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12. A field manual for marine protected area recreational user knowledge, attitude and practice (KAP) surveys

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Platform Description

Marine Protected Area (MPA) recreational Knowledge, Attitudes and Practice (KAP) surveys are a research approach to elicit basic quantitative information about marine recreational users' Knowledge about, Attitudes Towards and Practices within MPAs.

KAP surveys have been widely used in a range of disciplines including research in health (Delobelle et al. 2009), education (Esa 2010) and sustainability (Salas-Zapata et al. 2018) to provide a rapid understanding of a topic. In an MPA context, KAP surveys allow managers to assess MPA performance relative to social objectives and offer guidance for MPA planning, monitoring and management (Charles & Wilson 2008). For example, collecting MPA recreational user data on awareness, support, and compliance with zoning can complement consultation programs during MPA planning, and enables customisation of communication strategies, educational initiatives, and compliance management efforts (Sutton & Tobin 2009, Voyer et al. 2012, Kotowicz et al. 2017). Additionally, recreational user practice data provides information on spatial distributions of use and catch, facilitating ecological monitoring, targeted education and enforcement in high use areas (Pomeroy et al. 2005, Navarro et al. 2020). This data can also be used to estimate the value of recreation connected to an MPA (non-market use value) and predict the impact to recreation associated with zoning arrangements (i.e., the cost experienced by displaced recreators) (Raguragavan et al. 2013, Gao & Hailu 2018, Navarro et al. 2022). The data outputs and management implications of MPA recreational users' KAP surveys closely align with a national Adaptive Management Plan from Parks Australia (who manage the Australian Marine Parks located in Commonwealth waters), specifically for their management programs to, "improve awareness, understanding and support for marine parks" and "provide for and promote a range of environmentally appropriate, high quality recreation and tourism experiences and contribute to Australia's visitor economy" (Director of National Parks 2018). The merits of MPA recreational users' KAP surveys have led to their incorporation into socio-economic research and monitoring within Australia, (Haensch et al. 2020, Navarro et al. 2021) and internationally (Leeworthy 2013, Thomas et al. 2015).

Scope

This field manual draws on scientific literature (e.g., Martin et al. 2016, Haensch et al. 2020), national and regional workshops with MPA managers, and the building of a national socio-economic baseline across Commonwealth waters (Navarro et al. 2021). The survey approach has been refined through partnerships with First Nations peoples of Wadandi and Wudjari Country in the south-west of Australia ('Country' referring to the land, sea and waterways First Nations people are connected to), and a national working group of marine social and biodiversity scientists, following the collaborative and iterative approach described in Przeslawski et al. (2023). The final survey has been piloted across Western Australia in Baiyungu (Coral Bay), West Coastal Thalanyji (Exmouth), Yinikurtura (Cape Range), Malgana (Shark Bay), Wadandi (Ngari Capes), Wudjari (Esperance), Whadjuk (Perth) and Ngarluma (Karratha) Country.

Whilst guiding principles for social-economic science are commonly published and used, the standardisation of protocols through field manuals are unusual as the survey instruments and methodology deployed are often customised to suit individual research questions and context

(Pomeroy et al. 2005, Moon et al. 2016). Despite the undeniable importance of context, we aim to promote consistency across MPA recreational user research by providing a standard field manual for conducting MPA recreational users' KAP surveys. Adopting consistent approaches enables managers to assess changes and effectiveness of management over time (Pomeroy et al. 2005), make national-level comparisons and syntheses, generate insights beyond the scope of single studies and provides a scalable platform to conduct robust socio-economic science. This field manual has been established with an Australian focus (especially with regards to approvals and collaboration with First Nations peoples), but can be adapted to other contexts where recreational users interact with MPAs.

This field manual describes six sequential steps for planning, conducting, analysing and publishing results from MPA recreational users' KAP surveys (Figure 1). The six steps are described in detail below.

