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Institute for Marine and Antarctic Studies

# A survey of recreational fishers focusing on perceptions of stock status and management of Sand Flathead in Tasmania



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This study has been approved by the University of Tasmania Human Research Ethics Committee (HREC) (Project ID: [H0029142](#)).

Cover illustration of Sand Flathead by Peter Gouldthorpe.

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## 1 Executive Summary

Recreational fishers are a diverse and complex group with a wide range of species targeted, gear used, experiences sought, and benefits received. Such diversity provides challenges to researchers and fisheries managers when seeking to better understand fishers and manage fisheries. This includes efforts to understand fishers with a view to managing fisheries through rules and other initiatives that not only provide sufficient stock protection but are also broadly endorsed and valued by the fishing community.

In Tasmania, Sand Flathead (*Platycephalus bassensis*) account for 68% of the total recreational catch by number and are caught by 70% of the 106,000 Tasmanians who fish each year. The prominence of the fishery underscores the need to recognise, understand and attend to the diverse needs and expectations of flathead fishers particularly considering a 2022 assessment of the fishery as 'depleted' and subsequent efforts to develop a management response. With a longer-term goal of returning the fishery to a 'sustainable' status, a high degree of 'buy-in' from fishers and other stakeholders is necessary to maximise community understanding and endorsement of measures necessary to restore the fishery.

In late 2022, the Department of Natural Resources and the Environment Tasmania (NRE Tas) commissioned IMAS to undertake a survey of Tasmanian Sand Flathead fishers. The research aims to better understand values, motivations, and comprehension of the stock health and management requirements of Sand Flathead in Tasmania to:

- Assess the acceptability of management settings that may be required to reduce fishing mortality to a point that allows for biomass recovery; and
- Inform the development, promotion, and targeting of engagement and outreach activities across the diversity of the recreational sector to improve the acceptability of management measures required to allow Sand Flathead stocks to recover.

Respondents were surveyed through two means: 1) by telephone interview as an additional component to the 2022/23 Tasmanian state-wide recreational fishing survey – commenced 15 February 2023; and 2) a self-administered online survey using the Survey Monkey platform – commenced 15 March 2023. A combined total of 1,453 valid surveys were completed by the closing of the survey on the 15 April 2023.

This report covers four key research outputs:

1. A comprehensive response from Tasmanian recreational flathead fishers.
2. A typology of fisher-groups based on personal values and fishing motivations and preferences.
3. Understanding of recreational fishers on current stock status and drivers of decline and the relationship of these factors, as well as those identified in outputs 1 and 2, to adoption propensity for potential management settings and fishing stewardship practices.
4. Species preferences based on both experiential and consumption-oriented values to assess candidate species for fishing effort substitution.

While the analyses presented in this report focus on flathead fishing activities (particularly Sand Flathead), flathead fishing often intersects with and/or complements other fishing activities.

This was considered during survey design and is reflected in the profiles of recreational flathead fishers presented in this report.

### Who responded to this survey?

While the survey was completed by people across a broad demographic spectrum, most respondents were:

- Males aged from 45 to 74.
- Experienced fishers (79% reported having over 20 years' experience fishing for flathead in Tasmania).
- Highly educated: (63% had completed schooling through to at least Grade 12 and around one third had completed some form of higher education).
- Highly avid fishers.

The high degree of avidity and flathead fishing experience suggests a high level of respondent investment in the Tasmanian flathead fishery. A long and deep involvement in recreational fishing also suggests a capacity to provide a considered assessment of the current state of the Sand Flathead fishery. Other results indicating a high level of investment by respondents include 83% reporting a high degree of importance of fishing compared with other recreational activities and 77% reporting high importance of fishing for Sand Flathead compared with other target species.

Almost 90% of respondents indicated fishing from a boat as the main or only way they target flathead. Therefore, the views of shore-based fishers may be underrepresented in this study.

### A comprehensive profile of Tasmanian recreational flathead fishers

Four types of psychographic profiling were applied to portray the diversity of motivations and values of respondents. In each case, diversity was represented by identifying discrete fisher groups or segments.

Firstly, an exploration of "eudemonic" values: biospheric (for environment), altruistic (for others), and egoistic (for self), in a fishing context identified four distinct profile groups.

- The *Easy-going Profile* had a similar biospheric value to the overall respondent medoid (most common response profile of all respondents) but a lower alignment with altruistic and egoistic values. Females and less avid fishers were more likely to be in this profile.
- The *Balanced Profile* had similar values for all attributes to the overall respondent medoid but a stronger alignment with biospheric values compared to the *Easy-going* profile, although less so than the *Influencer* and *Collaborator* profiles.
- The *Influencer Profile* had a higher agreement with all three eudemonic components compared to the overall respondent medoid, and a stronger alignment with biospheric and altruistic values compared to the *Easy-going* and *Balanced* profiles. This profile also had a significantly higher egoistic alignment than all other profiles. Males and more avid fishers were more highly represented.
- The *Collaborator Profile* had a stronger alignment with biospheric and altruistic values compared to the overall respondent medoid and a lower alignment with egoistic values compared to the *Influencer* and *Balanced* profiles. Females and less avid fishers were more likely to be in this or the *Easy-Going Profile* than the *Influencer* profile.

Secondly, the following profiles were determined based on fisher catch and non-catch related motivations.

