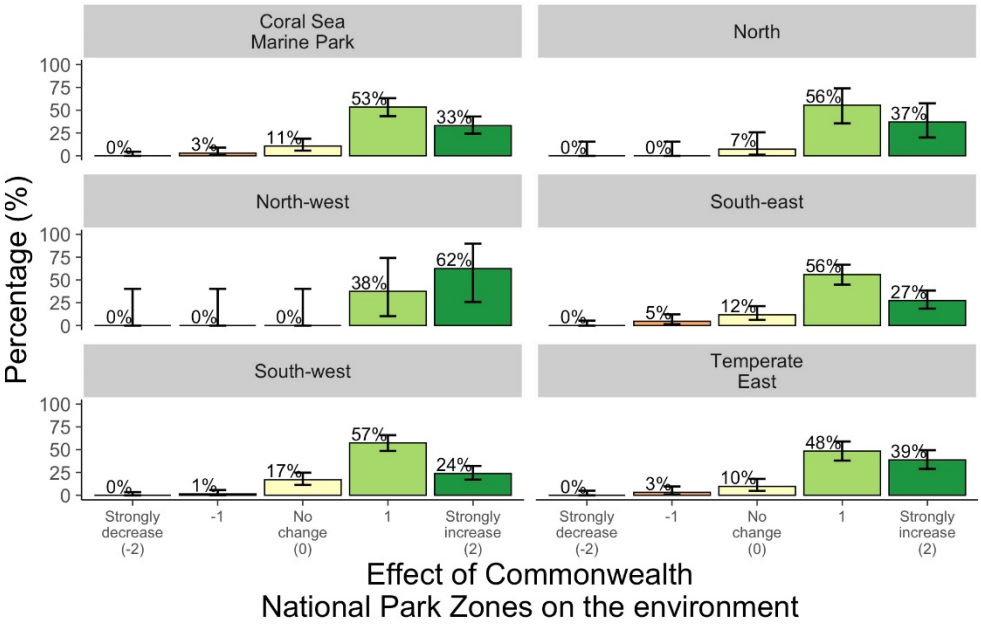

Figure 127. Non-extractive recreational users in the general public surveys' beliefs about the effect of National Park Zones (NPZs) in the Australian Marine Parks on the health of the marine environment. Note that non-extractive recreational users were asked about the NPZs at a national scale.

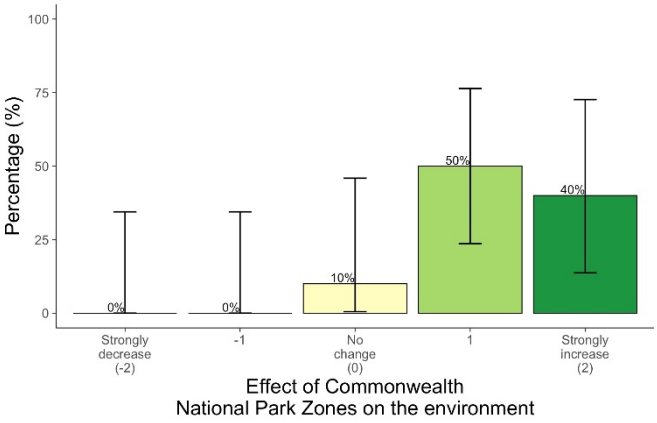

Figure 128. Non-extractive recreational users in the targeted surveys' beliefs about the effect of National Park Zones (NPZs) in the Australian Marine Parks on the health of the marine environment. Note that non-extractive recreational users were asked about the NPZs in the sub-network they visited most.

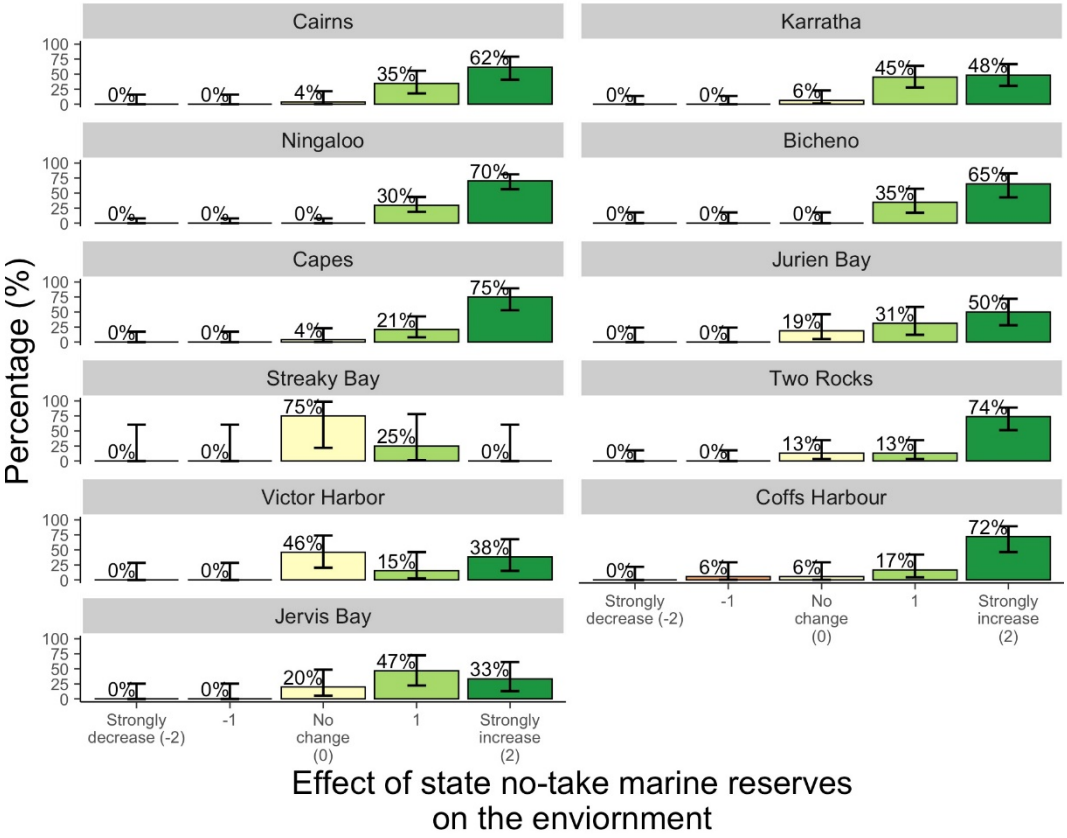

Figure 129. Non-extractive recreational users in the boat ramp surveys' beliefs about the effect of state no-take marine reserves on the health of the marine environment. Note that non-extractive recreational users were asked about the state no-take marine reserves in the survey location.

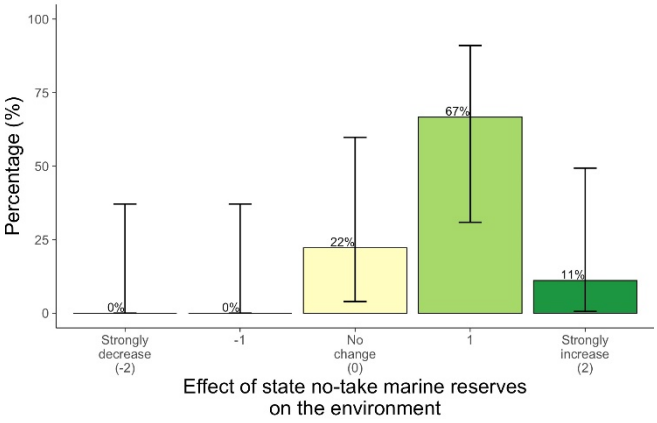

Figure 130. Non-extractive recreational users in the targeted surveys' beliefs about the effect of state no-take marine reserves on the health of the marine environment. Note that non-extractive recreational users were asked about the state no-take marine reserves in the sub-network they visited most.

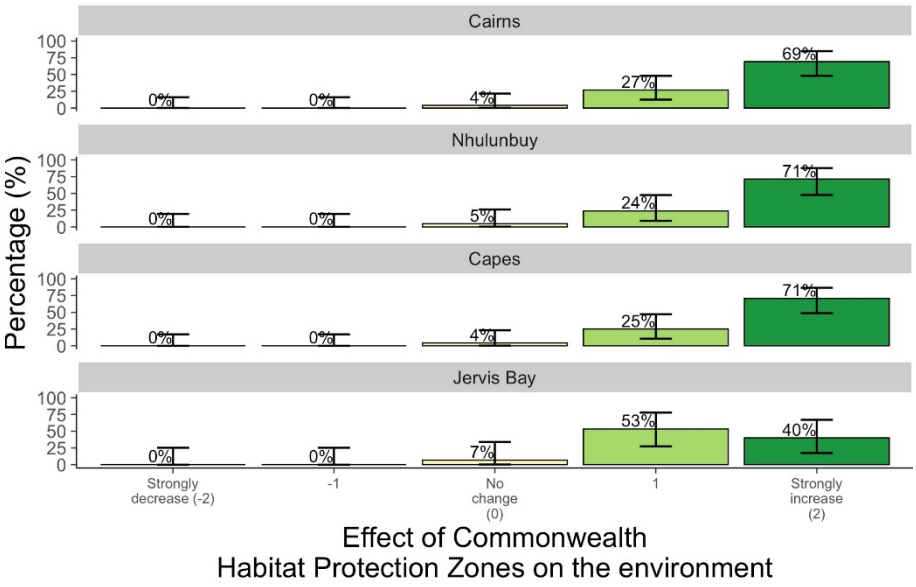

Figure 131. Beliefs of non-extractive recreational users in the boat ramp survey about the effect of Habitat Protection Zones (HPZs) in the Australian Marine Parks on the health of the marine environment. Note that non-extractive recreational users in the boat ramp survey were asked about HPZs in the survey location.

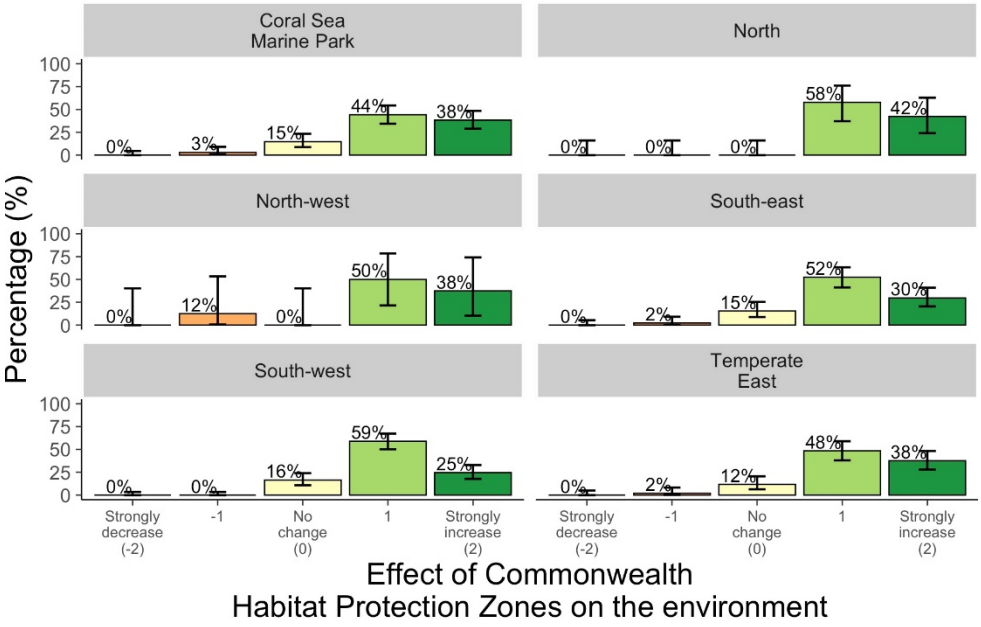

Figure 132. Non-extractive recreational users in the general public surveys' beliefs about the effect of Habitat Protection Zones (HPZs) in the Australian Marine Parks on the health of the marine environment. Note that non-extractive recreational users were asked about the HPZs at a national scale.

