The impact of recreational surfing into Australia's economy and participants' wellbeing

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Abstract

Surfing is a cultural ecosystem service providing recreational benefits to over 50 million people worldwide and contributing to market economies through retail and tourism expenditures. Australia is globally renowned as a premier surf destination, with more surfing ranking as the second-most practiced water based sports among the Australian population. This study presents the first assessment, at the national level, of the impact of surfing on Australia's economy and participants' wellbeing. Using an online survey, yielding 569 valid responses, our results show that average surf-driven domestic expenditure on equipment and travel is A$3,370 per person per year. Aggregating across a population of 678,000 Australian adult surfers, we calculate direct input into the market economy to be A$2.56 billion per year, whilst the overall impact is estimated at A$4.6 billion per year, after applying relevant retail and tourism multipliers. Our survey results also reveal that over 75% of sampled surfers reported better or much better outcomes in terms of their mental and physical health, as well as ability to form and foster social relationships. Survey participants also reported high levels of concern regarding coastal erosion, climate change and overcrowding. Despite limitations of the non-probabilistic sampling approach, as the first national results on the impact of surfing in Australia, we expect this study will help fill an important information gap in the economic assessment of coastal recreation. Our study fits into a broader body of work aimed at assessing economic activities associated with the oceans (i.e. blue economy), in order to inform decision-making processed towards greater coastal sustainability and resilience.

Keywords: surfing economics; coastal management, blue economy, outdoor recreation,

1. Introduction

In Australia, as in many other countries bordering the ocean or sea, coasts are important assets providing numerous services, including recreation for local residents, as well as domestic and foreign visitors (Rolfe & Gregg, 2012). The economic value of recreational beach visitation across Australian beaches is well researched (e.g. Pascoe, 2019; Prayaga, 2017; Rolfe & Dyack, 2011; Zhang et al., 2015), including for specific activities. In particular, a large body of literature exists on the estimation of recreational fishing values in Australia (Pascoe et al., 2014; Prayaga et al., 2010; Raguragavan et al., 2013; Scheufele & Pascoe, 2022; Yamazaki et al., 2013), while other have examined the values of diving (Carr & Mendelsohn, 2003; Huveneers et al., 2017; Stoeckl et al., 2010) and snorkeling (Kragt et al., 2009). Despite international recognition of surfing as cultural ecosystem service (Román et al., 2022), very few studies have examined economic values associated with recreational surfing in Australia.

Since Lazarow (Lazarow, 2009; 2007, 2008) first documented the direct contribution of surfing to the economy of the Gold Coast, in the state of Queensland, there have been practically no peer-reviewed studies on the economic value of surfing. A notable exception is Pascoe (2019), who estimated consumer surplus associated with surf trips, as part of a travel cost estimation of multi-purpose visitation to New South Wales beaches. Two reports commissioned by local councils have estimated the contributions of the surf industry to the local economy within the Victorian Surf Coast Shire (AECGroup, 2014) and the City of Gold Coast (City of Gold Coast, 2020).

The lack of scholarship regarding the value of recreational surfing is at odds with its high level of participation, with surfing being the second-most practiced water based sport, only after swimming (AusPlay, 2023). There are more Australians (15+ years) practicing surfing (705,800) than recreational fishing (360,200), sailing (194,400), scuba diving (55,800) and snorkeling (53,800) combined (AusPlay, 2022). Further, surfing is among the top five in-nature physical activities (after walking, swimming, running and cycling) and the fastest growing within this group (see Table A1 in the Appendix for participation figures across sports and physical activities). Between 2016 and 2022, the Australian surfing population grew by 37%, partially accelerated by newcomers during COVID-19 lockdowns and border closures.

Worldwide, there are an estimate 50 million surfers, with its popularity rising since the start of the pandemic and surfing's inclusion as an Olympic sport in 2021 (Mach & Ponting, 2021). Growing demands face the challenge of limited supply, given that surf breaks (and the waves they generate) are a finite resource, which in many cases are subject to growing risks (Orchard et al., 2023). In addition to user overcrowding and tourist pressures common to beach environments (e.g. congestion, littering) (Chen & Teng, 2016; Mach & Ponting, 2018), surfing ecosystems – i.e. surf breaks and their surrounding environments (Manero, 2023) – are exposed to changes from climatic events (e.g. storms, erosion) and coastal developments (e.g. seawalls, marine infrastructure). Evidence from across the world points at the growing impacts on surfing ecosystems, as the effects of coastal changes on wave formation are still poorly understood and rarely quantified or mitigated (Bryan et al., 2019; Corne, 2009; Jackson et al., 2007; Leon, 2012; Scarfe et al., 2009). There is thus a need among coastal planner and policymakers to sustainably manage coastal spaces to cater for diverse recreational user groups, including surfers (Olive, 2016).