- *Casual Anglers* were motivated by family and friends, as well as catching and sharing fish for food, and less motivated by nature and fishing alone. They tended to be older, less avid, and fished less for Sand Flathead compared to other groups.
- *Sport Anglers* were highly motivated by both catch and non-catch factors. They were particularly driven by the enjoyment of fishing for sport, capturing fish for food, and fishing for 'trophy fish'. They tended to be younger and more avid, with a strong motivation to compete in fishing competitions.
- *Leisure Anglers* had a similar profile to the overall respondent medoid, but higher motivation to fish for relaxation, and were the second-most motivated to get away from others to fish. They tended to be older and less avid than Sport Anglers but more avid than Casual Anglers.
- *Community Anglers* were motivated by spending time with family and friends, relaxation, and catching and sharing fish but were the least motivated profile to fish for isolation. They tended to be older, more avid, and fished more for Sand Flathead compared to Casual Anglers.
- *Independent Anglers* were less motivated by spending time with family and friends or in nature, and more motivated by catching fish for food. They were the least motivated to catch fish for sharing and were less avid and older compared to Sport Anglers.

Third, respondents were assigned across six profile groups (*Inshore Fishers, Generalists, Inshore and Freshwater Fishers, Marine Line Fishers, Marine Generalists* and *Inshore Fishers and Divers*) based on fishing modality (a combination of gear-type, location, fishing platform, and targeted species) and fishing motivations. The most prominent group was *Inshore Fishers*, capturing almost one third of respondents. This group was characterised by a preference for inshore line fishing with high value placed on food collection and the social aspects of fishing. A proportion of the *Inshore Fishers* group were also lobster pot fishers.

The other groups were approximately equal in size, each capturing around 15% of respondents:

- *Inshore and Freshwater Fishers* had a similar profile to the *Inshore Fishers* but also fished in freshwater.
- *Inshore Fishers and Divers* were also like *Inshore Fishers* but engaged in dive collection, with a focus on food harvesting and experiential and social values.
- *Marine Line Fishers* enjoyed all types of line fishing with a focus on catching fish to eat, personal experience and the social aspect of fishing.
- *Marine Generalists* were characterised by participating in all marine fishing activities to collect food, enjoy the personal experience and the social aspects, and catching trophies.
- *Generalists* are similar to *Marine Generalists* but also participated in freshwater fishing with a weak focus on catching freshwater fish to eat.

Finally, a harvest versus recreation/experience preference profile specific to Sand Flathead fishing was defined. *Harvest-oriented* respondents prioritised fishing trips where a substantial quantity of fish are caught and expressed a strong desire to retain and consume the fish they catch. In contrast, *Recreation-oriented* respondents place a higher value on non-consumptive

dimensions of the fishing experience. Compared with Harvest-oriented fishers, this group had less flathead fishing experience, were less avid and more likely to fish from the shore.

### Views on the health of the Sand Flathead fishery

Overall, nearly two in three respondents thought the Sand Flathead stock is in a poor condition, including 27% who thought it to be very poor. Respondents were more likely to have a negative perception of the health of the stock if they were less avid, more highly educated and had a greater fishery literacy (demonstrated by perceptions on the proportional impact of the commercial and recreational sectors on Sand Flathead stocks). Psychographic profiles including *Inshore Fishers and Divers*, and respondents in the *Casual Anglers* and *Leisure Anglers* motivation profiles as well as *Recreation-* relative to *Harvest-oriented* Sand Flathead fishers were also significantly more likely to consider the stock to be in a poorer condition.

Perceptions of Sand Flathead stock health also differed by the region most often fished by respondents. While most respondents reported poor stock conditions in all regions, north coast (apart from the Tamar River) fishers had the most favourable assessment followed by those fishing the east coast. The least-favourable assessments were from respondents who fish the southeast.

These region-based perceptions align well with regional comparisons of stock status in the IMAS fishery independent Sand Flathead surveys and stock assessment report.

Fifty-one percent and 62% of respondents were not satisfied with the number and size of Sand Flathead caught respectively. Female fishers, less-avid fishers, and shore-based fishers were significantly less satisfied with the number of fish caught.

For the size of fish caught, respondents more likely to be unsatisfied were less avid and more highly educated fishers. Psychographic profiles including *Inshore line fishers* relative to *Marine Line Fishers*, and *Leisure anglers* and *Independent anglers* relative to *Community anglers* were also significantly less likely to be satisfied with the size of Sand Flathead they caught. Recreation-orientated respondents were also significantly less likely to be satisfied with the fish that they caught than Harvest-orientated respondents.

There was a significant correlation between satisfaction with the fishery and their perceptions of the state of the stock, both overall and within all regions fished—those that fished in areas where the stocks were perceived as worse were less satisfied about both fish numbers and sizes caught.

These results indicate that stock rebuilding would likely increase fisher satisfaction in all areas and localised management should be considered to maximise satisfaction.

### What did respondents value about Sand Flathead and how would change impact them?

Almost all respondents highly valued Sand Flathead to eat. There was also a strong value placed on the experience of fishing even if no Sand Flathead are caught on a trip, supported by broad agreement with statements around taking just enough fish for a feed rather than the bag limit and a preference to catch fewer but bigger fish.

Thirty percent of respondents indicated that they would not go fishing if they could not catch as many flathead. Importantly, the impact of not being able to catch Sand Flathead due to a

depleted stock was reported as a significantly greater personal 'impact' than not being able to catch Sand Flathead due to management changes to recover the stock.

Respondents who reported being less impacted by management interventions to recover the stock were those who were less avid, less experienced, better informed about the health of the Sand Flathead stock, highly educated, and primarily fished from the shore.

Approximately half of the respondents agreed that a further depletion to the Sand Flathead stock would have a medium to high impact on the overall fishing experience for all Tasmanians, the ecosystem where they fish, and their personal fishing experience. One in four thought it would have an impact on the overall Tasmanian economy. One in five thought it would impact their mental health and less than one in ten thought it would impact their personal financial well-being.