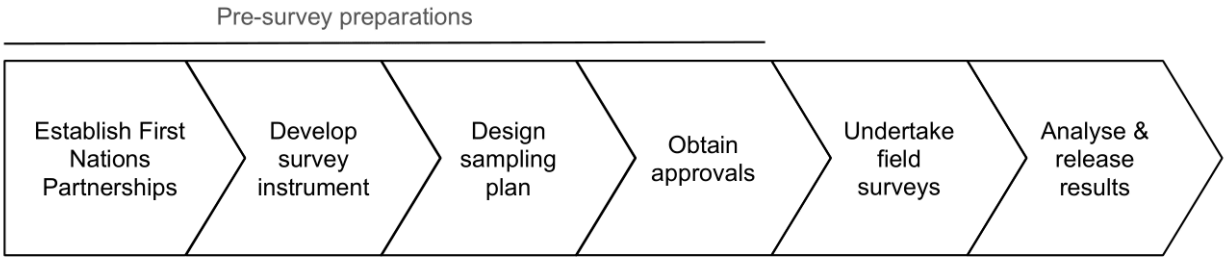

Figure 1: The six steps outlined in this field manual for conducting MPA recreational users' KAP surveys.

Pre-survey preparations

Establish First Nations partnerships

Within Australia, MPA recreational users' KAP surveys take place on, and are related to the management of First Nations peoples' Land and Sea Country. Therefore, First Nations peoples of the Country should be contacted during early phases of planning, and established protocols for collaborating with First Nations groups should be followed (NAILSMA & CSIRO 2020). Obtaining approval to conduct research on, or related to First Nations peoples Land and Sea Country requires sensitivity and ample time to build relationships and trust. For example, researchers wishing to collaborate with the Esperance Tjaltjraak Native Title Aboriginal Corporation are required to engage in an initial consultation meeting with representatives from the six Wudjari families (i.e., the Circle of Elders) to discuss research intentions and scope. This session is critical to gaining preliminary approval and serves as a platform for families to express concerns and expectations. It's important to note, however, that consultation does not imply consent. Researchers should aspire to thoughtfully co-design projects with First Nations people, as opposed to having these communities be the recipient of fully-developed research plans (St John & Akama 2022, Tamwoy et al. 2022).

It is important that free, prior and informed consent is obtained, and that Indigenous Cultural Intellectual Property is protected if cultural knowledge is to be shared for data collection or co-design of specific surveys (NAILSMA & CSIRO 2020). This follows the internationally recognised CARE (Collective benefit, Authority to control, Responsibility, Ethics) principles for Indigenous data governance (Carroll et al. 2020). First Nations partnerships involved in developing and trialling this field manual have highlighted that MPA recreational users' KAP surveys provide scalable opportunities for First Nations ranger-led research.

Develop survey instrument

Whilst it is often desirable to tailor a survey's questions or topics to specific areas or contexts, this survey is designed to be standardised and transferable between locations. However, modules (e.g., an economic module) can be added to the end of the survey to target certain topics or enhance specific analyses.

The survey template (Appendix 1) has five sections: (1) Pre-survey, which includes interview metadata (e.g., surveyor ID, survey site), survey introduction and informed consent protocol; (2) Practices, which records details of activities the respondent has participated in on a given day; (3) Knowledge, which captures the awareness the respondent has for local jurisdictions, MPAs and their zonation; (4) Attitudes, which collects data on the attitudes and perceptions towards MPA zones; and (5) Demographics, for collecting information about the respondents.

Survey software

We recommend ESRI's Survey123 software in combination with a light-weight weather proof tablet device, and managing the surveys using ESRI's desktop app Survey123 Connect due to its flexibility, and extensive options to customise question parameters. Additionally, Survey123's online platform offers real time plots and statistics for data review, which is useful for monitoring data collection. Key software features and alternative software options are detailed in Appendix 2.

The XLSform survey template provided in Appendix 3 can be uploaded into Survey123 Connect to customise a survey to a particular location.

Design sampling plan

We recommend that MPA recreational users' KAP surveys employ a probability-based face-to-face approach at marine access points (e.g., boat ramps or shore access points). Whilst this approach can generate a gender biassed sample (Navarro et al. 2020) and is limited when asking about non-compliant behaviour (Arias & Sutton 2013), it directly targets active users of the marine environment and ensures the sampling closely reflects the targeted population (i.e., MPA recreational users). It is optimal to complement face-to-face surveys with other sampling approaches such as online open link, panel surveys or probability-based mobile phone or letter-box sampling approaches (Dillman et al. 2014, Goodrich et al. 2023) to understand sampling biases.

Probability-based sampling, where every recreational user has a known probability of being sampled, involves the development of a survey shift schedule with a known set of sampling probabilities (Cornesse & Bosnjak 2018). Weighting the survey schedule to oversample busy

locations and time periods (e.g., weekends, holidays) maximises sampling efficiency, especially in remote locations.