To raise awareness of the importance and fragility of surfing ecosystems, over the last few decades, community organizations, such as Surfrider Foundation (www.surfrider.org.au) and Surfers Against Sewage (www.sas.org.uk), have played a fundamental role in knowledge generation and translation, including for policy change (Touron-Gardic & Failler, 2022). For example, in 2020 in Chile, advocacy efforts by Fundación Rompietes and Save The Waves Coalition led to the creation of the Created Piedra del Viento Coastal Marine Sanctuary – a 4,000 hectares biodiverse hotspot, home to two iconic surf breaks (Save the Waves, 2020a).

More recently, a growing body of academic literature is demonstrating the multiple values associated with recreational surfing, and the need to protect them from rising threats. From a health and well-being perspective, surfing has been examined as part of 'blue spaces', i.e.,

health-enabling places where water is at the center of the environment (Britton et al., 2020; Olive & Wheaton, 2020). The therapeutically benefits of surfing are now well documented among adult and children participants with special conditions, such as post-traumatic stress disorder (Caddick et al., 2015; Marshall et al., 2021), poor mental health (Marshall et al., 2023; McKenzie et al., 2021; Olive et al., 2023), disabilities (Armitano et al., 2015) and chronic illness (Government of Western Australia, 2023). While surfing is an individual sport, it has been shown to contribute to multiple aspects of social wellbeing, including community cohesion and strong family relationships (Lazarow & Olive, 2017; Pearson, 1979; Suendermann, 2015; Wheaton et al., 2021). Further, surfing's sense of place has been observed as a catalyzer of pro-environmental attitudes, like care for coastal landscapes, ocean literacy and activism (Booth, 2020; Fox et al., 2021; Lazarow, 2010; Román et al., 2022). In fact, surf breaks are often located within or nearby areas of high ecological significance, thus co-hosting cultural and environmental values simultaneously (Reineman et al., 2021; Touron-Gardic & Failler, 2022).

Beyond surfers and direct surroundings, the presence of surfing ecosystems has observed effects on local and regional communities, for example, through revitalizing and enhancing regional economies; attracting and fixating local employment; and promoting improvement of local services and infrastructure (Machado et al., 2018; McGregor & Wills, 2017; Reineman, 2016). Economic analyses have estimated various forms of values, benefits and impacts of recreational surfing (see Table A2 in the Appendix for a comprehensive overview of market and non-market valuation of surfing). For example, using night lights as proxy indicator, McGregor and Wills (2017) found that, at a global scale, good quality surf breaks add $4.00 billion in economic activity, when effects within 10km radius are considered, compared to poor quality breaks. A hedonic pricing study by Scorse et al. (2015) found location right next to the Santa Cruz (California) would increase a house price by U$106,000, compared to an equivalent property one mile (1.6 km) further away. While a few other non-market valuation studies exists (e.g. Pascoe, 2019; Ramos et al., 2019), the literature on surfing economic values focuses on direct expenditure (see Table A2).

Prior to the COVID-19 pandemic, global expenditure in surf tourism was calculated at between U$31.5 and U$64.9 billion per year (Mach & Ponting, 2021). Local studies, often commissioned by non-for-profit organization Save the Waves coalition, have estimated economic impacts of surf tourism in popular destinations, such as such as in Uluwatu, Indonesia (Margules et al., 2014) and Guarda do Embaú, Brazil. (Bosquetti & de Souza, 2019). In Australia, the contribution of surfing to the Gold Coast was first estimated by Lazarow (2009) at A$126-233m/yr (in 2007 prices). Based on an unpublished 2019 report, the City of Gold Coast indicates the contribution of surfing to the local economy is $542 million, equivalent to 1.5% of the area's Gross Regional Product (City of Gold Coast, 2020). Within the Surf Coast Shire (Victoria), the surf industry is estimated to contribute A$217 million, directly and indirectly, through mechanism, like equipment manufacturing and sales, and provision of hospitality services (AECGroup, 2014). No other studies could be found regarding the economic value or impact of surfing in Australia.