### What did respondents think was causing the depletion of the Sand Flathead stocks in Tasmania?

Overwhelmingly respondents thought that commercial fishing was the having the greatest impact on Sand Flathead stocks, significantly more than recreational fishing, which was ranked second. A smaller proportion of respondents thought that marine farming was having a major impact, followed by environmental factors and climate change.

Reliable and publicly accessible data indicates that recreational fishing is the overwhelming driver of population decline. This discrepancy between fisher views and critical fishery information suggests a need to continue and enhance community awareness efforts, particularly as management changes are required to rebuild the fishery. A significant correlation between fishery awareness and acceptance of remedial management changes also supports this assertion.

### What did respondents think about the management and compliance around regulations for Sand Flathead in Tasmania?

Most respondents agreed that swift and appropriate management is required for a sustainably managed fishery. There was also strong support for increased compliance checks by police to enforce recreational fishing rules. However, three in four respondents agreed that most recreational fishers comply with fishing rules. Over two-thirds agreed that fisheries data should be collected by government or an affiliated agency, but just under half also agreed that data should be collected by an independent recreational fishing organisation.

Nearly two-thirds of respondents thought the bag limit of 20 per day per person was too high. Respondents more likely to express this view were younger, less avid, more highly educated, well-informed about the health of the Sand Flathead fishery, shore-based fishers and characterised as *Inshore Fishers & Divers*.

There was also a regional trend where respondents who fished in areas where the stock is perceived to be in worse condition were more likely to perceive the bag limit as too high.

Two-thirds of respondents thought that the minimum size limit for Sand Flathead of 32 cm was about right, with most of the remainder indicating that it was too small. Less experienced fishers and those with greater awareness of the state of the stock were more likely to express this view. Conversely, fishers who predominantly fished areas with fewer larger Sand Flathead

as determined by IMAS fishery independent sampling – Frederick Henry / Norfolk Bays, Tamar River, southeast coast, D’Entrecasteaux Channel, and the Tasman Peninsula – were more likely to think that the size limit was too big, presumably as it reduces their ability to harvest fish.

A reduction in the daily bag limit, followed by ‘closing the fishery’ were the most-suggested management responses to curb declining stocks in free-text responses; the least cited measure was enhancement through restocking. There was, however, a strong divergence of views on how to manage the Sand Flathead fishery. This likely relates to a lack of awareness around the state of the stock, the main drivers of stock decline and the impacts of current and required management measures, and distrust in management including a perception that fishing rules will not be relaxed when the fishery improves.

In summary, this study revealed a consensus that the stock is in poor condition, especially in the southeast. Respondents expressed dissatisfaction with both the number and size of Sand Flathead. There was a notable misconception about the primary driver of depletion, with respondents attributing it more to commercial fishing than recreational fishing, impacting perceptions of necessary management interventions. Demographic factors such as age, gender, fishing frequency, experience, and literacy influenced respondents' conservative views on stock health and support for management measures. Inshore and freshwater fishers tended to be more conservative, while community anglers were less so. Reduced access to Sand Flathead from stock depletion was a concern for all, with varied opinions on management interventions. Psychographic factors, particularly fishing orientation, played a significant role, with recreation-oriented fishers being more conservative. Surprisingly, those fishing less were more accepting of restrictive measures, challenging the assumption that they would be disproportionately affected by catch limits. Financial investment and equipment requirements were suggested as potential factors influencing attitudes toward fishery management.

### Species preference and the potential for substitution for Sand Flathead?

Among a list of recreational fishing key target species, Sand Flathead was overwhelmingly ranked highest to catch as well as eat. This was somewhat expected as the survey was focused on Sand Flathead but is consistent with the long-standing status of the species as the most targeted, caught and consumed recreational fishing species in Tasmania.

When considering species rankings to identify potential substitute species, Tiger Flathead were rated highly, but would be limited to fishers with access to a boat. Southern Calamari and Striped Trumpeter were also ranked highly for both catching and eating. However, they are assessed as depleting and depleted, respectively, and are therefore poor candidates for effort substitution.

Other species that ranked highly for catching and/or food were the range extending species Yellowtail Kingfish, King George Whiting, and Snapper. These species can be targeted in sheltered waters by boat fishers (and to some extent shore-based fishers), are good ‘fighting fish’ and highly regarded as table fish. However, their current potential value as substitute species is limited by their regional availability, particularly in southern and eastern waters. While seasonal influences on distribution and abundance are likely to decrease in coming years with predicted increases in water temperature, it would be prudent to manage these species conservatively until their emergence in Tasmanian waters is more fully understood. This is especially true of King George Whiting and Snapper which are now known to breed in

Tasmanian waters (rather than being seasonal vagrants) and are also known to be vulnerable to overfishing.

Other species caught regularly by recreational fishers but ranked lower for either catching or eating were Australian Salmon, Ocean Perch, and Gurnard. Australian Salmon are good fighting fish, often found in high abundance, currently assessed as 'sustainable' and are a popular target on mainland Australia, particularly for shore-based fishers. These qualities may make them a good candidate for teaching children or new fishers how to fish. Ocean perch and gurnard are caught regularly by recreational fishers and while not valued highly for the experience of catching, have good quality flesh. A key concern, particularly if they are promoted as a substitute species, are their venomous spines and perceived difficulty to clean and fillet. With education on handling and preparing however, these concerns may be addressed.