Using a restrictive spatial and temporal sampling design (Smallwood & Ryan 2020) is a pragmatic approach to conducting MPA recreational users' KAP surveys. However, the data collected is only truly representative of the sampling time frame, so while we encourage comparisons across MPAs, this should be interpreted attentively. To aid this interpretation it is essential that detailed information on the sampling design should be maintained and recorded in any resulting metadata products (see Appendix 1 for shift metadata template).

The sampling effort required for a robust sample size will depend on how the data are intended to be used, and the popularity of the access points sampled. As a general rule, expect an average of five interviews per four-hour shift at a high-use boat ramp or shore access point. Whilst some days may far exceed this, particularly during school holidays and in fine weather, others will have very few, if any, interviews completed. For the calculation of broad metrics (e.g., % awareness of zones), a target of 100 surveys should be completed (Navarro et al. 2021), though additional surveys will provide more robust data for detailed modelling (e.g., influence of fisher avidity). This corresponds to approximately 20 four-hour shifts.

Restrictive spatial and temporal sampling design of probability-based face-to-face MPA recreational users' KAP surveys is outlined in five steps below:

Step 1: Identify the relevant MPA access points that you wish to sample

This may include boat ramps, beach launching locations (for boat-based recreational users) and/or shore access points. It is often impractical to sample all possible sites; therefore local knowledge (e.g., that of First Nations rangers or relevant management agency) can be used to identify a minimum set of heavily visited access points. This will normally exclude remote sites, and their recreational users which may differ systematically from those at popular sites (e.g., part of their motivation for recreation could revolve around solitude). If excluded it should be highlighted that the sample does not represent remote users of the MPA.

Step 2: Create a sampling schedule

A sampling schedule describes when surveys will take place. To design a sampling schedule the primary sampling unit needs to be defined; this could be a full day or can be divided into two shifts per day (e.g., AM and PM) in which case sampling would occur from the combination of all days and shifts. In designing a cost-effective sampling schedule an important consideration is whether survey staff are local to the study region or must travel there from further afield.

Local survey staff:

Using local survey staff is ideal as this allows flexibility in the sampling schedule; shifts can occur across a few months rather than having to be clumped into "field trips". Employing local First Nations Rangers is a suitable way of ensuring staff are local.

To develop a sampling schedule with local staff the first step is to identify the time period across which you wish to sample. This could be the entire year, or a select few months (e.g., when weather

is favourable for boating), with the choice being a trade-off between representativeness and practicality. It is important to capture both school holiday and non-school holiday periods to capture a representative sample of both locals and visitors. With a target period identified, a sampling schedule should be created by randomly selecting days from the target period.

Remote survey staff:

Having non-local staff is challenging as the sampled days must be clumped into field trips. From a practical point-of-view the survey schedule would then consist of every day (or shift) in the field trip. To capture a representative sample of locals and visitors, we suggest timing field trips to capture both school holiday and non-school holiday periods. Multiple field trips at different times of the year are also desirable to increase representativeness.

Step 3: Assign access points

Once a sample schedule has been developed, access points can be assigned to samples. For boat ramp surveys we recommend selecting just one access point per shift for shifts approximately 3-4 hours in length. This ramp can be randomly selected or selected using a weighted random sampling process to oversample busy locations to maximise data.

For shore-based surveys we recommend a transect design, in which the sites are ordered geographically into a route with fixed arrival and leave times for each site. To construct this schedule each shore site should be assigned an on-site time (we recommend spending more time at busy sites). Start points and route direction (i.e., north-south or south-north) should be randomised. If there are more sites in the route than can be sampled in a single shift we recommend random (or weighted random) sampling to select a fixed number of sites for a given day.

Step 4: Expecting the unexpected

It is common for bad weather (or other circumstances) to mean that there are zero or very few individuals to sample at a given site. Local knowledge should be used to guide decisions on when shifts should be cancelled (e.g., if wind speed exceeds a threshold). For quiet days that aren't cancelled a threshold can be used to identify when it is worthwhile changing site. For example if there are less than five trailers a contingency site should be sampled instead.

Step 5: Inverse probability sampling

Where a weighted random sampling plan has been used to oversample priority sites or time periods (e.g., boat ramps, school holidays), or when there have been unexpected changes to the sampling plan, inverse probability weights should be used in analyses to correct for sampling bias and increase representation across sampling time frame (see Appendix 4 for details on calculating inverse probability weights).