Mirroring an international pattern (Mach, 2021), the lack of recognition of surfing values in Australia is both a cause and effect of surfing's absence from crucial considerations around the "blue economy" and "ocean sustainability". For example, Australia's State of the Environment Report addresses concerns linked to coastal visitation for fishing, snorkeling and scuba diving – but not surfing (DCCEEW, 2021). Unlike countries like New Zealand and Peru, where surf breaks are recognized by national-level legislation (Orchard, 2020; Orchard et al., 2023; Scheske et al., 2019), Australia's environmental laws and polices largely overlook surf breaks (and surfing ecosystems) as valuable natural assets. Australia is home to over 1,230 documented surf breaks, but only 20 have some form of legal protection, under the NSW *Crown Lands Act 1989* and Victoria's *Heritage Act 2017*. Other forms of recognition exist, like the Gold Coast surf management plan (City of Gold Coast, 2015) and World Surfing Reserves (Save the Waves, 2020b), although these lack legal weight. In absence of an understanding of the value of surfing ecosystems and formal protection mechanics, coastal planners and developers risk making decisions causing irreversible damage. For instance, the expansion of the Ocean Reef Marina in Perth (Western Australia) caused the disappearance of three surf breaks in 2022 (Manero, 2023). Despite initial dismissal due to cost concerns, petitions from local community groups for the construction of an artificial surfing reef were endorsed for further consideration by the local council in June 2023.

This study aims to assess the impact of recreational surfing on Australia's market economy and participants' wellbeing. As growing coastal hazards compromise the processes needed for wave formation, coastal planners are required to prioritize strategies to safeguard ecosystem functions that sustain local socio-economic and environmental benefits. We expect the results of this study to help fill the current knowledge gap in Australia's understanding of benefits derived from coastal recreation. The reminder of the paper is structured as follows. The *Methods* section describes the survey design, data collection and analysis processes. The *Results* present a summary of key finding in relation to surf-driven expenditure and perceived impact on participants' wellbeing. The *Discussion* brings our results into context with the broader literature and provides insights into the implications of our findings. The *Conclusion* offers some final remarks and suggestions for future research.

2. Methods

2.1. Data collection

Data were collected through an online survey administered between February 27 and May 31, 2023. Data collection and storage were carried out in accordance with the Australian National University Ethics protocol 2022/822. The survey consisted of three sections. The first section included questions in relation to respondents' surfing habits (such as expenditure and travel). Other questions regarded surfers' concerns in ration to surf amenity and the perceived impact of surfing on their lives. The second part of the questionnaire consisted of an interactive mapping exercise, where respondents could select the surf breaks they had visited, and the frequency, over the 12 months prior to completing the survey. The third and final section included socio-demographic questions that describe surfers' profiles. See survey

instrument in Appendix. For the purpose of this study, surfers are defined as individuals who ride a wave with their bodies and/or a surf craft that is not motorized (Lazarow, 2009).

Responses were collected through snowball sampling (Johnson, 2014), which is recommended when targeting "hard to reach" groups or population sub-samples that typically under-represented in opt-in online are too small to be accurately represented in standard panels (Sadler et al., 2010; Zhang et al., 2020). As an incentive, survey participants were given the option (upon survey completion) to enter a random draw offering: one wetsuit valued at A$900, one surfboard valued at A$1,000) and two A$250 cash vouchers. The survey was made available on the Australian National University's Qualtrics (2023) platform and the link shared through a number of platforms, including large surfing organizations (Surfrider Foundation, Surfing Western Australia and Surfing Mums), radio and written media (Manero & Yusoff, 2023; Rivalland, 2023) and authors' networks.

A limitation of snowball sampling is that, being non-probabilistic, it is subject to self-selection bias (Johnson, 2014), thus attracting responses from highly committed sport participants—a common feature of recreation demand research (Mackenbach et al., 2018). To assess the representativeness of our sample, we checked the characteristics of the surfing population against those reported by The Australian Sports Commission, which are the most comprehensive and representative figures of participation in sports and physical activities across Australia (AusPlay, 2022).

The survey returned 1,050 responses, but only 569 (54%) were retained after the clean-up process. This was mainly due to the high incidence of bot-generated responses, which has become a serious and widespread threat to the integrity of data from online surveys (Roman et al., 2022; Zarouali et al., 2023; Zhang et al., 2022). Following recent guidelines, several preventative steps were taken to mitigate bot incidence (Goodrich et al., 2023; Griffin et al., 2022), including avoidance of social media advertising and raffle-based incentives (not for single completion). Invalid entries were identified through a combination of: duplicate IP address, geolocation location outside of Australia, completion time, and duplicate and/or unusual responses to open-ended questions (Goodrich et al., 2023; Griffin et al., 2022). A summary of the clean-up protocol is presented in Table X in the Appendix