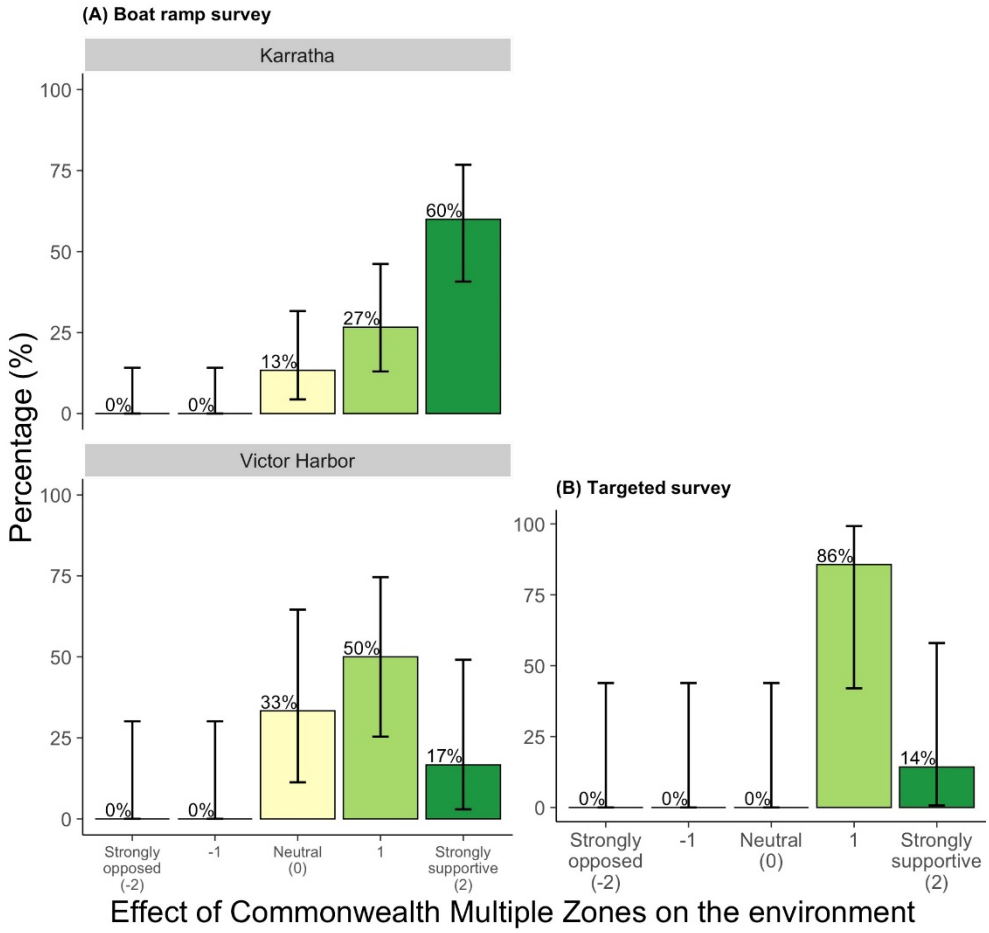

Figure 133. Beliefs of non-extractive recreational users in (A) the boat ramp survey and (B) the targeted survey about the effect of Multiple Use Zones (MUZs) in the Australian Marine Parks on the health of the marine environment. Note that non-extractive recreational users in the boat ramp survey were asked about the MUZs in the survey location, while those in the targeted survey were asked about the MUZs in the sub-network they visited most.

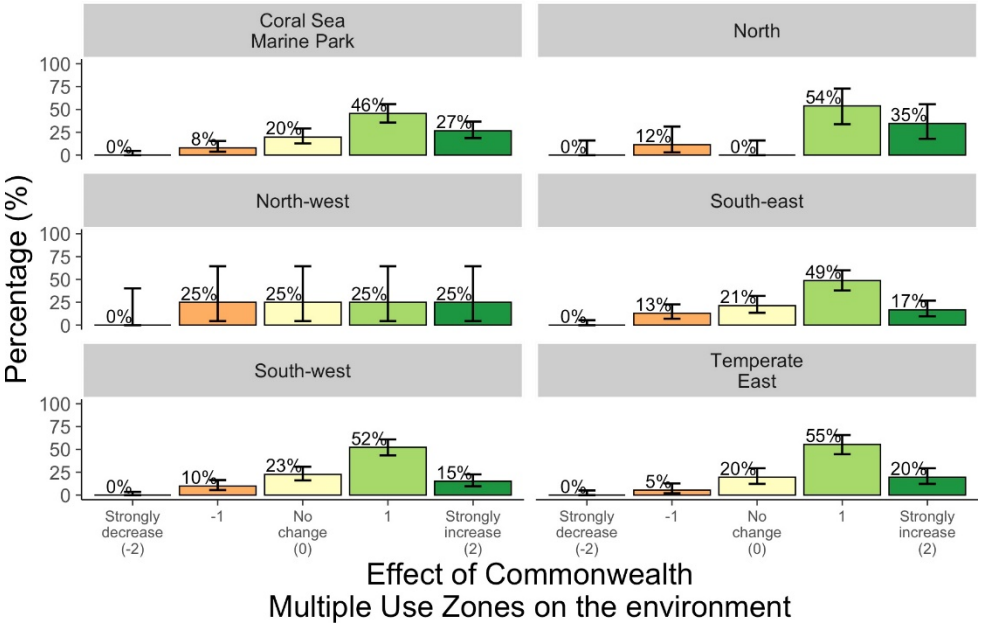

Figure 134. Non-extractive recreational users in the general public surveys' beliefs about the effect of Multiple Use Zones (MUZs) in the Australian Marine Parks on the health of the marine environment. Note that non-extractive recreational users were asked about the MUZs at a national scale.

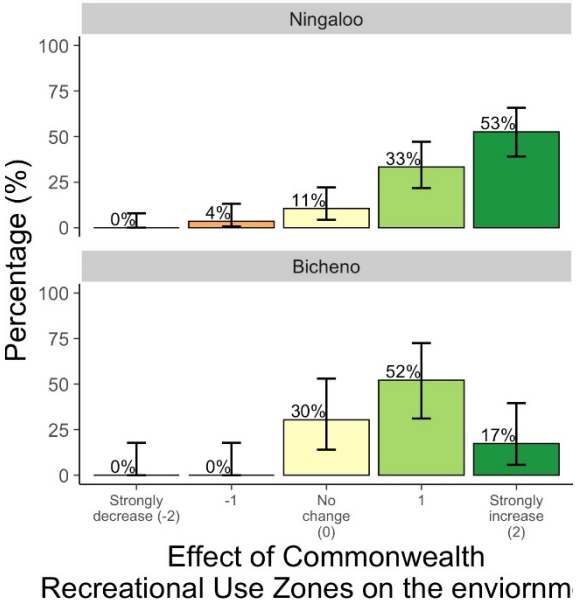

Figure 135. Non-extractive recreational users in the boat ramp surveys' beliefs about the effect of Recreational Use Zones (RUZs) in the Australian Marine Parks on the health of the marine environment. Note that non-extractive recreational users were asked about the RUZs in the survey location.

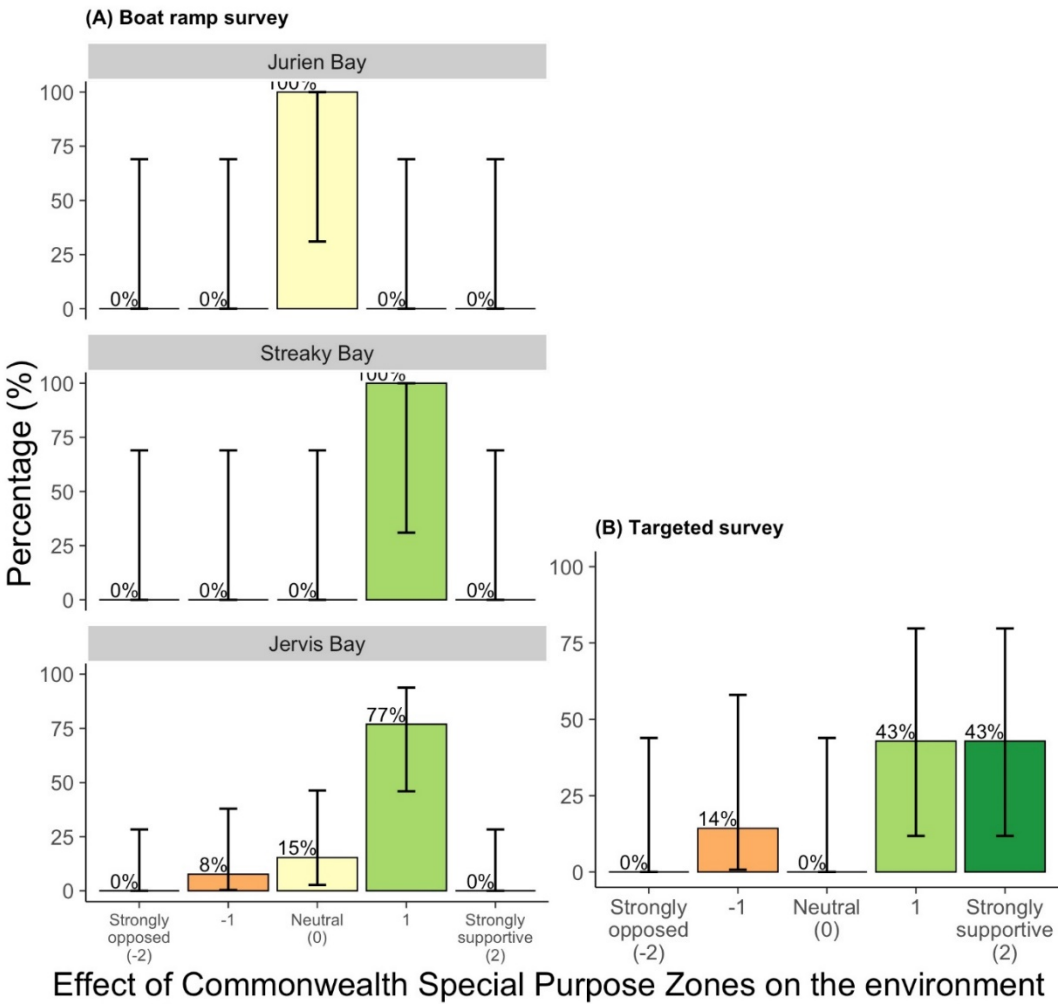

Figure 136. Beliefs of non-extractive recreational users in (A) the boat ramp survey and (B) the targeted survey about the effect of Special Purpose Zones (SPZs) in the Australian Marine Parks on the health of the marine environment. Note that non-extractive recreational users in the boat ramp survey were asked about the SPZs in the survey location, while those in the targeted survey were asked about the SPZs in the sub-network they visited most.

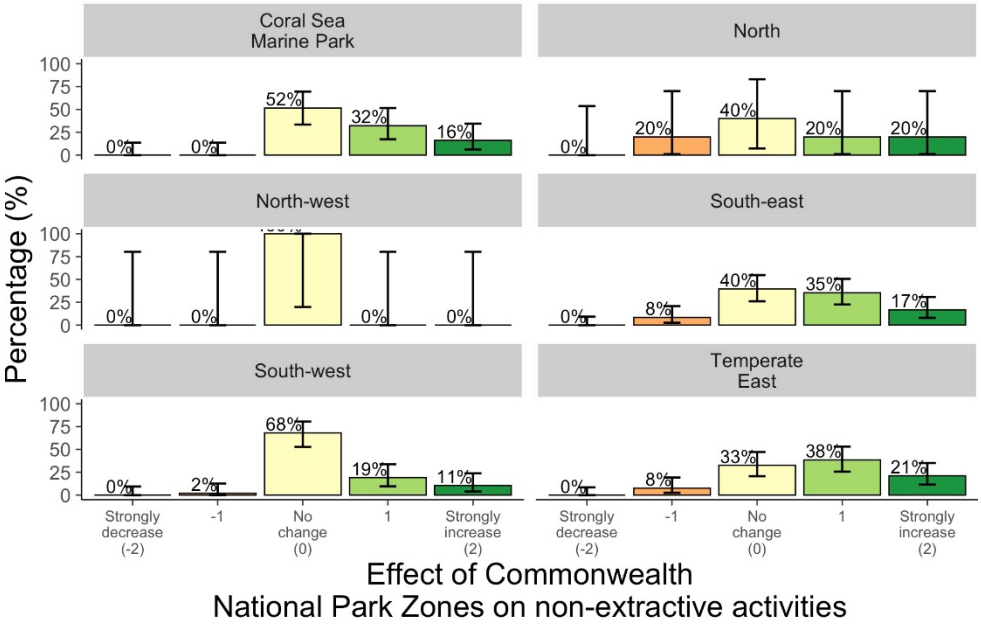

Figure 137. Non-extractive recreational users in the general public surveys' beliefs about the effect of National Park Zones (NPZs) in the Australian Marine Parks on their non-extractive activities. Note that non-extractive recreational users were asked about the NPZs at a national scale.