Obtain approvals

Any research with or about people, including MPA recreational users' KAP surveys should be subject to a formal review by a human ethics review committee or agency specific body, who can

assess a survey against nationally accepted standards. Researchers without access to a formal review committee should consider partnering with researchers who do (NHMRC 2007).

We recommend that MPA recreational users' KAP surveys be conducted anonymously, without collecting personally identifying information (e.g., full name, address). Doing so minimises risks to respondents, and is likely to maximise response rates. However, if personally identifying information is to be collected, the protocols of collecting, handling and storing this data must adhere to relevant privacy laws (NHMRC 2007).

We also recommend that researchers obtain informed consent for the re-use of anonymous survey responses in human ethics agreements and that this is clearly outlined to potential participants. This would allow data to contribute to national syntheses, maximising data impacts and minimising the need for repeat surveys and associated survey burden on respondents.

In Australia, researchers require approvals to conduct research relevant to, or on, agency managed land or waters, including First Nations peoples (see Establish First Nations partnerships above).

Surveyor training

Prior to fieldwork, surveyors must undergo training on ethical data collection procedures, participant recruitment methods, and have an understanding of the survey's purpose and broader research context to inform respondents adequately. They should understand community attitudes, especially those that might trigger conflict (e.g., lack of support for a proposed MPA), and be briefed on handling antagonistic responses.

Field procedures

Surveyors should have access to a tablet device hosting the survey instrument, a fully charged battery pack, GPS with bluetooth capability, charging equipment and precautionary spares. Shifts can be long and therefore field personnel need to be equipped with adequate water, food if necessary, sun protection and or wind barriers/waterproof clothing and toilet access should be considered. Surveyors must possess paper copies of relevant approvals and participant information and consent forms, and adhere to institution specific fieldwork risk assessment and safety protocols (Figure 2). If possible, surveyors should conduct fieldwork in uniform or branded clothing from their research institution.

On a typical day in the field each surveyor will be allocated to a site/shift pre-determined in the sampling plan. Upon arrival at a sampling site, the surveyor will fill out the metadata (template in Appendix 1), including; the researcher conducting the survey, what site are they surveying, start and end time, number of boat trailers (if at a boat ramp) or approximate number of people (if at a beach access point) and any additional comments.

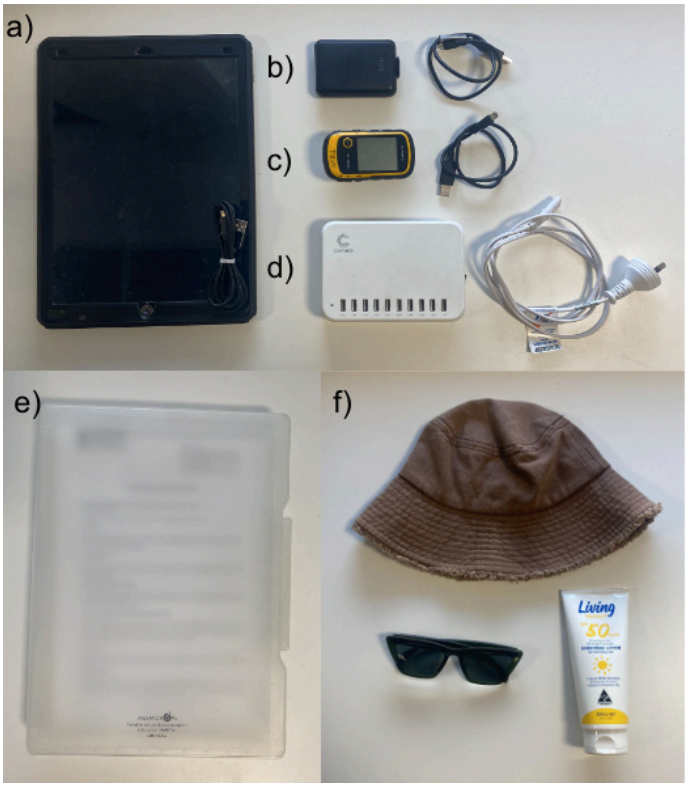

Figure 2: Equipment needed to conduct face-to-face MPA recreational users' KAP surveys; a) tablet hosting survey instrument and charging cable, b) portable power pack and charging cable, c) bluetooth GPS and charging cable, d) charging equipment, e) folder containing copies of relevant approvals, permits and participant information forms, f) personal protective equipment and uniform, which will vary depending on survey location, climate, and institution specific safety protocols.