2.2. *Data analysis*

Following the processes undertaken in nation-wide study of surf expenditure in the UK (Mills & Cummins, 2015) and the most recent available estimates in Australia (Gold Coast) (Lazarow, 2009), data on surf-related expenditure was used to estimate surf-driven input into the national economy. As per Lovell et al. (2020), respondents were asked to report on expenses paid by them for others, but exclude expenses paid by other for them. Domestic travel-related expenses were solicited based on travel involving at least one night away from home. Only expenses for the last trip were recorded, as it is often difficult for participants to recall travel information over long periods of time (Heagney et al., 2019). To extrapolate over the whole year, we calculate the average overnight costs (based on last trip) and make the conservative assumption that all previous trips consisted of only one night away from home. To calculate the total input into Australia's economy we exclude purchases of second-

hand boards. We aggregate based on a population of 680,500 adult (18+) surfers in Australia (AusPlay, 2022). We apply retail (1.77) and tourism (1.84) multipliers to account for the increase in intermediate inputs in the economy (indirect contribution) resulting from increased consumption of goods and services in other parts of the economy (Tourism Research Australia, 2023).

Our estimates are based on transactions that take place within established markets, which are closely aligned with the United Nations' System of Environmental-Economic Accounting (SEEA) stipulation for the use of exchange values (Pelletier et al., 2021). A limitation of our estimates is that they do not account for the full ecosystem service value, as other forms of value are excluded, such as consumer surplus and mental health (Buckley et al., 2019; Parsons, 2017). While expenditure is only a partial measure, it provides a useful indicator of the economic importance of surfing, in a way that makes it comparable to figures from previous Australian and international studies (Lazarow, 2009). Further, we do not estimate surf-derived environmental costs, such as those associated with the production of non-recyclable waste (wetsuits and surfboards) and carbon emissions from regular and holiday travel (Gibson & Warren, 2017; Manero & Mach, 2023).

3. Results

3.1. Characterization of survey respondents

Most survey participants were male (57%), although the proportion as lower compared to national statistics. A comparison of survey participants against Australian Sports Commission surfers data, and characteristics of the Australian general population are presented in Table 1. Characteristics of our survey respondents can be explored through the interactive Power Bi data portal available in the Appendix.

Most respondents rated as intermediate (40%) or competent (26%), while fewer considered themselves as beginners (11%) or advanced/pro (2%). The most frequently used surf craft were shortboards (53%), followed by longboard (33%). Surfing is a regular activity, practiced on average twice a week.

Table 1 Socio-demographic characteristics of respondents

		Sample	Australian surfers	Australian Population
Gender	Female	41.48	32.77	50.95
	Male	57.12	67.23	49.05
	Prefer another term or prefer not to say	1.4	-	-
Age group	18-24 years	5.10	10.76	8.34
	25-34 years	21.62	20.29	19.13
	35-44 years	32.33	25.15	18.10
	45-54 years	18.98	19.97	16.76
	55-64 years	14.59	13.65	15.50
	65+ years	7.38	10.18	22.17
Annual household before tax income (AUD/year)	Under $15,600	.70	4.24	3.65
	$15,600 - $25,999	3.16		7.68
	$26,000 - $41,999	4.39		9.84
	$42,000 - $64,999	7.38	6.26	12.79
	$65,000 - $90,999	15.82	10.62	12.65
	$91,000 - $129,999	16.17	12.99	16.70
	$130,000 - $181,999	18.10	13.16	13.42
	$182,000 and over	25.13	22.86	16.35
	I would rather not say	9.14	29.87	6.92
Highest level of education	Under Year 12	1.23	3.71	21.70
	Year/Grade 12 or equivalent	6.85	15.34	18.0
	TAFE qualification[a]	7.56	14.68	17.6
	Diploma or advanced Diploma	8.26	9.86	9.70
	Undergraduate or Bachelor's degree	31.99		19.6
	Graduate Diploma / Certificate	13.18	56.42	3.60
	Masters or Doctorate	28.30		8.10
	Other	1.93	-	-
	Prefer not to say	.70	-	-
Location by state and capital/regional	New South Wales Sydney	31.81	30.35	20.49
	New South Wales Regional	20.74	11.37	11.07
	Victoria Melbourne	6.68	14.35	19.45
	Victoria Regional	9.49	4.24	6.18
	Queensland Brisbane	12.13	18.92	9.82
	Queensland Regional	6.85	4.06	10.27
	South Australia Adelaide	1.23	2.63	5.55
	South Australia Regional	2.28	1.88	1.60
	Western Australia Perth	21.09	6.64	8.54
	Western Australia Regional	12.3	1.90	2.14
	Australian Capital Territory Canberra	2.64	0.66	1.76
	Tasmania Hobart	0.00	0.00	1.00
	Tasmania Regional	1.76	2.66	1.27
	Northern Territory Darwin	0.00	0.00	0.57
	Northern Territory Regional	0.00	0.33	0.36