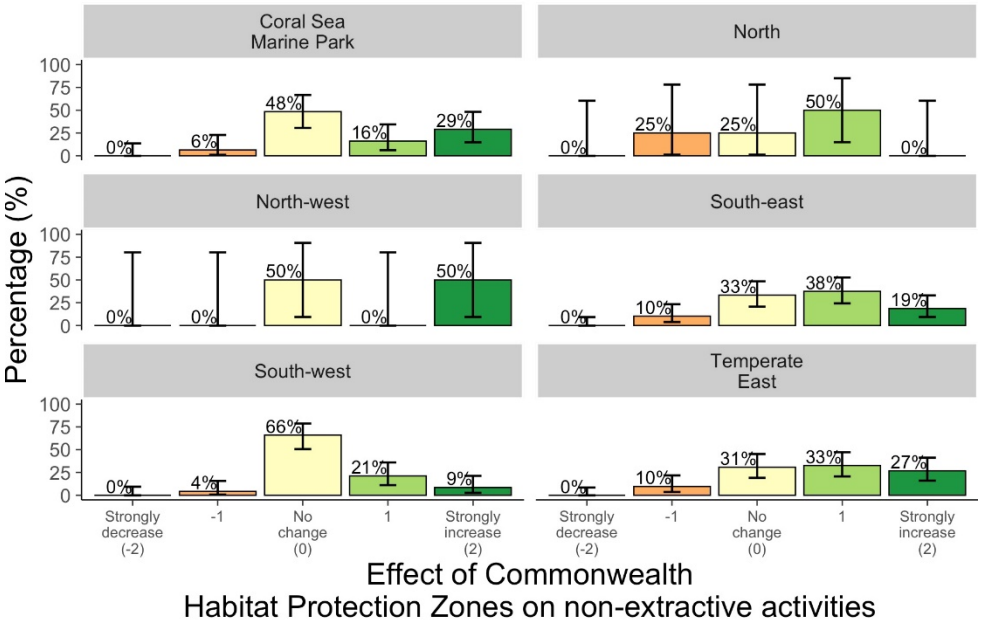

Figure 138. Non-extractive recreational users in the general public surveys' beliefs about the effect of Habitat Protection Zones (HPZs) in the Australian Marine Parks on their non-extractive activities. Note that non-extractive recreational users were asked about the HPZs at a national scale.

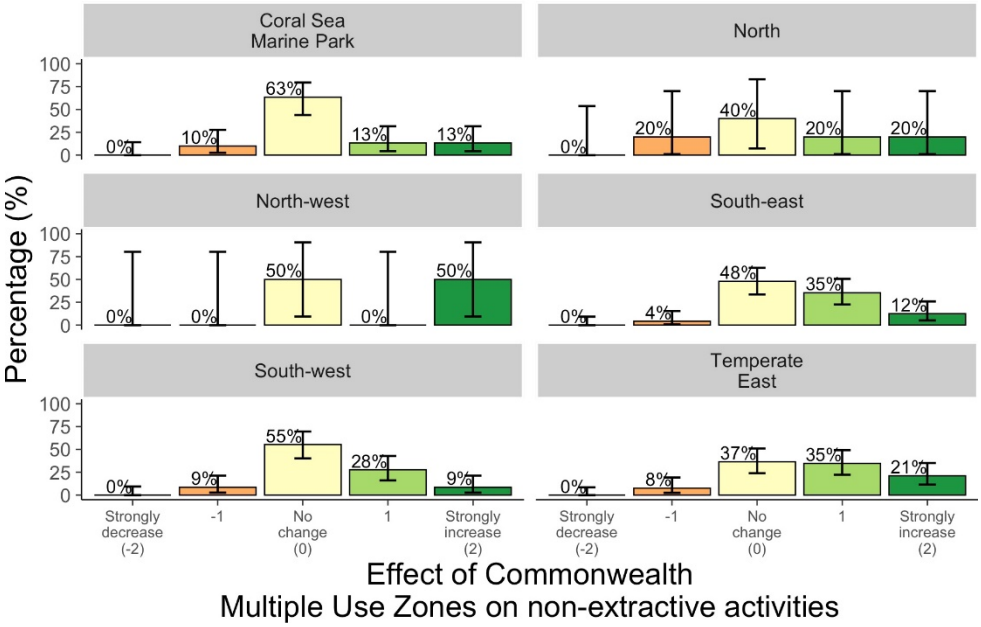

Figure 139. Non-extractive recreational users in the general public surveys' beliefs about the effect of Multiple Use Zones (MUZs) in the Australian Marine Parks on their non-extractive activities. Note that non-extractive recreational users were asked about the MUZs at a national scale.

6.3.4 Charter operators

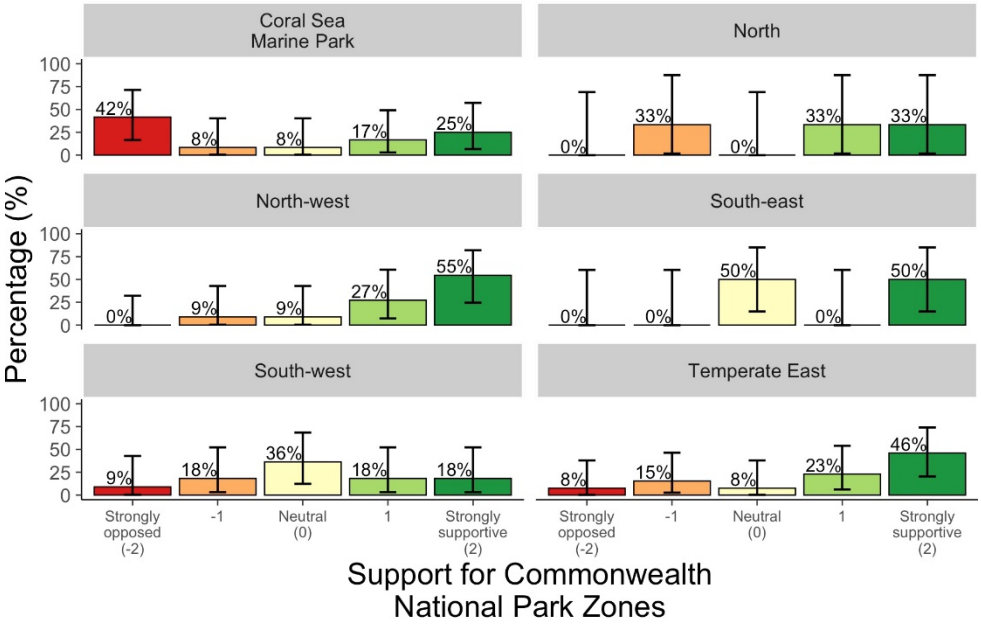

Figure 140. Support of charter operators for the National Park Zones (NPZs) in the Australian Marine Parks. Note that charter operators were asked about the NPZs in the sub-network they operate in most.

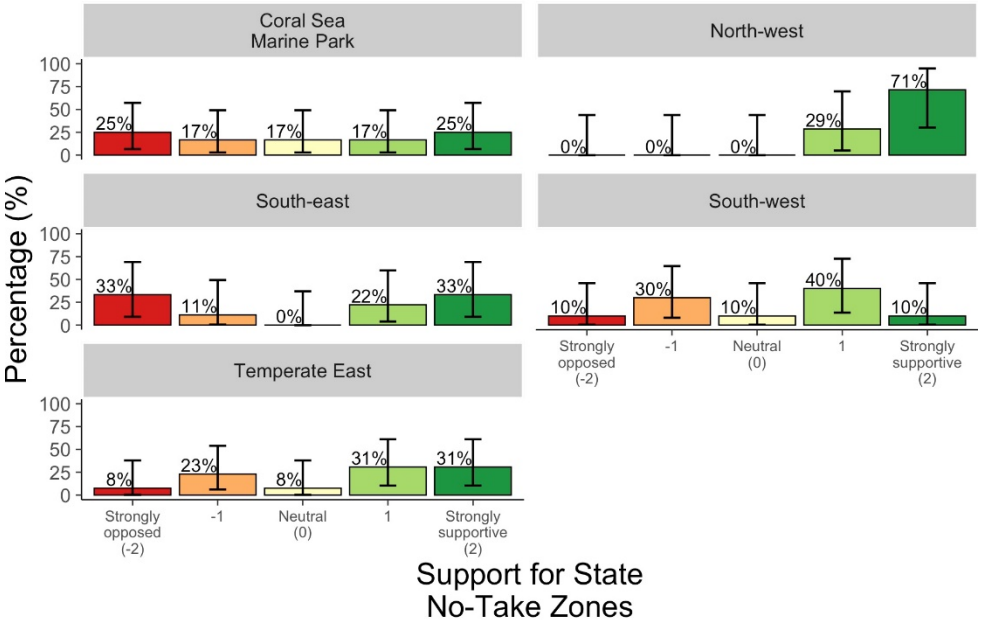

Figure 141. Support of charter operators for state no-take marine reserves. Note that charter operators were asked about the state no-take marine reserves in the sub-network they operate in most.

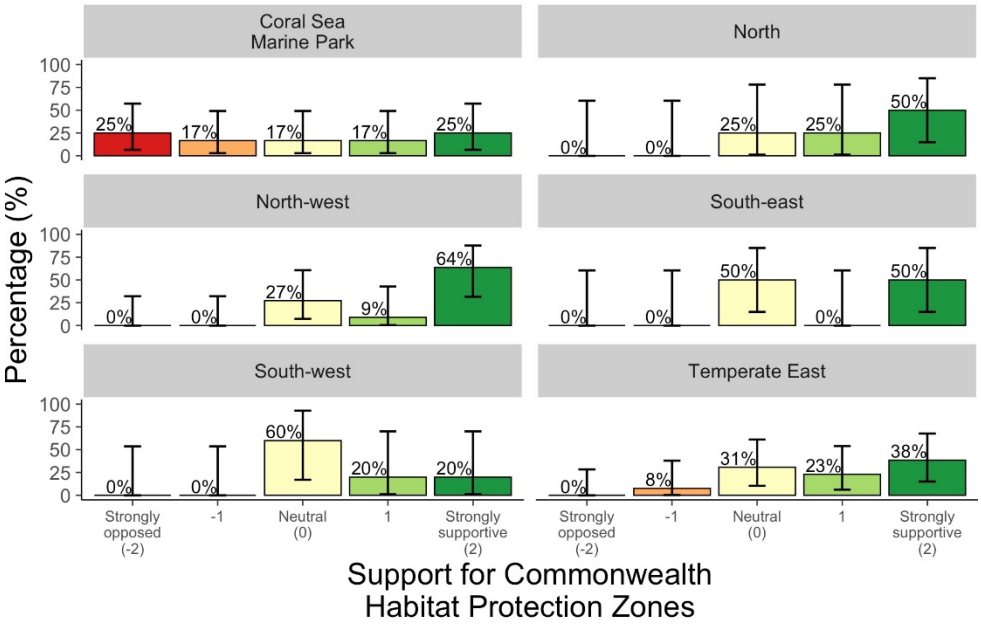

Figure 142. Support of charter operators for the Habitat Protection Zones (HPZs) in the Australian Marine Parks. Note that charter operators were asked about the HPZs in the sub-network they operate in most.