#### Willingness to voluntarily adjust fishing behaviour to reduce impacts on Sand Flathead?

Most respondents agreed that voluntarily undertaking responsible fishing behaviours could be an effective complementary means of further reducing fishing pressure on Sand Flathead. Stewardship programs have been implemented in other fisheries with some degree of success. Most respondents also expressed a willingness to educate family, friends, and other fishers on recreational fishing rules. This suggests potential for social sanctioning and peer-to-peer education, which is typically a key objective of stewardship programs.

There are several ways to improve fish handling practices when releasing fish, to minimise damage and maximise survival. These include reducing direct contact with fish such as using a 'de-hooker'. Almost three-quarters of respondents indicated using them (particularly experienced fishers and boat-based fishers), but there is room to improve this through awareness initiatives that target less experienced and land-based fishers.

Circle hooks are known to reduce the occurrence of deep hooking, which has been shown to significantly increase damage and reduce survival rates of released fish. A minority of fishers reported using them when bait fishing for Sand Flathead, suggesting significant room for increasing awareness of their use.

Management measures to reduce fishing effort below the threshold at which the Sand Flathead stock can recover will result in a greater number of fish being released. Improving fish handling practices, including using circle hooks for bait fishing and minimising handling using de-hookers, will reduce unintended mortality of released fish, providing a secondary measure to ensure that fishing mortality remains below the recovery threshold.

## Contents

<b>1</b>	<b>Executive Summary</b> .....	<b>2</b>
	<b>Figures</b> .....	<b>11</b>
	<b>Tables</b> .....	<b>19</b>
<b>2</b>	<b>Introduction</b> .....	<b>20</b>
<b>3</b>	<b>Methods</b> .....	<b>23</b>
3.1	Survey Response .....	23
3.2	Understanding recreational Sand Flathead fishers through segmentation analysis	24
3.2.1	Demographic segmentation .....	24
3.2.2	Behavioural (fishing) segmentation .....	24
3.2.3	Geographic segmentation .....	25
3.2.4	Psychographic segmentation .....	26
3.3	Fishery literacy .....	27
3.4	Analysis .....	28
3.4.1	Comparisons of question responses between subgroups .....	28
3.4.2	Profile clustering .....	29
3.4.3	Sentiment quotes .....	30
3.4.4	Qualitative analysis of survey responses .....	30
<b>4</b>	<b>Results &amp; Discussion</b> .....	<b>31</b>
4.1	Who responded to the survey? .....	31
4.1.1	Demographic segmentation .....	31
4.1.2	Fishery literacy .....	32
4.1.3	Behavioural (fishing) segmentation .....	34
4.1.4	Centrality of recreational fishing .....	35
4.1.5	Psychographic segmentation .....	39
4.2	Flathead fishery dynamics .....	60
4.2.1	Flathead species catch composition .....	60
4.2.2	Regions fished for Sand Flathead .....	60
4.3	What did respondents say about Sand Flathead? .....	62
4.3.1	Perceptions on the status of Sand Flathead in Tasmania .....	62
4.3.2	Satisfaction with the Sand Flathead fishery .....	64
4.3.3	Perceptions on causality of Sand Flathead stock depletion .....	66
4.3.4	Perceptions on a further depleted stock on fishing in Tasmania .....	69
4.3.5	Personal impact from reduced ability to catch Sand Flathead .....	71
4.4	Perceptions on current management controls for recreationally caught Sand Flathead	73
4.4.2	Perceptions on possible management changes .....	76

## SURVEY OF RECREATIONAL FISHERS IN TASMANIA WITH A FOCUS ON SAND FLATHEAD

4.4.3	Respondent opinions on required actions by management .....	80
4.4.4	Summary of perspectives on stock health and management .....	81
4.5	Perceptions on compliance and policing .....	84
4.5.1	Perceptions on data collection for fisheries management .....	85
4.6	Perceptions on stewardship, voluntary actions, and good fishing practices .....	85
4.6.1	Gear to minimise damage and fish handling practices while flathead fishing .....	86
4.7	Species preferences and substitution potential .....	89
4.7.1	Southern Calamari .....	91
4.7.2	Tiger Flathead .....	91
4.7.3	Eastern Australian Salmon .....	91
4.7.4	Yellowtail Kingfish .....	91
4.7.5	Striped trumpeter .....	92
4.7.6	Southern Bluefin Tuna .....	92
4.7.7	King George Whiting .....	93
4.7.8	Scorpaeniformes .....	93
4.7.9	Snapper .....	94
4.7.10	Freshwater species .....	94
4.7.11	Mackerel .....	95
4.7.12	Black Bream .....	95
4.7.13	Blue Eye Trevalla .....	96
4.7.14	Mullet .....	96
4.7.15	Other species .....	96
4.8	Social media use .....	98
5	References .....	99
	Appendix 1 – Survey question factor analysis plots .....	103
	Appendix 2 – Survey instrument .....	149
	Appendix 3 – Stock status relative to satisfaction regional correlation table .....	180
	Appendix 4 – Cluster diagnostic plots .....	181
	Appendix 5 – Other feedback on the sand flathead fishery or fisheries management .....	185