Data sources: Australian surfers (AusPlay, 2023); Australian population Gender (Australian Bureau of Statistics, 2022c), Income (Australian Bureau of Statistics, 2022b), Education (Australian Bureau of Statistics, 2022a) (reported for population aged 15-74 years); Location (Australian Bureau of Statistics, 2022c); [a] In Australia, TAFE (Technical and Further Education) is a government-run education system providing vocational and skill-based training, post high school. Notes: 1. Ausplay data report all university degrees together. 2. Ausplay data used the six following income brackets (AUD), which do not correspond directly to the ABS and this survey: <40k; 40k-69k, 70k-99k, 100k-149, 150k-199k, 200k+. figures for these brackets are reported in order from lowest to highest. 3. Location for survey data is broken down by: Regional = MM area 2-7. City = MM area 1. 4. MM= Modified Monash categories.

3.2. Surf-driven contribution to Australia's market economy

Survey respondents reported spending, on average $8.30 on regular items such as food, drinks or parking, each time they visit their regular surf spots. Accounting for the reported surf frequency, the estimated annual expenditure per surfer per annum on regular items is $697.

Purchases of surf gear and surf-related services (e.g. repairs, coaching) averaged $1,575 – with new surfboards accounting for the largest proportion (40%). Most of these expenses occurred within the domestic economy, with 93% of respondents reporting spending 75%-100% of their surf-related expenses (gear and services) within Australia. Excluding second-hand boards and accounting only for domestic expenses, the average surfer spends $1,172 in Australia every year on gear and other surf-related purchases.

Table 2 Annual domestic surf-related expenditure across the whole sample (n=569) in A$

Category	Mean	Median	Std. dev	Min	Max
Regular items on visits to local surf breaks	697	195	1,266	0	8,450
Second-hand surfboards	193	0	500	0	6,000
New surf-related gear and services, excl. travel	1,381	890	1,840	0	21,100
New surf-related gear and services, excl. travel, spent in Australia	1,172	744	1,578	0	18,463

Over the 12 months prior to survey completion, 81% of respondents (n=461) took at least one domestic trip. Among those who travelled, the mean number of trips was 4.8, with an average of 7.22 nights away. The distance for domestic trips, calculated as a straight line between postcode and destitution, was 1,173 km on average, with a mean of 238 km. Twenty-tow respondents covered a distance greater than 12,400km. In their last trip, 84% of respondents were accompanied by at least one other adult, and 40% reported travelling with children. Total expenses for the last trip (including paid for by the respondent for others, but not incurred by others for the respondent) averaged $1,480, with accommodation ($616) and travel ($382) being the largest components. Annual expenses on domestic surf trips were calculated based on the number of annual trips, and the average expenses for the last trip (Bergstrom et al., 1990; Lovell et al., 2020). No information was available on the length of previous overnight domestic trips. Therefore, a minimum of one night was assumed, with a cost equal to the average overnight spend (mean=A$277). Among those who took at least one domestic trip, the average annual travel expenses were A$2,347. Including zero expenses for those who did not travel (n=108), the average travel expenditure across the whole sample (n=569) was A$1,901.

Table 3 Characteristics of domestic surf-related travel

Category	Mean	Median	Std.dev	Min	Max
Respondents taking at least one domestic trip (n=461)					
Last domestic trip expenses (A$)	1,480	900	1,856	0	13,700
Last domestic trip number of nights away	7.23	3	15.96	1	240
Last domestic trip expenses per night ($A/night)	277	210	233	0	1,633
Number of domestic trips per year	4.79	3	5.66	1	50
Yearly domestic trip expenses, excluding last trip ($A)	867	417	1,394	0	11,900
Total domestic travel yearly expenses ($A)	2,347	1,480	2,606	0	21,741
Whole sample (n=569)					
Total domestic travel yearly expenses ($A)	1,901	1,100	2,520	0	21,741

Across the whole sample, the average surf-related expenditure per annum, in Australia, is $A3,770. This includes regular items (A$697), new gear and services (A$1,172) and domestic travel (A$1,901). Aggregating across 678,800 adult (18+) surfing participants across Australia (AusPlay, 2023), the direct input into the market economy is estimated at A$2.56 billion per year. Accounting for indirect impacts through retail and tourism multipliers, the estimated input into the Australian economy from surf-drive expenditure is A$6,806 per person per annum, totalling $A4.62 billion across the adult surfing population.