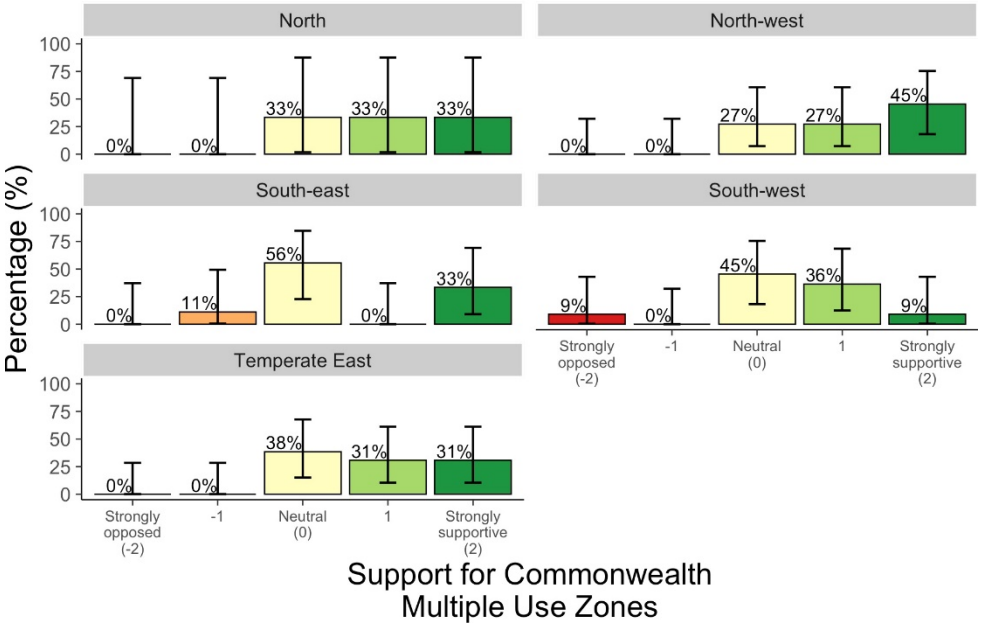

Figure 143. Support of charter operators for the Multiple Use Zones (MUZs) in the Australian Marine Parks. Note that charter operators were asked about the HPZs in the sub-network they operate in most.

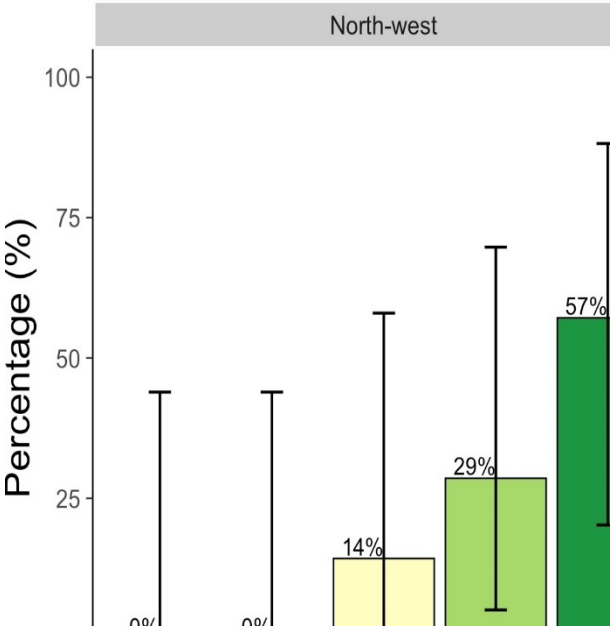

Figure 144. Support of charter operators for the Recreational Use Zones (RUZs) in the Australian Marine Parks. Note that charter operators were asked about the RUZs in the sub-network they operate in most.

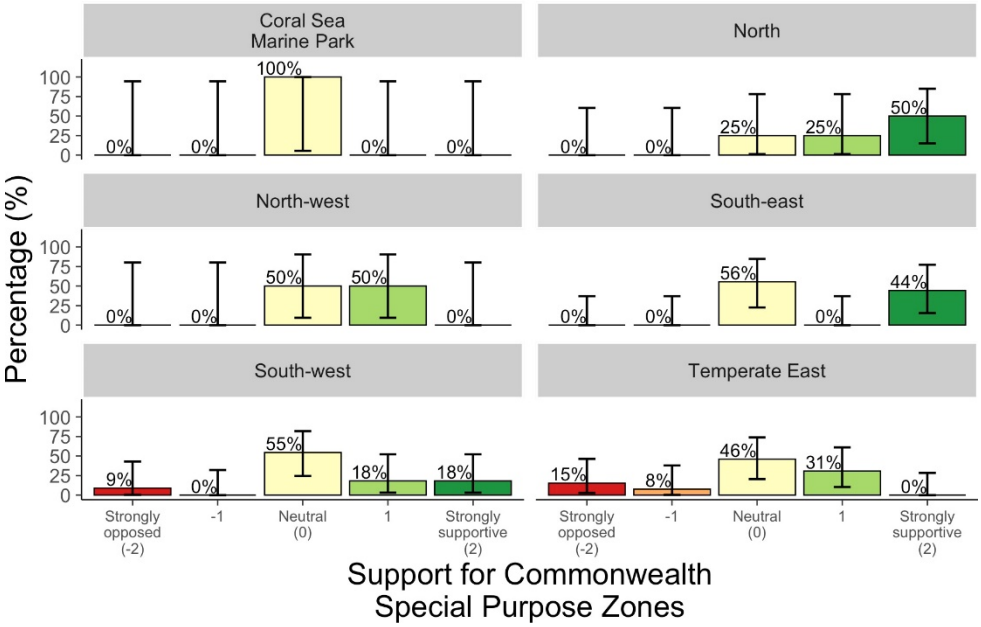

Figure 145. Support of charter operators for the Special Purpose Zones (SPZs) in the Australian Marine Parks. Note that charter operators were asked about the SPZs in the sub-network they operate in most.

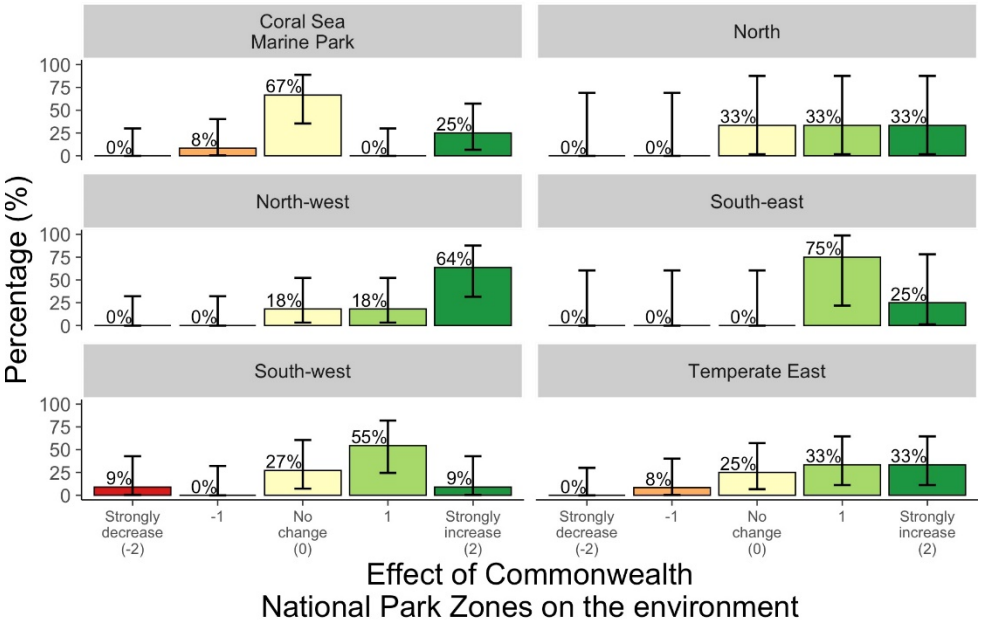

Figure 146. Charter operators' beliefs about the effect of National Park Zones (NPZs) in the Australian Marine Parks on the environment. Note that charter operators were asked about the NPZs in the sub-network they operate in most.

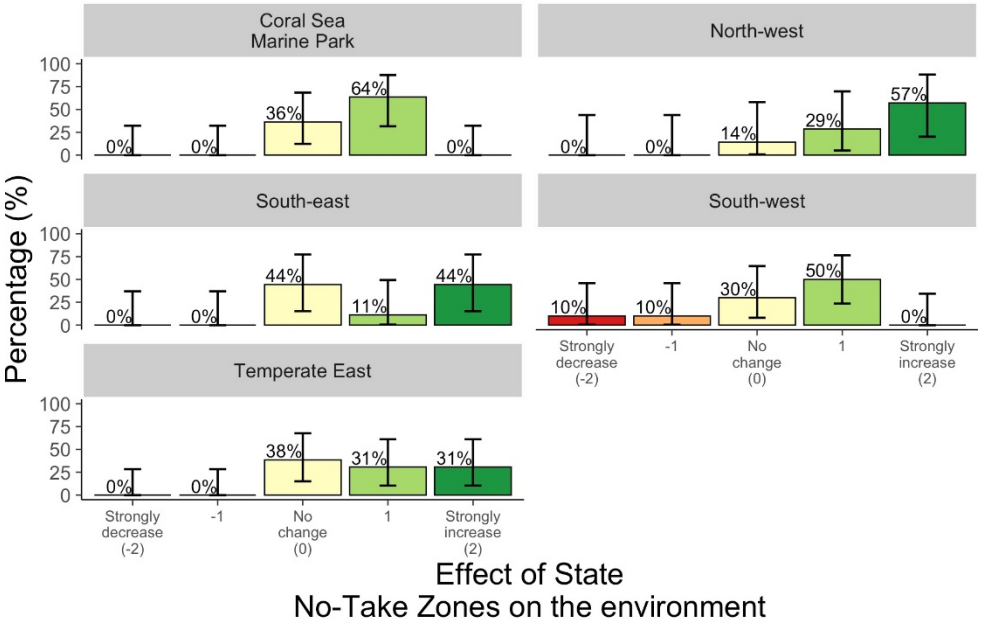

Figure 147. Charter operators' beliefs about the effect of state no-take marine reserves on the environment. Note that charter operators were asked about the state no-take marine reserves in the sub-network they operate in most.

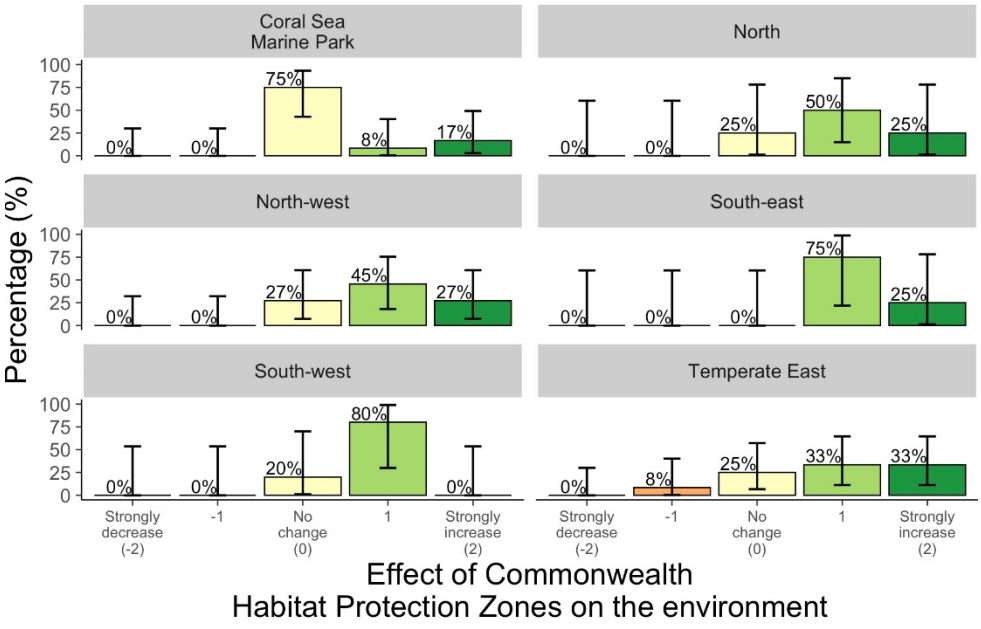

Figure 148. Charter operators' beliefs about the effect of Habitat Protection Zones (HPZs) in the Australian Marine Parks on the environment. Note that charter operators were asked about the HPZs in the sub-network they operate in most.