## Figures

Figure 1. Tasmanian regions presented in the survey as options to select for 'main region fished for flathead'.....	25
Figure 2. Gender and age group profile of survey respondents (n = 1,402, with 6 reporting 'other' for gender). Vertical axis numbers represent age groups. ....	31
Figure 3. Gender and age group of survey respondents comparing between the 2017/18 statewide survey (Lyle et al. 2019) and the flathead focus survey. Vertical axis numbers represent age groups. ....	32
Figure 4. Education profile of survey respondents (n = 1,407, one respondent reported as 'Unsure').....	32
Figure 5. Quartile ranking of fishery literacy relating to the Sand Flathead fishery in Tasmania (n = 1,091, 340 respondents reported as 'Unsure'). ....	33
Figure 6. Percentage of responses indicating the confidence of respondents to identify a Sand Flathead vs a Tiger Flathead (n = 1,453, 4 reported a response of 'unsure' and 5 responded "I didn't know there were different species"). ....	34
Figure 7. The number of days fishing by survey respondents comparing between the 2017/18 statewide survey (Lyle et al. 2019) and the flathead focus survey (n = 1,533, four respondents reported as 'Unsure'). Vertical axis numbers represent the number of days fished as groupings, i.e., 1–4 days fished in the 12-month preceding the survey. The legend colours represent the age groups within each avidity grouping. ....	34
Figure 8. Experience flathead fishing profiles for survey respondents shown as proportional distribution across five sample bins (n = 1,445). ....	35
Figure 9. The number of days fishing for flathead by survey respondents shown as proportional distribution across five sample bins (n = 1,437). ....	35
Figure 10. The centrality of fishing to the lifestyle of respondents compared to their other hobbies, activities, or sports (n = 1,321). ....	36
Figure 11. Respondent answer to a question relating to the centrality of Sand Flathead to their recreational fishing experience (n = 1,390). ....	36
Figure 12. How important are Sand Flathead to the overall fishing experience of respondents by the main region they fish for Sand Flathead. ....	37
Figure 13. Respondent answers to questions relating to whether they would go fishing less if they couldn't catch Sand Flathead (n = 1,390). ....	37
Figure 14. Respondent thoughts on whether they would go fishing less if they couldn't catch Sand Flathead.....	38
Figure 15. Platform respondents' fish for flathead from profiles (n = 1,436). ....	38
Figure 16. Response profiles to proposition statements to elicit a respondent profile related to bio-spheric, altruistic and egoistic values. ....	39
Figure 17. Profiles of the four eudemonic groups identified through cluster analysis of responses to Q99 – 108 (Appendix 2), characterised by the most-representative respondent (or 'medoid'; green line). The black dotted line indicates the medoid of all respondents when not partitioned into groups. These questions ask respondents to rate the degree to which they find personal alignment with different human values (three in each of three eudemonic categories, in italics). A random selection of 50 respondents in each group are depicted by shaded polygons to illustrate intra-group variation.....	40
Figure 18. Responses to questions regarding eudemonic values (n = 1,214), stratified by the Eudemonic profiles identified through cluster analysis of the response data (y axis; A: 'Easy-going'; B: 'Balanced'; C: 'Influencer'; D: 'Collaborator' on each panel correspond to the labels in Figure 17). ....	42

Figure 19. Comparison of demographic and recreational fishing profiles of eudemonic clusters. Groups that share a letter were not statistically significantly different.....43

Figure 20. Respondent answer profile to a range of questions on what motivates them to go recreational fishing. ....44

Figure 21. Five fishing motivation profiles identified through cluster analysis of responses to Q96, represented by medoid (most representative respondent; green line) of each. The radial axis represents the level of importance placed on each motivation (italicised labels; note that “Not very” and “None” correspond to responses “Not all that important” and “Not at all important”). The black dotted line indicates the medoid of all respondents (i.e., when not partitioned into clusters) for comparison. Fifty randomly selected respondents in each profile group are depicted by the faint shaded polygons to illustrate variation in each cluster.....45

Figure 22. Responses to Q96 sub questions (Importance of motivating reasons to go fishing; n = 1,263), by Fishing Motivation profiles identified through cluster analysis of the response data (y axis; Profiles A-E on each panel correspond to the Profile labels in Figure 21.....46

Figure 23. Demographic and recreational fishing question responses stratified by Fishing motivation profiles. Groups that do not share letters are significantly different. ....48

Figure 24. Respondents’ attitudes to a range of questions relating to recreationally fishing for Sand Flathead.....50

Figure 25. Two Sand Flathead fishing orientation profiles identified through cluster analysis of responses to Q98, represented by medoid (most representative respondent) of each. The radial axis indicates respondent agreement with each orientation statement. ....51

Figure 26. Responses to Q98 sub questions (n = 1,247), by Sand Flathead fishing orientation profiles identified through cluster analysis of the response data. ....52

Figure 27. Demographic and recreational fishing question responses stratified by Sand Flathead fishing orientation profiles. Groups that do not share letters are significantly different. ....53

Figure 28. Responses to different types of recreational fishing activities (modes) and reasons for doing them (motivation orientations) scored by how important each combination type is to the respondent from one being not at all important to 10 being very important. Grey bars indicate the percentage of respondents that reported they did not do the activity. ....55

Figure 29. Fisher modality and motivation profiles identified through clustering respondents by responses to Q72–Q95. Green points on each ‘radar’ plot indicate the responses of the representative respondent (the ‘medoid’) of each profile, and for comparison, the black points indicate the responses of the medoid of all respondents (when not clustered into different profiles). The faint filled polygons are the response profiles of fifty random respondents classified in each profile. Responses are grouped by modality, for example within ‘Gamefishing’ are responses to Q72–Q75 regarding each motivation pertaining to this modality: Food = “...for tuna, billfish or pelagic shark for food”; Exp = “...for personal enjoyment of the activity”; Social = “...to share catch or the experience with others”; and Trophy = “...for a ‘trophy’ or memento”. ....56

Figure 30. Responses to the recreational fishing modality questions Q72–Q95, by fisher profile cluster (rows). Each of these questions asked the importance of a unique combination of fishing method and reason for participation, which are stratified on the y and x axes, respectively. The black numbers on bars indicate the median response including respondents that reported not participating in the activity (treating “Don’t do it” as 0 importance), and grey values indicate the median only among respondents that did report participating in the activity. ....57