Circumstances dictate when to approach potential respondents; avoid interrupting them if they are immediately busy (e.g., tying a boat down) or in an unsafe location (e.g., rock fishing in a slippery location). For boat ramp surveys it is important to be cognisant of the weather conditions and how busy the ramp is. Generally, respondents should be asked to pull up in a wash down bay or a similar out-of-the-way location to complete the survey.

We recommend interactions be initiated with a smile and a conversational question, followed by the surveyor introducing themselves, and briefly outlining the participant information form (template in Appendix 5); describing the research, survey, and ethical protocols that will be followed (e.g., the survey is anonymous, all questions are voluntary and you can withdraw at any time). This should be followed by the informed consent protocols approved by formal human ethics review. A template for paper participant consent forms is provided in Appendix 5, however we don't recommend their use as it can be challenging to sign in windy coastal conditions. If permitted, it is optimal to obtain verbal consent with the surveyor selecting "Yes" or "No" to a consent question on the survey instrument to maximise survey efficiency, alternatively, respondents can select "Yes" or "No". Regardless of informed consent protocol, refusuals must be recorded to calculate response rate.

Following consent, surveyors should conduct the survey by reading questions verbally and recording responses. With practice, surveyors will develop the delivery of the questions and elicit responses in a conversational manner.

Analysis and release

MPA recreational users' KAP data can be analysed in various ways to inform MPA planning, monitoring and management. Analysis of most knowledge and attitude questions involves calculating percentages corresponding to each response (Navarro et al. 2021), but can be used to explore how several factors drive pro-environmental behaviour through statistical modelling (Arias & Sutton 2013, McNeill et al. 2018). It can be useful to conduct spatial analysis of MPA use patterns such as spatial plotting, kernel density or hotspot analysis (Koehn et al. 2013, Fagerholm et al. 2021). Economic revealed preference modelling can also be used to determine MPA recreational value and predict the impact associated with different MPA zoning arrangements (Gao & Hailu 2018, Navarro et al. 2022). Details on the analysis options, statistical approaches and management implications can be found in Appendix 6.

There are currently no fit-for-purpose repositories of marine social and economic data equivalent to those used for marine bio-physical data (e.g., GlobalArchive for fish annotations, https://globalarchive.org/). Repositories ensure data standards, enable discoverability, and comparisons of results (e.g., scaling multiple regional monitoring programs to develop national insights). Research is needed to understand the requirements of a marine social and economic data repository and scope how it would function in practice.

In the meantime, we recommend detailed meta-data about MPA recreational users' KAP surveys and sampling design be uploaded to the Australian Ocean Data Network (https://portal.aodn.org.au/), so that they are accessible to other researchers. To do this, researchers must include informed consent for sharing de-identified survey responses in human ethics agreements (see Appendix 5 for details).

Demonstration of outputs

To demonstrate the use of MPA recreational users' KAP surveys, we present data collated from two boat ramp surveys of recreational fishers on Wadandi Country, conducted in 2019 (Navarro et al. 2021), and 2023 (unpublished). We draw on selected outputs from these surveys.

An example of an MPA recreational users' knowledge data output is displayed in Figure 3, which shows that in 2019, 12% of recreational fishers were aware of the Geographe or South-West Corner Marine Park. More recent surveys in 2023 show awareness has increased to 36%, representing a statistically significant increase ($\chi 2 = 11.77$, $p < 0.001$). The low but improving awareness of these MPAs suggest that efforts to date aimed at increasing awareness have had a positive effect (e.g. boat ramp signage has been installed and zoning has been added to major boating apps in the region); however, significant progress is still to be made to match awareness of the adjacent state MPAs, measured at 81% in 2019 and 74% in 2023 (Navarro et al. 2021). To understand this difference in recreational fisher awareness, research could investigate the drivers of KAP and differences in management and communication between the MPAs. In turn, this could lead to MPA communication, education, and compliance management tailored to the user groups with the lowest awareness and targeted to high use areas evident from practice data. Similar trends over time can be inferred about changes in attitudes towards zoning and practices in MPAs as well (see examples in Appendix 6).