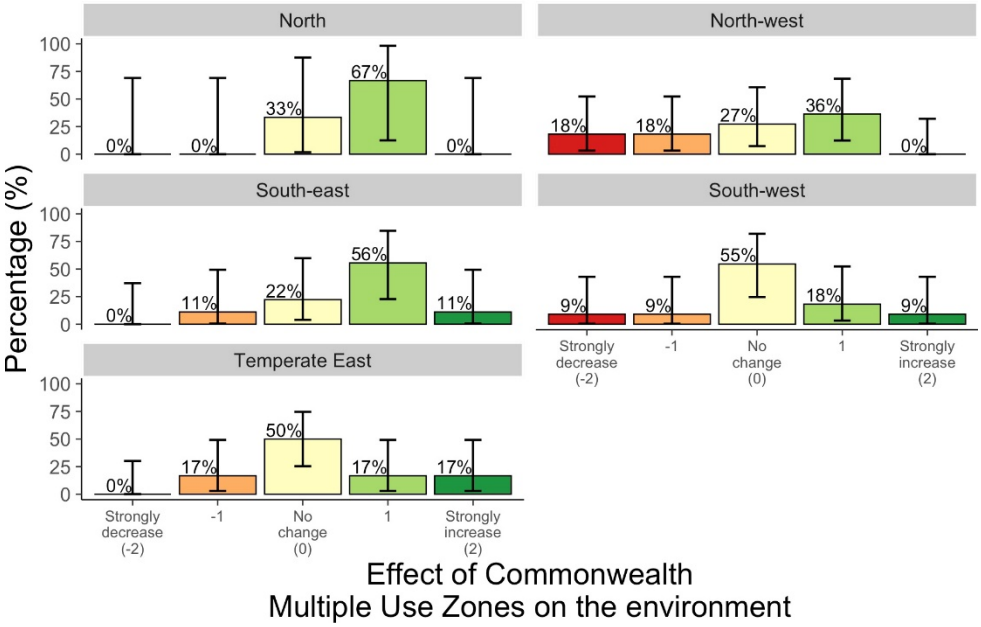

Figure 149. Charter operators' beliefs about the effect of Multiple Use Zones (MUZs) in the Australian Marine Parks on the environment. Note that charter operators were asked about the MUZs in the sub-network they operate in most.

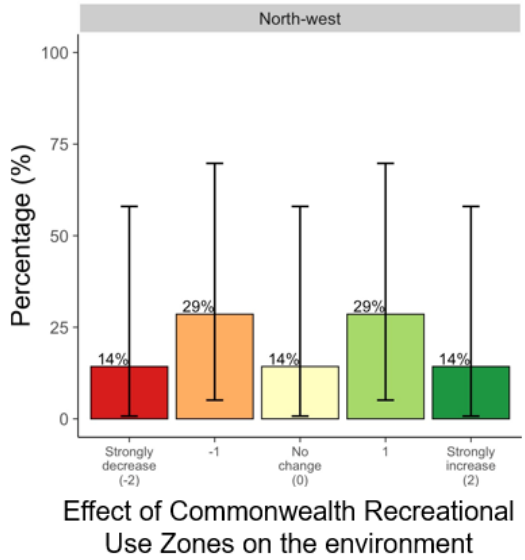

Figure 150. Charter operators' beliefs about the effect of Recreational Use Zones (RUZs) in the Australian Marine Parks on the environment. Note that charter operators were asked about the RUZs in the sub-network they operate in most.

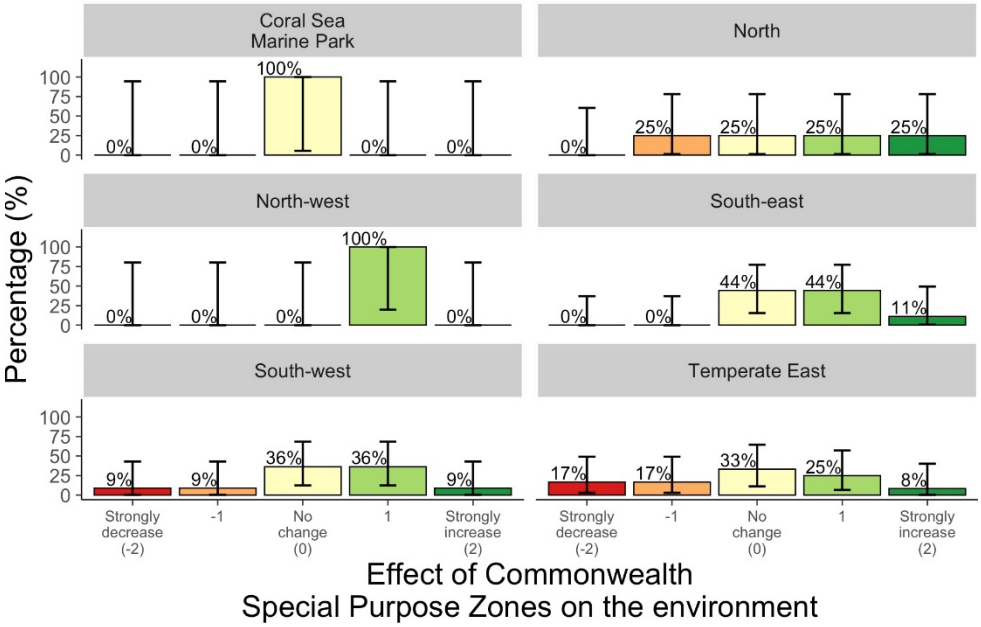

Figure 151. Charter operators' beliefs about the effect of Special Purpose Zones (SPZs) in the Australian Marine Parks on the environment. Note that charter operators were asked about the SPZs in the sub-network they operate in most.

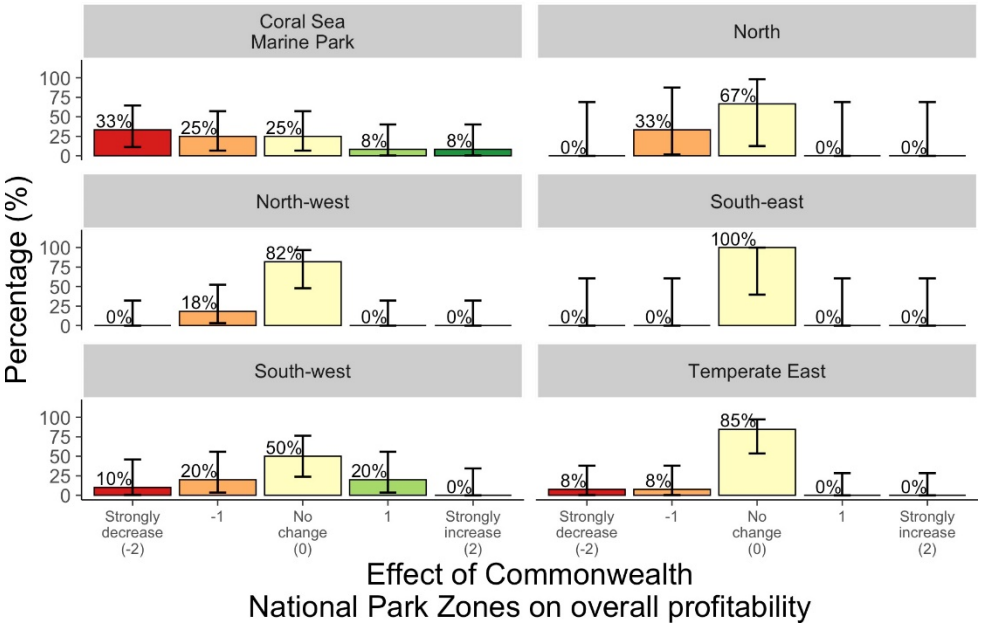

Figure 152. Charter operators' beliefs about the effect of National Park Zones (NPZs) in the Australian Marine Parks on their overall profitability. Note that charter operators were asked about the NPZs in the sub-network they operate in most.

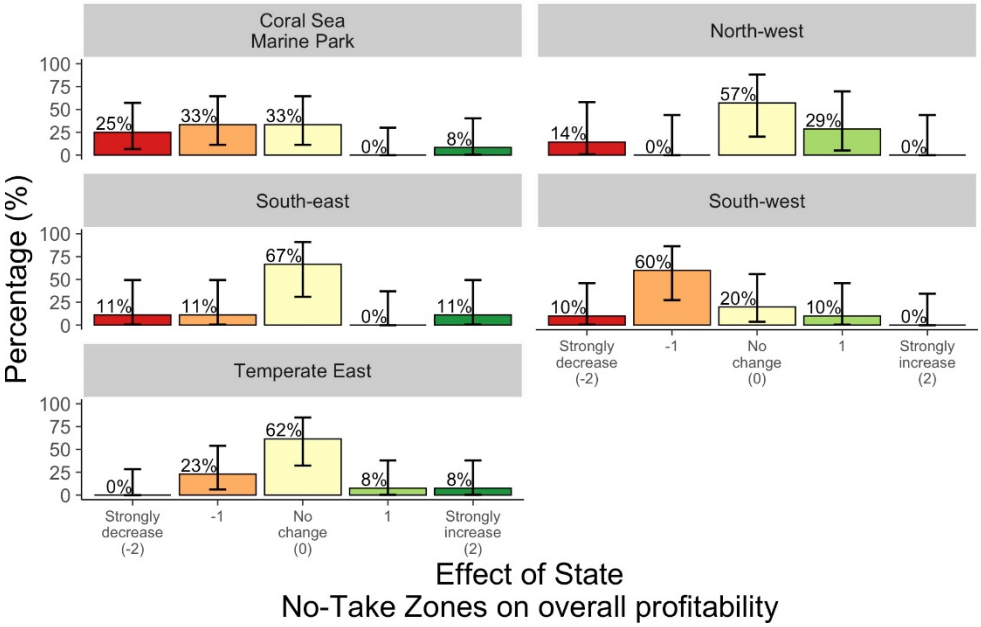

Figure 153. Charter operators' beliefs about the effect of state no-take marine reserves on their overall profitability. Note that charter operators were asked about the state no-take marine reserves in the sub-network they operate in most.

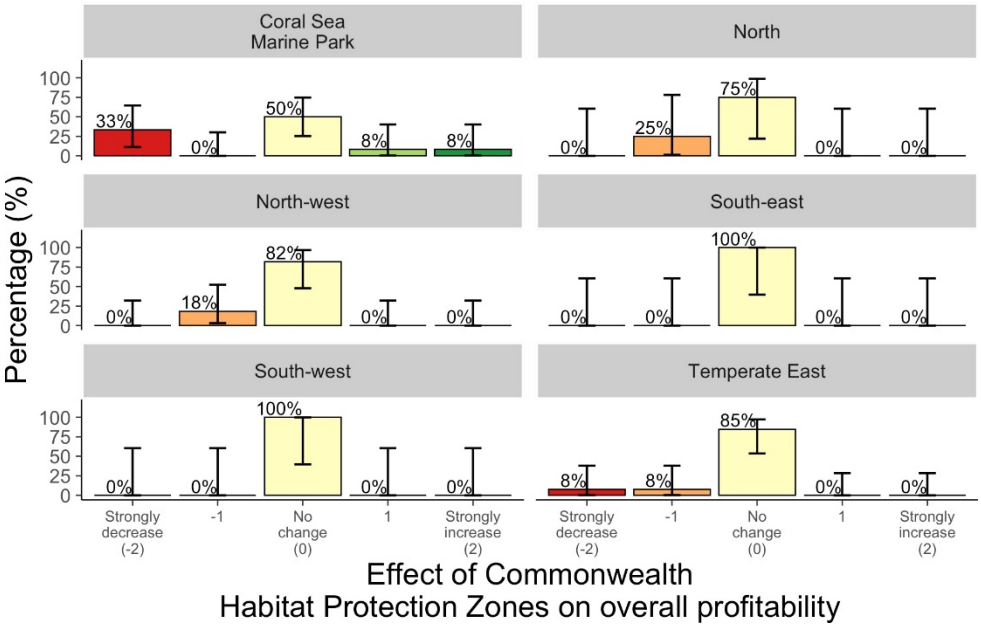

Figure 154. Charter operators' beliefs about the effect of Habitat Protection Zones (HPZs) in the Australian Marine Parks on their overall profitability. Note that charter operators were asked about the HPZs in the sub-network they operate in most.