Figure 31. Comparison demographic and recreational fishing-related question responses across fishing modality/motivation profile groups identified through cluster analysis. ....59

Figure 32. A: Catch composition of the flathead species caught in Tasmania, by individual respondent. Each vertical bar represents the proportional flathead catch of respondents (n =

1,439). B: Breakdown of “Other” flathead species caught. Percentages in the x axis labels indicate the proportion of respondents that reported catching each species. ....60

Figure 33. The proportional frequency of respondents based on the regions where they primarily fish for Sand Flathead. ....61

Figure 34. The opinion of survey respondents on the condition of the Sand Flathead stock in Tasmania (n = 1,453, 20 respondents provided a response of ‘unsure’). ....62

Figure 35. The opinion of survey respondents on the condition of the Sand Flathead stock in Tasmania based on where they spend most of their time fishing (n = 1,453, 20 respondents provided a response of ‘unsure’). ....63

Figure 36. The satisfaction level of respondents based on the number of Sand Flathead caught (n = 1,429, 6 respondents provided a response of ‘unsure’). ....64

Figure 37. Fisher satisfaction based on the number of Sand Flathead caught based on where they spend most of their time fishing for Sand Flathead. ....65

Figure 38. Fisher satisfaction based on the size of Sand Flathead caught (n = 1,430, 7 respondents provided a response of ‘unsure’). ....65

Figure 39. Respondent satisfaction with the size of Sand Flathead where they spend most of their time fishing. ....66

Figure 40. Respondent perceptions on the impact of various factors that might be impacting the Sand Flathead stocks in Tasmania. ....67

Figure 41. Respondent perspective on the drivers of depletion of Sand Flathead stocks based on where they spend most of their time fishing. ....69

Figure 42. Respondent perceptions on the impacts to them on reduced access to Sand Flathead for reasons relating to depletion of the stock or management interventions that may reduce the number of fish that could be harvested with the intention of rebuilding stocks. ....70

Figure 43. Respondent perceptions on the impacts to them on reduced access to Sand Flathead for reasons relating to depletion of the stock or management interventions that may reduce the number of fish that could be harvested with the intention of rebuilding stocks. ....71

Figure 44. Response profile to Q113f "Please respond whether you agree or disagree to the following question “Swift and appropriate management to ensure a fishery is managed sustainably is important for recreational fishers.” .....73

Figure 45. Respondents’ perceptions on the bag limit of 20 fish per person per day at the time of the survey (n=1,443, with a further four responding they were ‘UNSURE’). ....74

Figure 46. Perceptions on the appropriateness of the Sand Flathead bag limit at the time of the survey based on the region most commonly fished. ....75

Figure 47. Perceptions on the appropriateness of the minimum size limit of Sand Flathead at the time of the survey which was 32 cm (n=1,447, with a further 24 responding they were ‘UNSURE’). ....75

Figure 48. Perceptions on the appropriateness of the size limit of Sand Flathead at the time of the survey based on region most commonly fished. ....76

Figure 49. Respondent support scores (from 1 to 10) for seven hypothetical management scenarios. Minimum legal-size limits were 32 cm if not indicated. ....77

Figure 50. Estimated marginal mean effects of each management measure (x axis) on support for hypothetical management scenarios (with all other measures held constant at their average) generated from a proportional odds model of responses to Q26–Q31. The model was fit with a random effect for individual respondent. Points indicate the mean response across the predicted responses (treating ordinal Support response levels as numeric) and translucent bands indicate confidence intervals. P values indicate significance of the effects of each measure. Model Nagelkerke pseudo-R<sup>2</sup> = 0.24. ....79

Figure 51. Frequency of respondents’ perspectives on the most effective measures for rebuilding flathead stocks (responses to Question 32 “What do you think would be the best way to help rebuild the sand flathead fishery...”) based on coding structure presented in Table 2. There were 1,222 responses (excluding “no opinion”, “na”, etc.) to Question 32. ....81

Figure 52. Matrix plot visually significant differences to questions about stock status and management interventions between factors assessed in this study. Green indicates a factor that reported a significantly more ‘conservative’ response (i.e., the bag limit is too high, the stock is in a poor condition), Yellow indicates a factor that reported a significantly less ‘conservative response’ (i.e., the stock is in a good condition, lack of support for more restrictive management intervention), while grey indicates no significant difference. SF fish. Orient. = Sand Flathead Fisher Orientation. ....83

Figure 53. Respondent perception on compliance of the recreational fishery in Tasmania.....84

Figure 54. Respondent perception on data collection for sustainable management of the recreational fishery in Tasmania. ....85

Figure 55. Responses to a question asking survey participants their thoughts on the following: ‘As well as changing fishing rules for Sand Flathead, do you think that encouraging recreational fishers to voluntarily reduce their catches could make a big difference in the recovery of Sand Flathead stocks?’ (n = 1,390, 159 respondents provided a response of ‘unsure’).....86

Figure 56. The response profile to a question asking respondents to indicate how likely they were to remind or educate friends, family, or others about recreational fishing rules, where 1 indicates they are highly unlikely and 10 indicates they are highly likely (n = 1,219). ....86

Figure 57. How regularly respondents use a de-hooker when flathead fishing (n = 1,390). ....86

Figure 58. How common it is for respondents to use a de-hooker by the main region they fish for Sand Flathead. ....87

Figure 59. How regularly respondents use circle hooks when bait fishing for flathead (n = 1,390). ....87