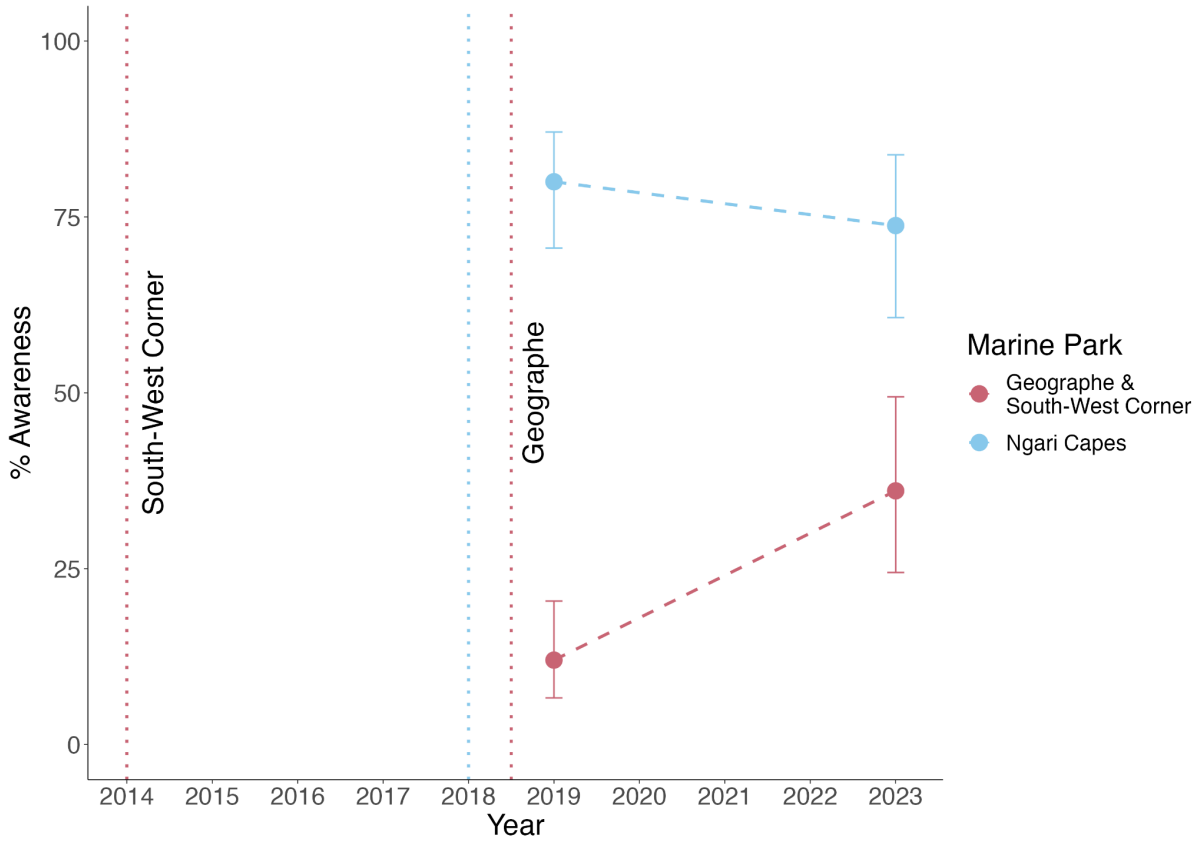

Figure 3: The percentage of recreational fishers aware of the Geographe, South-west and Ngari Capes Marine Parks in 2019 and 2023 with 95% confidence intervals. The vertical dotted lines represent the implementation of zoning for each MPA.

The relatively simple nature of MPA recreational users' KAP surveys is both a strength and a limitation. As a limitation, the simplicity of the survey does not provide explanatory depth; for example, where negative attitudes are found, the survey will provide limited insights into why this attitude exists and other research tools will need to be deployed to understand underlying causes (e.g., psychometric or qualitative research, Barclay et al. 2017). As a strength, the simplicity of the survey makes it rapid, straightforward and relatively cheap to conduct and results are easily understood by managers. The quantitative outputs are easily communicable and consistency in the methodology supports comparative analysis across MPAs. As such, these strengths make MPA recreational users' KAP surveys highly applicable to aid MPA planning, for long-term monitoring within and across MPAs, and to inform management and research priorities.

Field Manual Maintenance

In accordance with the universal field manual maintenance protocol described in Chapter 1 of the Field Manual package, this manual was created in 2023 as part of Version 3.

The version control for Chapter 12 (KAP surveys) is below:

Version Number	Description	Date
1	There was no KAP manual included in Version 1 of the field manual package	28 Feb 2018
2	There was no KAP manual included in Version 2 of the field manual package	July 2020
3	Publicly released as Chapter 12 through online portal	TBC

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