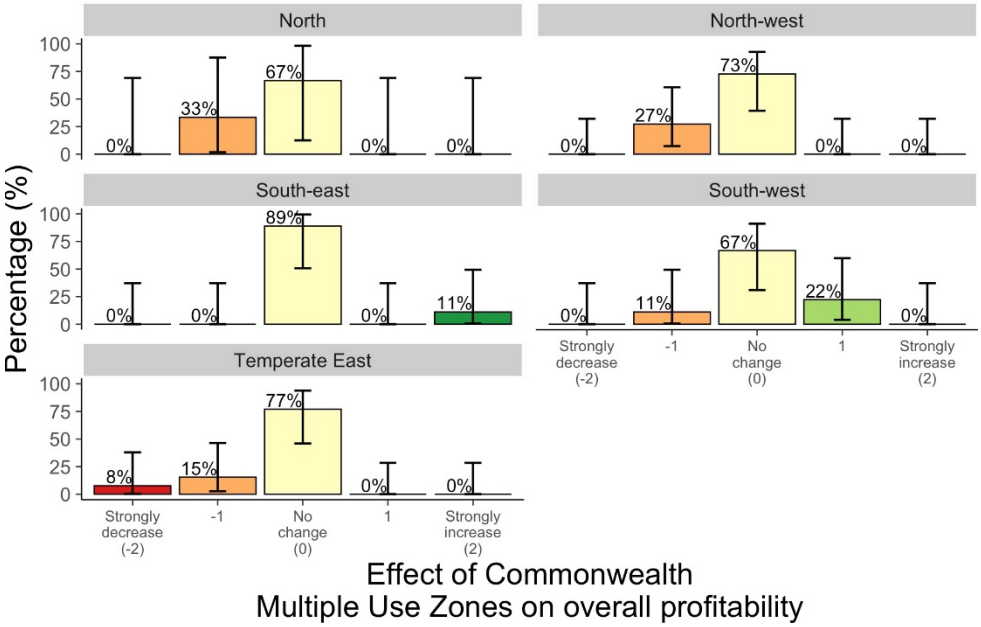

Figure 155. Charter operators' beliefs about the effect of Multiple Use Zones (MUZs) in the Australian Marine Parks on their overall profitability. Note that charter operators were asked about the MUZs in the sub-network they operate in most.

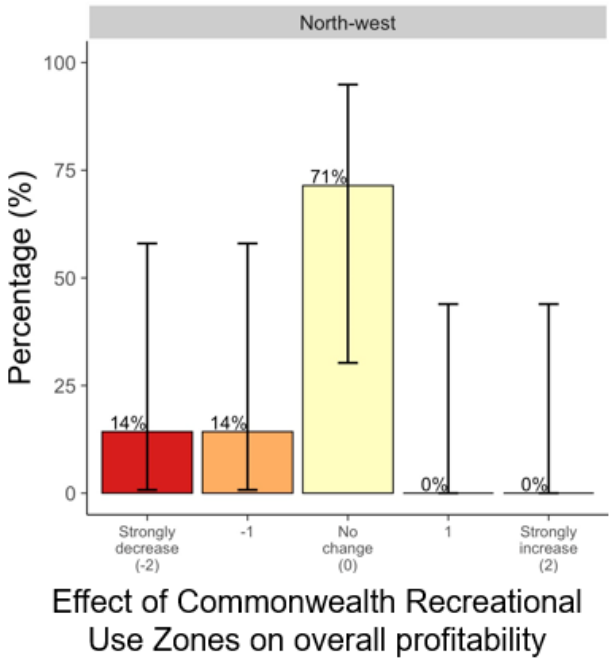

Figure 156. Charter operators' beliefs about the effect of Recreational Use Zones (RUZs) in the Australian Marine Parks on their overall profitability. Note that charter operators were asked about the RUZs in the sub-network they operate in most.

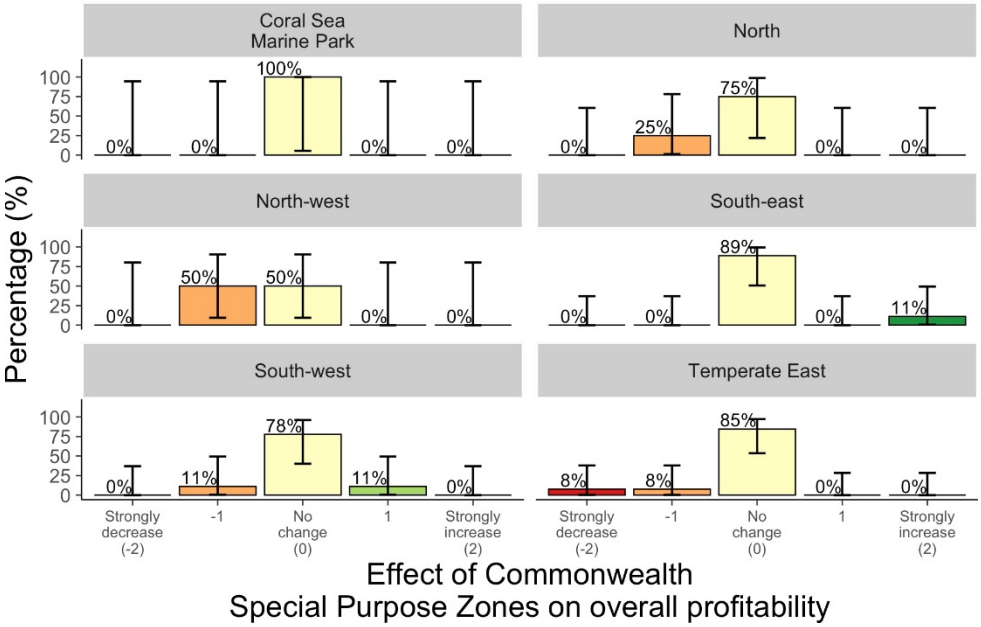

Figure 157. Charter operators' beliefs about the effect of Special Purpose Zones (SPZs) in the Australian Marine Parks on their overall profitability. Note that charter operators were asked about the SPZs in the sub-network they operate in most.

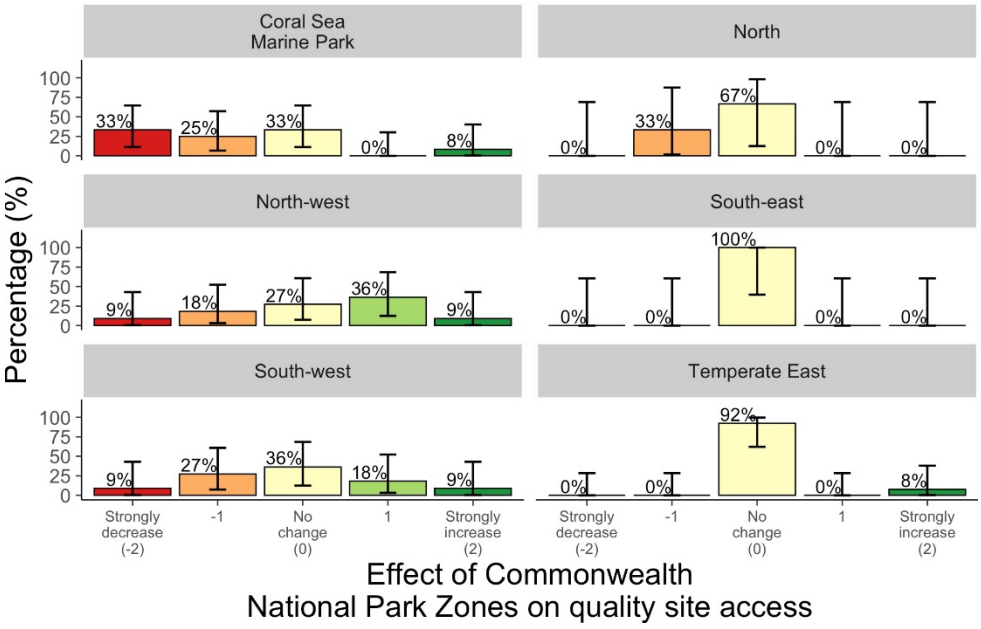

Figure 158. Charter operators' beliefs about the effect of National Park Zones (NPZs) in the Australian Marine Parks on their ability to access quality sites. Note that charter operators were asked about the NPZs in the sub-network they operate in most.

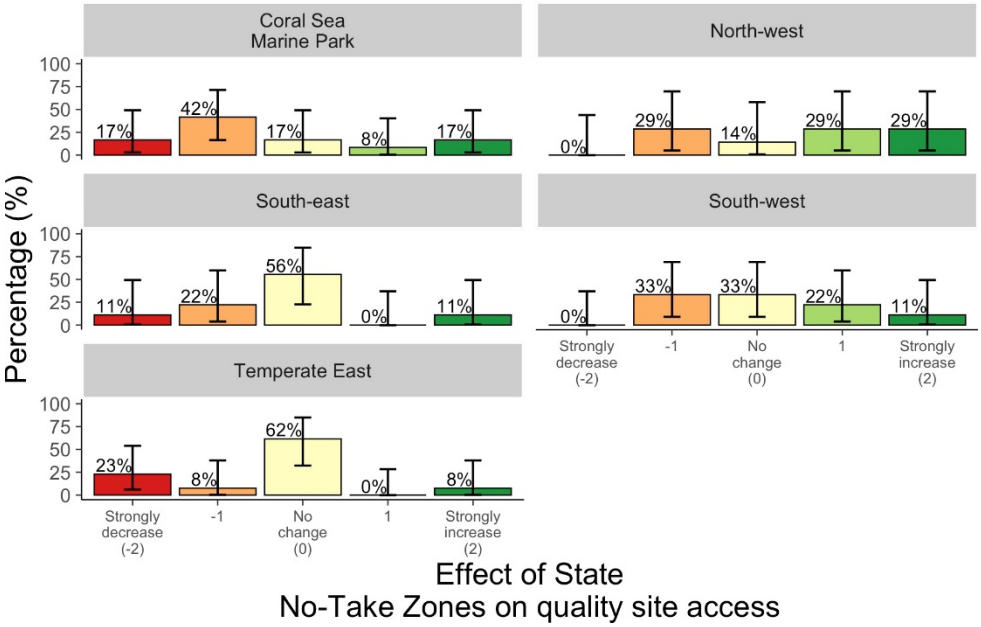

Figure 159. Charter operators' beliefs about the effect of state no-take marine reserves on their ability to access quality sites. Note that charter operators were asked about the state no-take marine reserves in the sub-network they operate in most.

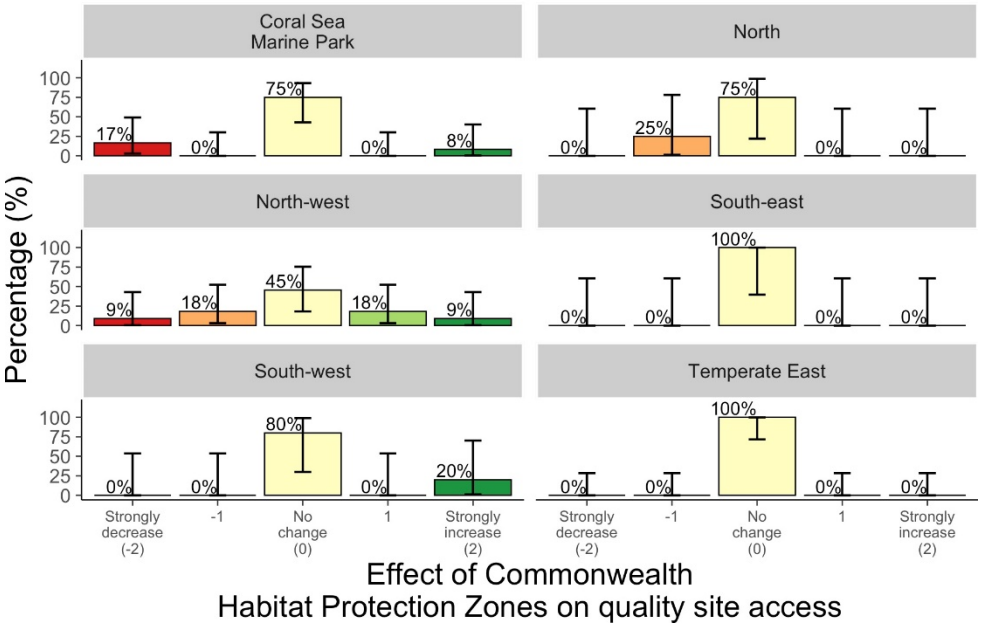

Figure 160. Charter operators' beliefs about the effect of Habitat Protection Zones (HPZs) in the Australian Marine Parks on their ability to access quality sites. Note that charter operators were asked about the HPZs in the sub-network they operate in most.