3.3. Self-reported impact on wellbeing

Across all 11 measures of perceived surfing's impact, over 50% of respondents reported a positive change, i.e. "better" or "much better" (Figure 1). The highest proportion of positive impacts were reported for physical health (95%), mental health (99%), ability to deal with stress/difficulty (94%) and time spent outdoors (96%).

Survey responses also highlight the impact of surfing on 'participation and sense of belonging to a community' and "ability to maintaining and enjoy exiting relationships", with 80% and 82% of respondents, respectively, reporting "better" or "much better" outcomes.

Across age groups and gender there was very little variation across most forms of impact (see interactive data visualization in Appendix). A ten-point difference or more was observed in the sense of belonging to a community and ability to develop new relationships questions, where 88% of females reported positive impacts, compared to 74% and 78% respectively for males.

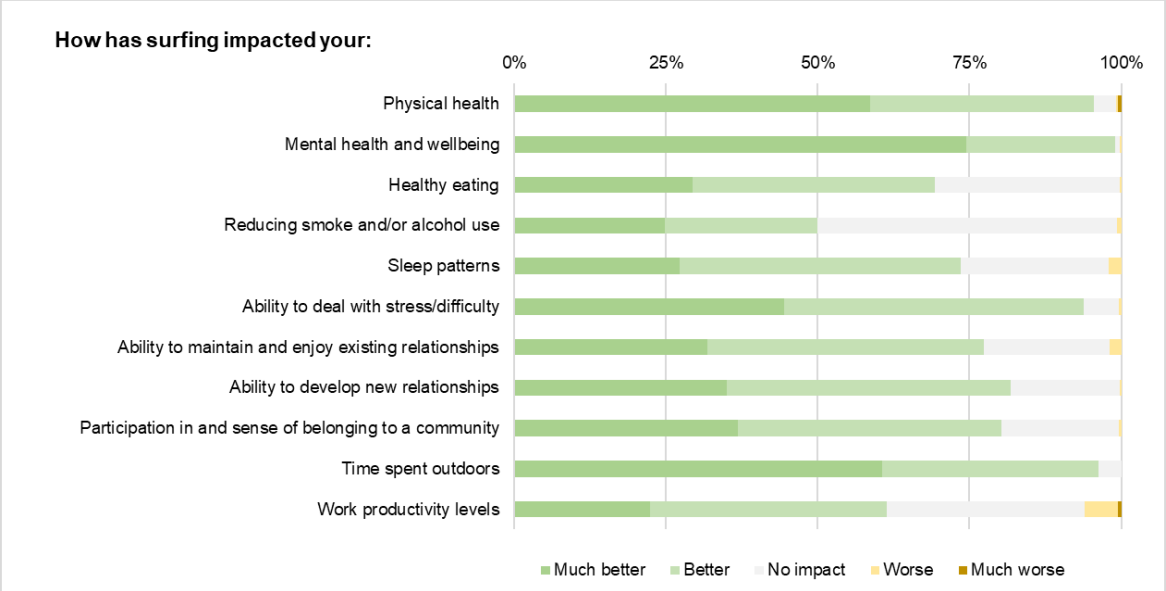

Figure 1 Self-reported impacts of surfing on participants lives

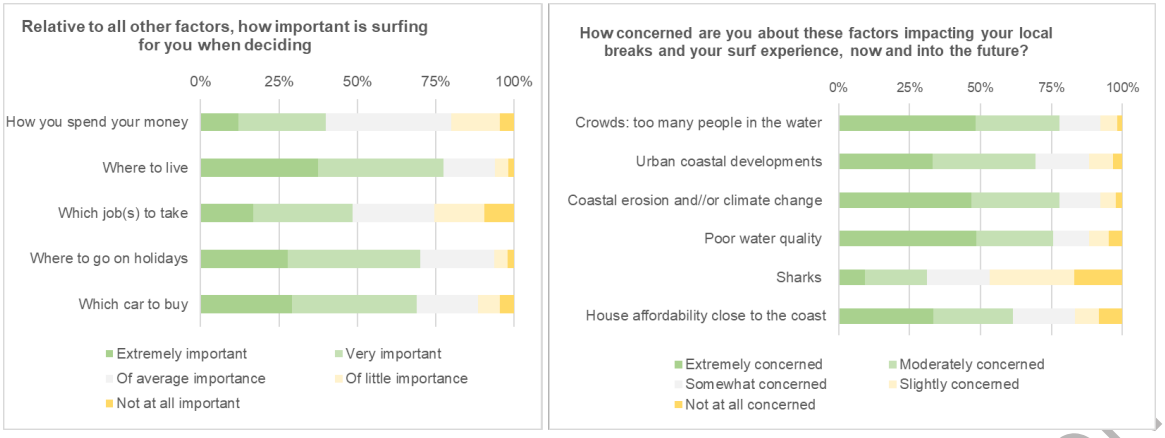

Figure 2. Importance of surfing in personal decisions (left) and concerns associated with surf sites (right)