Figure 60. How regularly respondents use Sand Flathead for bait (n = 1,390). ....88

Figure 61. How often respondents use Sand Flathead as bait by the main region they fish for Sand Flathead.....88

Figure 62. (A) Respondent scores rating how important each of the listed species is to their fishing experience from 1 to 10, where 1 is their least favourite fish and 10 is their most favourite fish to catch. (B) Respondent scores rating how important each of the listed species is for them to catch and eat, from 1 to 10, where 1 is you don’t enjoy eating at all to 10 is it would be your favourite fish to eat. (C) Respondent scores rating how important each of the listed species is to their fishing experience, from 1 to 10, where 1 is you don’t enjoy the experience of catching them at all to 10 where it is one of their favourite fish to catch. Respondent scores rating how important each of the listed species is for them to catch and eat, from 1 to 10, where 1 is you don’t enjoy eating at all to 10 is it would be your favourite fish to eat. ....90

Figure 63. Bump plot showing the ranking (and change of ranking) based on whether respondents experience catching the species, consume the species, the importance to the fishing experience and the importance of consuming the species. ....95

Figure 64. Frequency of species other than those listed in Q39-53 and Q55-69 mentioned by respondents relating to fish and cephalopods that they rate as either for consumptive (n = 593) or experiential values (n = 488). The top 20 species from each value are shown, the remainder accounted for less than 1% of mentions.....97

Figure 65. Use of social media including platform preferences of respondents.....98

Figure 66. Responses to Q14 “The two main species of flathead caught in Tasmania are sand flathead and tiger flathead. How confident are you in your ability to tell the difference between them?” .....104

Figure 67. Responses to Q71 “How important is fishing to you compared to other hobbies, activities or sports?” .....105

Figure 68. Responses to Q37 “How important is fishing for sand flathead to you compared to fishing for other species?” .....106

Figure 69. Responses to Q38. “How strongly do you agree with the statement, “if I couldn’t catch Sand Flathead I would go fishing less?”, with 1 being “I basically wouldn't go fishing” and 10 being “it would not change my behaviour” .....107

Figure 70. Responses to Q20. “In your opinion, how do you think the sand flathead stock is currently doing in Tasmania?” .....108

Figure 71. Responses to Q21. “In the last 12 months, how satisfied have you been with the number of Sand Flathead you caught on you fishing trip(s)?” .....109

Figure 72. Responses to Q22. “In the last 12 months, how satisfied have you been with the size of Sand Flathead you caught on you fishing trip(s)?” .....110

Figure 73. Responses to Q111d. The perceived impact of Commercial fishing on the depletion of the Sand Flathead population in Tasmania.....111

Figure 74. Responses to Q111e. The perceived impact of Recreational fishing on the depletion of the Sand Flathead population in Tasmania.....112

Figure 75. Responses to Q111b. The perceived impact of marine farming on the depletion of the Sand Flathead population in Tasmania.....113

Figure 76. Responses to Q111c. The perceived impact of environmental factors other than climate change or those from marine farming on the depletion of the Sand Flathead population in Tasmania. ....114

Figure 77. Responses to Q111a. The perceived impact of climate change on the depletion of the Sand Flathead population in Tasmania.....115

Figure 78. Responses to Q110e. Perceptions on the impacts of a further depleted stock of Sand Flathead based to the overall fishing experience for all Tasmanians [altruistic domain]. .....116

Figure 79. Responses to Q110c. Perceptions on the impacts of a further depleted stock of Sand Flathead. ....117

Figure 80. Responses to Q110a. Perceptions on the impacts of a further depleted stock of Sand Flathead on the respondents personal fishing experience [egoistic domain]. ....118

Figure 81. Responses to Q110g. Perceptions on the impacts of a further depleted stock of Sand Flathead on the overall ecosystems and environment in Tasmania [Biospheric/altruistic domain].....119

Figure 82. Responses to Q110f. Perceptions on the impacts of a further depleted stock of Sand Flathead on the overall Tasmanian economy [altruistic domain].....120

Figure 83. Responses to Q110d. Perceptions on the impacts of a further depleted stock of Sand Flathead on respondents’ personal mental health [egoistic domain]. ....121

Figure 84. Responses to Q110b. Perceptions on the impacts of a further depleted stock of Sand Flathead on respondents’ personal financial wellbeing [egoistic domain]. ....122

Figure 85. Responses to Q109a. Perception of the potential impacts to respondents’ overall fishing experience due to reduced access to numbers of Sand Flathead due to depletion of the stock.....123

Figure 86. Responses to Q109b. Perception of the potential impacts to respondents’ overall fishing experience due to reduced access to larger fish due to their depletion within the stock. ....124

Figure 87. Responses to Q109c. perceptions on the impacts to respondents on not being able to keep as many Sand Flathead due to reduced catch limits imposed to recover the stock..125

Figure 88. Responses to Q109d. perceptions on the impacts to respondents on not being able to keep as many Sand Flathead due to increased size limits imposed to recover the stock based on a range of demographic and fishing factors. Letters show significant differences ( $\alpha = 0.05$ ) based on Kolmogorov-Smirnov tests with a Holm multiple comparison correction.....126

Figure 89. Responses to Q113f. Agreement profile to the question “Swift and appropriate management measures to ensure a fishery is managed sustainably is important for recreational fishers”, based on a range of demographic and fishing factors. Letters show significant differences ( $\alpha = 0.05$ ) based on Kolmogorov-Smirnov tests with a Holm multiple comparison correction.....127

Figure 90. Responses to Q23. “Do you think the current bag limit for Sand Flathead, which is 20 per person per day, is...much too low, a bit low, about right, a bit too high or much too high?”. .....128