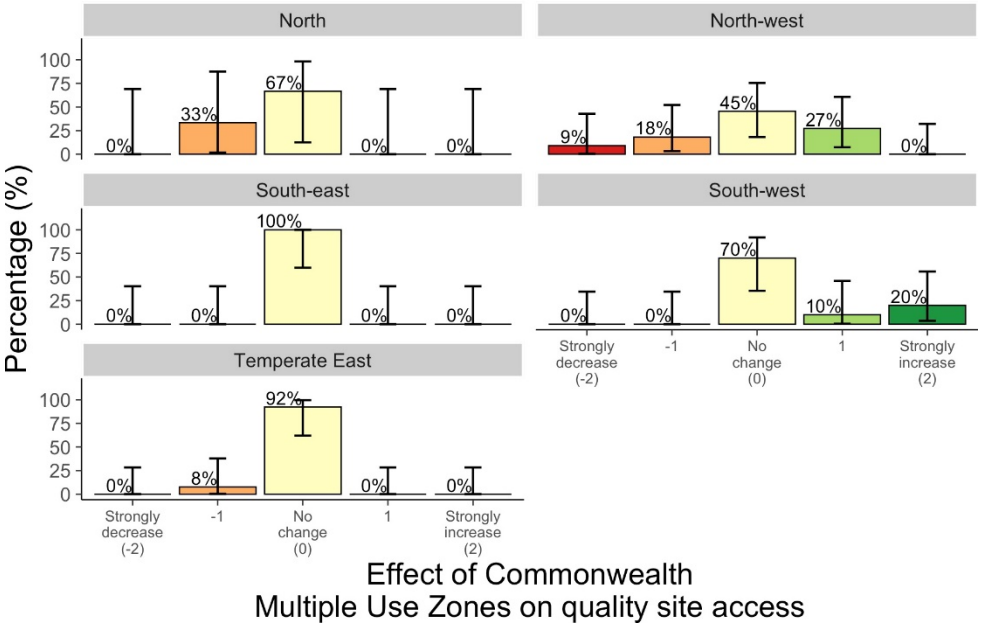

Figure 161. Charter operators' beliefs about the effect of Multiple Use Zones (MUZs) in the Australian Marine Parks on their ability to access quality sites. Note that charter operators were asked about the MUZs in the sub-network they operate in most.

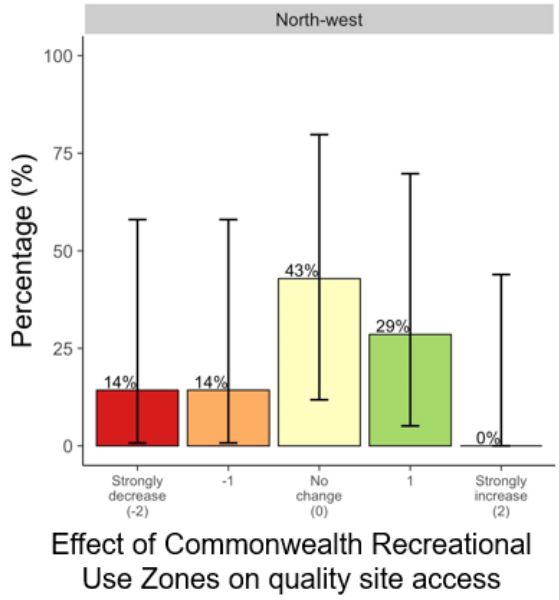

Figure 162. Charter operators' beliefs about the effect of Recreational Use Zones (RUZs) in the Australian Marine Parks on their ability to access quality sites. Note that charter operators were asked about the RUZs in the sub-network they operate in most.

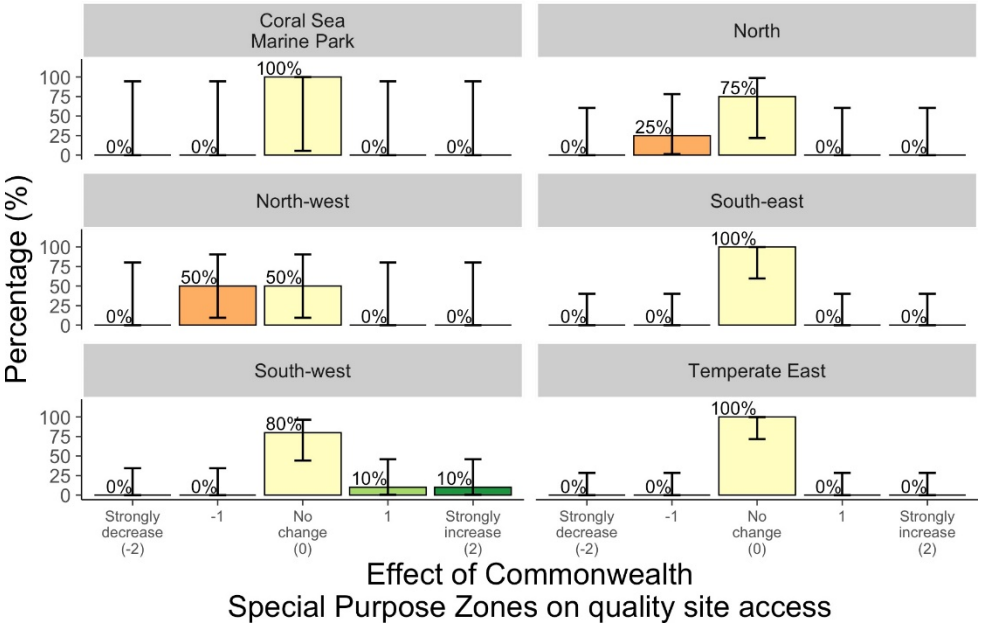

Figure 163. Charter operators' beliefs about the effect of Special Purpose Zones (SPZs) in the Australian Marine Parks on their ability to access quality sites. Note that charter operators were asked about the SPZs in the sub-network they operate in most.

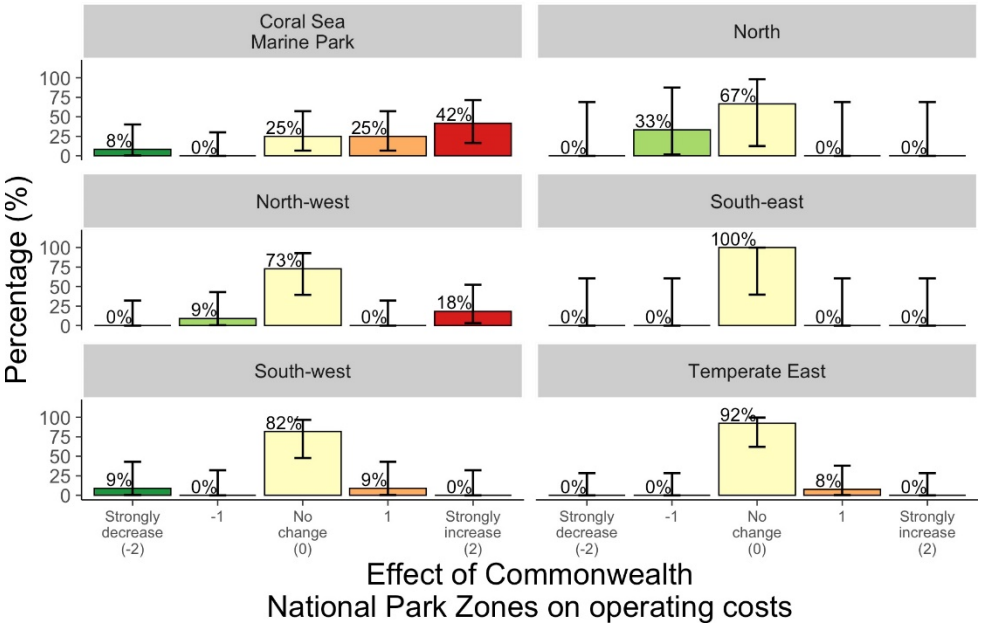

Figure 164. Charter operators' beliefs about the effect of National Park Zones (NPZs) in the Australian Marine Parks on their operating costs. Note that charter operators were asked about the NPZs in the sub-network they operate in most.

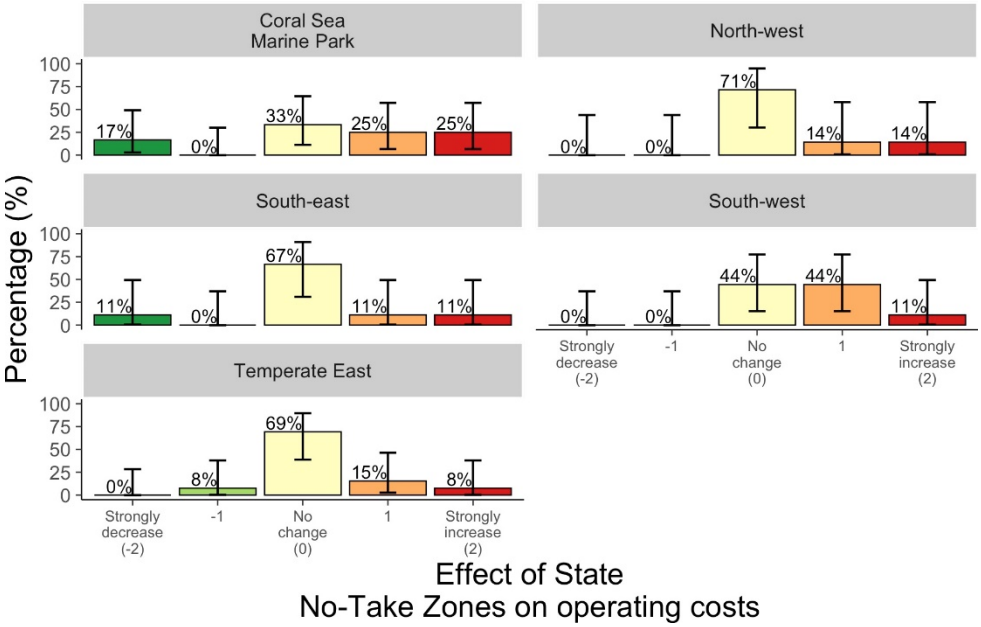

Figure 165. Charter operators' beliefs about the effect of state no-take marine reserves on their operating costs. Note that charter operators were asked about the state no-take marine reserves in the sub-network they operate in most.

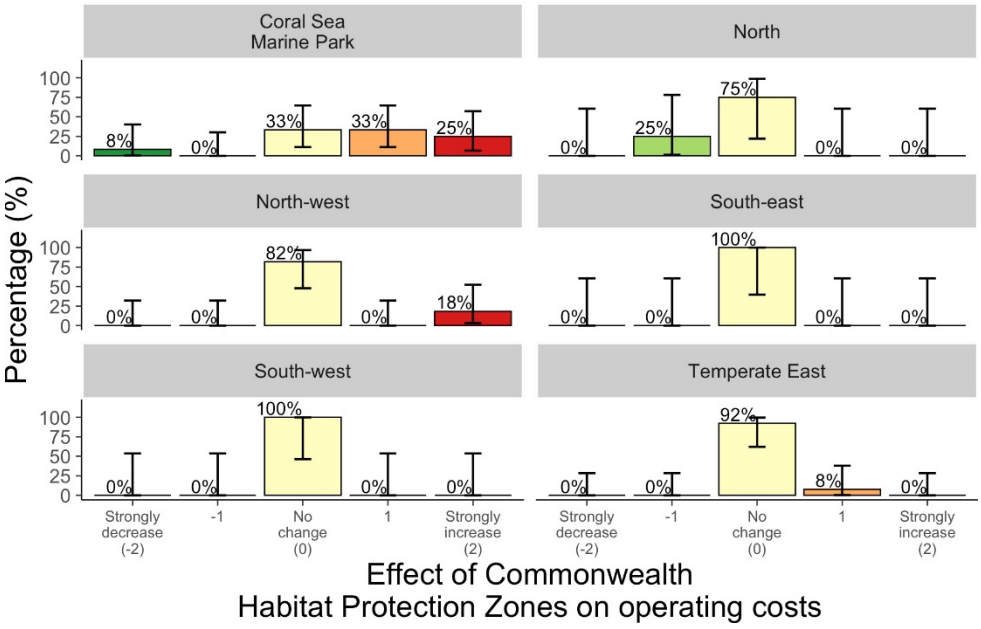

Figure 166. Charter operators' beliefs about the effect of Habitat Protection Zones (HPZs) in the Australian Marine Parks on their operating costs. Note that charter operators were asked about the HPZs in the sub-network they operate in most.