Looking to the importance of surfing in lifestyle choices, it appears to have a clear impact on where individuals go on holiday, the car they buy and where they choose to live with 78%, 70% and 69% reporting surfing plays a 'extremely' or 'very important' role in these factors. As with questions on self-reported wellbeing discussed above there was very little meaningful variation across either age or gender.

When it comes to the factors surfers are concerned crowding at surf spots and climate change/coastal erosion with 77% and 78% reporting they are either extremely or moderately concerned about these issues in the future. Across all states only around a third of respondents reported being extremely or moderately concerned about sharks.

3.3.1. Comparison of well-being impacts from surfing and running

To understand how the perceived benefits of surfing stacked up against those in other sports we compared the results of the subjective impact questionnaire to a sample of runners. The data for runners came from a cohort of 60,000 UK individuals who had participated in *parkrun* (a weekly free 5km community race) at least once and were aged 16 years or older (Quirk et al. 2021). Similar to our study, participants were asked to rate how taking part in Parkrun has impacted various aspects of their life. Results were recorded on the same 5-point Likert scale used in this study.

A comparison between the surfing and running cohorts is presented in Table 2. Firstly, across all variables surfers reported that their sport had a greater perceived impact on their mental and physical wellbeing than runners. Secondly, the greatest difference between the two groups occurs in the questions asking about mental health and community connection.

One factor to note is that these interpretations are not meant to be casual but rather describe potential avenues for future research. Whilst the age and lower socio-economic characteristics were similar between the two groups, the female proportion in the *parkrun* sample (51%) was 10% higher than in our surfers' sample.

Table 4. Percentage of survey respondents reporting a "better" or "much better" result associated with their participation in surfing or park-run

Improvements from participating in surfing / park-run impacted your	% Surfers (n=569)	% *Parkrun* participants (n=60,000)
Physical health	95	85
Amount of time spent outdoors	96	74
Sense of belonging to a community	80	70
Mental health	99	69
Ability to develop new relationships	82	57
Overall lifestyle choices (diet, reduced smoking)	N/A	52
Healthy eating	69	N/A
Reduced smoking	50	N/A
Amount of time spent with friends and family	77	N/A
Time spent with friends	N/A	41
Time spent with family	N/A	28

4. Discussion

The study provides the first nation-wide analysis of recreational surfing in Australia, focusing on surf-driven contributions to the national economy and impacts on participants (self-reported) well-being and their lifestyle choices. The results fill a knowledge gap in our understanding of Australia's second most-practice water-based sport, which plays a defining role for the livelihoods, culture and lifestyles of hundreds of communities across the country.

The average annual surf-related expenditure per survey respondent is $3,770, including regular items, new gear, services, and domestic travel. Aggregating these results across the adult surfing population (AusPlay, 2023), the direct input into the market economy is estimated to be $2.56 billion per year. Accounting for retail and tourism multiplies, the overall impact of Australia's economy is estimated at A$4.62 billion per year. This figure comprises various components of surf-related expenditure, including regular items, new gear and services, and domestic travel. We note that negative environmental impacts also exist associated with purchases of new gear and surf-related travel, namely toxic pollutants and greenhouse gas emissions (Serong, 2017). As the understanding of surfing demands and impacts evolves, we suggest future studies of coastal tourisms include surfing in holistic life-cycle assessments (Herrero et al., 2022).

This study also provides the first Australia-wide insights into health and well-being benefits associated with recreational surfing. Whilst a growing body of literature documents the positive therapeutically benefits of surfing for participants with specific conditions (Britton et al., 2020; Caddick et al., 2015; Hignett et al., 2018), our analysis provides new information on the effects on the general surfing population. Following approaches validated in previous outdoor sport research (Quirk et al., 2021), we used a suite of self-reported measures of perceived impacts.