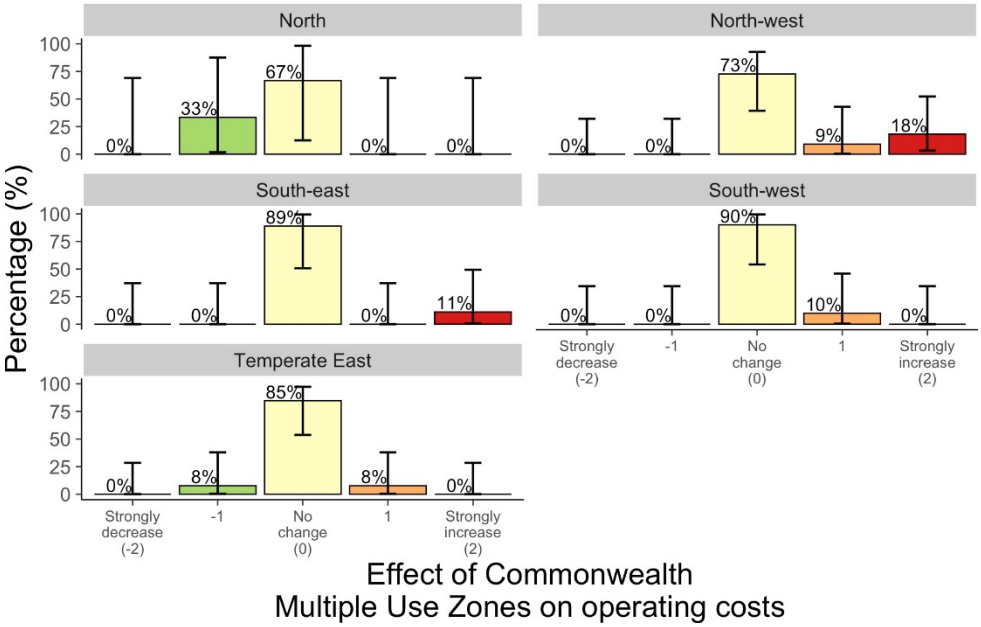

Figure 167. Charter operators' beliefs about the effect of Multiple Use Zones (MUZs) in the Australian Marine Parks on their operating costs. Note that charter operators were asked about the MUZs in the sub-network they operate in most.

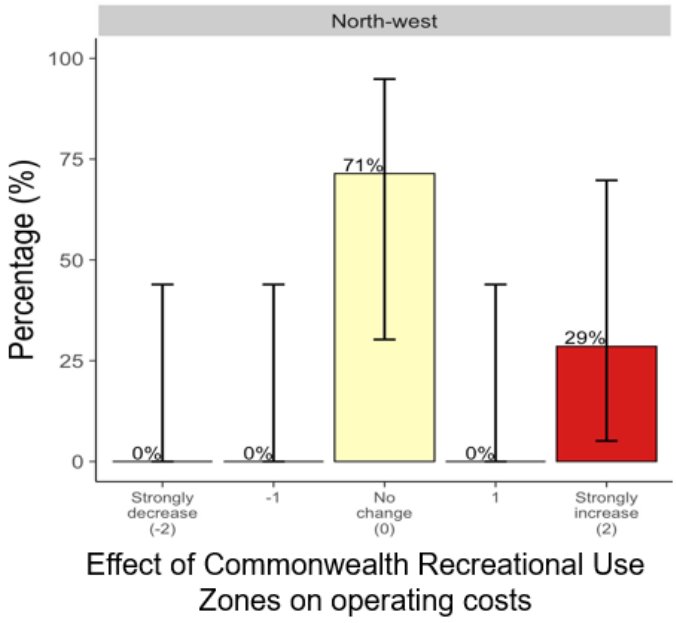

Figure 168. Charter operators' beliefs about the effect of Recreational Use Zones (RUZs) in the Australian Marine Parks on their operating costs. Note that charter operators were asked about the RUZs in the sub-network they operate in most.

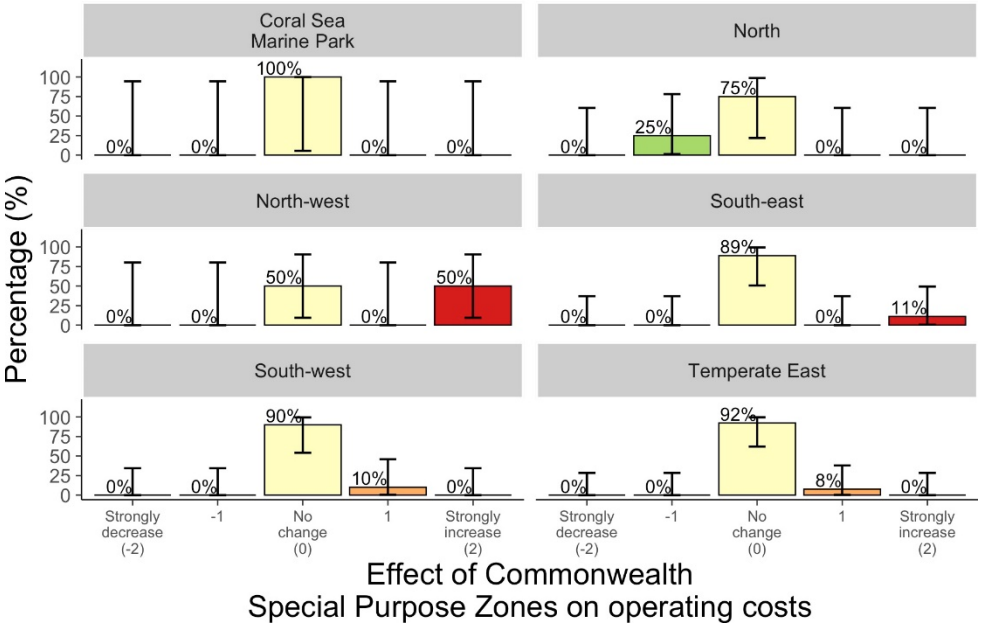

Figure 169. Charter operators' beliefs about the effect of Special Purpose Zones (SPZs) in the Australian Marine Parks on their operating costs. Note that charter operators were asked about the SPZs in the sub-network they operate in most.

6.4 National recreational fishing model

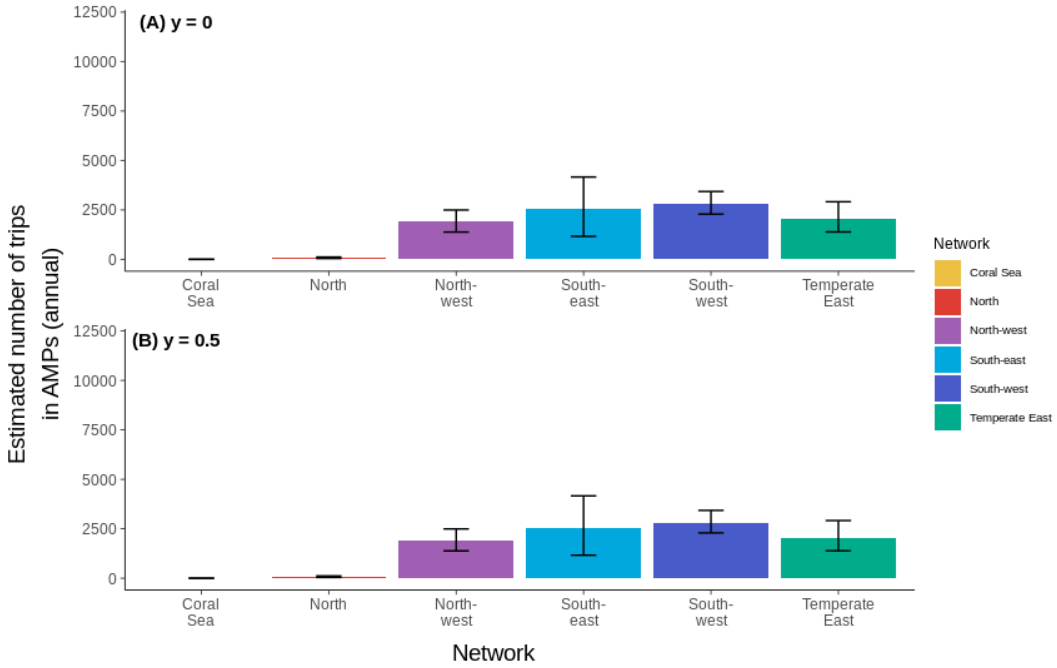

Figure 170. Estimated number of recreational boat-based line fishing trips in the Australian Marine Parks using the uncalibrated Western Australia-based national recreational fishing models. (A) shows scenario with no competition between adjacent ramps (y = 0) and (B) allows for intermediate levels of competition between adjacent ramps (y = 0.5).

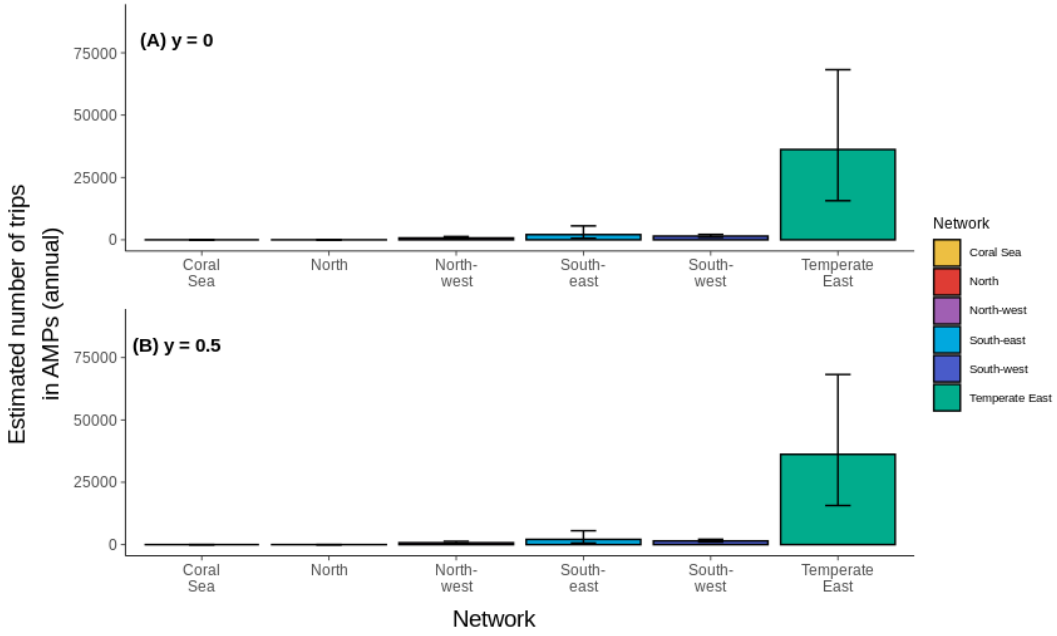

Figure 171. Estimated number of recreational boat-based line fishing trips in the Australian Marine Parks using the NSW-based national recreational fishing models. (A) shows scenario with no competition between adjacent ramps (NSW-based y0) and (B) allows for intermediate levels of competition between adjacent ramps (NSW-based y0.5).

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