Our results point to the existence of positive impacts of surfing on several aspects of physical, mental and social well-being, with over 75% of survey responses reporting "better" or "much better" outcomes associated with the practice of the sport. Whilst these results are not a clinical diagnosis, they are based self-reported measures of perceived impacts applied in similar studies of sport impact. Our results are the first for the Australian surfing population, and are consistent with previous findings pointing to the benefits of outdoor exercise and interaction with "blue spaces" (Drake et al., 2021; Murrin et al., 2023; Quirk et al., 2021). We recommend that future research examines these relationships to quantitatively understand the influence of multiple factors on positive wellbeing outcomes.

Our results also suggest that surfing plays an important role on community connection, including ability to form new relationships and foster current ones. Surfing has long been a core part of Australian culture with boardriders clubs playing a key role social role in many coastal communities (Lazarow & Olive, 2017; Olive & Wheaton, 2021). Across the country there are currently 215 boardriders clubs, as well as numerous community and not-for-profit organizations such as Surfrider, Save the Waves and Surfing Mums. These findings provide new insights into the impacts of surfing, adding to a rich body of literature documenting the positive impact of sporting organisations on social capital and community wellbeing (Forsell et al., 2022; Nicholson & Hoye, 2008; Skinner et al., 2008).

It is important to note that recreational surfing also entails risk of injury and even death, which epidemiological studies have found are comparable to those of other outdoor and water-based activities (Lawes et al., 2023; Nathanson et al., 2002; Pikora et al., 2012). We also note the heightened risk of sun-induced skin damage due to increased time spent outdoors, which is a common concern among avid participants of water-based sports (De Castro-Maqueda et al., 2021).

This study also explored the relative importance of surfing in personal decisions. Our results indicate that for 78% of respondents surfing is a "very or extremely important" factor when deciding where to live. The fact that participants of nature-based sports aspire to live close to the natural features that enable those activities is consistent with utility theory and has been previously reported (Orlowski & Wicker, 2019). In this study, we provide the first set of data documenting surfers' preferences, which we recommend are further investigated through more elaborate analysis, including hedonic pricing. To the authors' knowledge, globally, only one study has quantified the impact of proximity to surf breaks on house prices (Scorse & Hodges, 2017), leaving an important knowledge gap in Australia.

In terms of concerns, respondents over 75% of respondents were "extremely or moderately" concerned about crowding at surf spots and climate change/coastal erosion. These perceptions mirror growing hazards from erosion and changes to the shoreline, which have been systematically documented across Australian beaches (Toimil et al., 2023). Despite media and popular attention towards the risks of shark interactions (Boyle & Le Busque, 2022), only 27% of our survey respondents reported high levels of concern.

The ability to extrapolate findings from our study is limited by the non-probabilistic sampling approach. Nonetheless, we expect the publications of these first national results on the impact

388 of surfing will pave the wave for future research projects aimed at filling the current
389 knowledge gap in water-based recreational activities in Australia

390 **5. Conclusions**

391 As coastal resources come under pressure from climate change, coastal erosion and
392 competing uses, there is an increasing need for evidence to help guide the sustainable
393 management of these resources. Recreational surfing is one of Australia's most popular
394 water-based sports, but its socio-economic impacts are much less understood than those of
395 other ocean activities, such as fishing and scuba diving. Using a snowball sample of 569
396 Australian surfers, we estimate average annual expenditure at $A3,370 per person, with
397 approximately 56% of that being spent on domestic tourism. Aggregating across the
398 Australian surfing population, direct market input is $A2.56 billion per year, while the overall
399 impact is estimated at $A4.62, once accounting for tourism and retail multipliers. Our results
400 also provide the first assessments of surfing's impact on the general participating population,
401 complementing previous studies on surf therapy under clinical settings. Over 94% of survey
402 participants reported positive impacts of surfing on their physical health, mental health and
403 ability to deal with stress; whilst over 75% experienced improvements in their sense of
404 community belonging and ability for form and foster social relationships. As the first
405 Australia-wide survey on the impact of surfing, this study calls for future research to further
406 advance the understanding of benefits, but also negative impacts, associated with recreational
407 surfing.

408

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Ana Manero: Conceptualization, Methodology, Formal analysis, Investigation, Data Curation, Writing - Original Draft, Writing - Review & Editing, Supervision, Project administration, Funding acquisition; **Asad Yusoff:** Conceptualization, Software, Formal analysis, Investigation, Writing - Original Draft, Writing - Review & Editing, Visualization. **Mark Lane**: Conceptualization, Methodology, Funding acquisition. **Katja Verreydt**: Conceptualization, Methodology, Funding acquisition.

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