Figure 91. Responses to Q24. “Do you think the current size limit for Sand Flathead, which is 32 cm, is...much too big, a bit too big, about right, a bit too small or much too small?” .....129

Figure 92. Responses to Q25. Support profile for hypothetical scenario “Halve the bag limit to 10 fish, introduce a boat limit of 20 fish and increase the minimum size limit to 35 cm”, based on a range of demographic and fishing factors. Letters show significant differences ( $\alpha = 0.05$ ) based on Kolmogorov-Smirnov tests with a Holm multiple comparison correction.....130

Figure 93. Responses to Q26. Support profile for hypothetical scenario “Reduce the bag limit to 5 fish, keep no boat limit, and increase the minimum size limit to 35 cm”, based on a range of demographic and fishing factors. Letters show significant differences ( $\alpha = 0.05$ ) based on Kolmogorov-Smirnov tests with a Holm multiple comparison correction. ....131

Figure 94. Responses to Q27. Support profile for hypothetical scenario “an 18-month closure of the Sand Flathead fishery, then a bag limit of 10 fish, no boat limit and a minimum size limit of 35 cm”, based on a range of demographic and fishing factors. Letters show significant differences ( $\alpha = 0.05$ ) based on Kolmogorov-Smirnov tests with a Holm multiple comparison correction.....132

Figure 95. Responses to Q28. Support profile for hypothetical scenario “Halve the bag limit to 10 fish, keep no boat limit, and keep the size limit of 32 cm”, based on a range of demographic and fishing factors. Letters show significant differences ( $\alpha = 0.05$ ) based on Kolmogorov-Smirnov tests with a Holm multiple comparison correction.....133

Figure 96. Responses to Q29. Support profile for hypothetical scenario “Reduce the bag limit to 5 fish on the southeast and mid-east coast and 10 fish everywhere else, introduce a boat limit of 15 fish statewide and maintain the minimum size limit of 32 cm”, based on a range of demographic and fishing factors. Letters show significant differences ( $\alpha = 0.05$ ) based on Kolmogorov-Smirnov tests with a Holm multiple comparison correction. ....134

Figure 97. Responses to Q30. Support profile for hypothetical scenario “Halve the bag limit to 10 fish, maintain no boat limit, maintain the minimum size limit of 32 cm, and introduce a maximum size limit of 40 cm”, based on a range of demographic and fishing factors. Letters show significant differences ( $\alpha = 0.05$ ) based on Kolmogorov-Smirnov tests with a Holm multiple comparison correction.....135

Figure 98. Responses to Q31. Support profile for hypothetical scenario “Reduce the bag limit to 5 fish, introduce a boat limit of 20 fish, maintain the minimum size limit of 32 cm and introduce a maximum size limit of 38 cm”, based on a range of demographic and fishing factors. Letters show significant differences ( $\alpha = 0.05$ ) based on Kolmogorov-Smirnov tests with a Holm multiple comparison correction.....136

Figure 99. Responses to Q113a. Agreement profile for the statement “Overall, I believe most recreational flathead fishers comply with fishing rules”, based on a range of demographic and fishing factors. Letters show significant differences ( $\alpha = 0.05$ ) based on Kolmogorov-Smirnov tests with a Holm multiple comparison correction.....137

Figure 100. Responses to Q113b. Agreement profile for the statement “There needs to be more compliance checks”, based on a range of demographic and fishing factors. Letters show significant differences ( $\alpha = 0.05$ ) based on Kolmogorov-Smirnov tests with a Holm multiple comparison correction.....138

Figure 101. Responses to Q113c. Agreement profile for the statement “Current penalties for non-compliance of fisheries rules are adequate”, based on a range of demographic and fishing factors. Letters show significant differences ( $\alpha = 0.05$ ) based on Kolmogorov-Smirnov tests with a Holm multiple comparison correction. ....139

Figure 102. Responses to Q113g. Agreement profile for the statement “Overall, recreational fishers do the right thing to ensure that there are healthy fish stocks for future generations”, based on a range of demographic and fishing factors. Letters show significant differences ( $\alpha = 0.05$ ) based on Kolmogorov-Smirnov tests with a Holm multiple comparison correction. ....140

Figure 103. Responses to Q113d. Agreement profile for the statement “Data for managing a recreational fishery should be collected by the Government or a Govt affiliated research agency”, based on a range of demographic and fishing factors. Letters show significant differences ( $\alpha = 0.05$ ) based on Kolmogorov-Smirnov tests with a Holm multiple comparison correction.....141

Figure 104. Responses to Q113e. Agreement profile for the statement “Data collected”, based on a range of demographic and fishing factors. Letters show significant differences ( $\alpha = 0.05$ ) based on Kolmogorov-Smirnov tests with a Holm multiple comparison correction.....142

Figure 105. Responses to Q33. “As well as changing fishing rules for Sand Flathead, do you think that encouraging recreational fishers to voluntarily reduce their catches could make a big difference in the recovery of Sand Flathead stocks?” .....143

Figure 106. Responses to Q114. “How likely are you to remind or educate friends, family or other recreational fishers about recreational fishery rules with 1 being not at all likely to 10 being extremely likely?” .....144

Figure 107. Responses to Q34. “How often do you use a de-hooker when flathead fishing?” .....145

Figure 108. Responses to Q35. “How often do you use circle hooks when bait fishing for flathead.” .....146

Figure 109. Responses to Q36. “Do you ever use Sand Flathead as bait?” .....147

Figure 110. Diagnostic metrics for the fishing modality and value orientation-based profiling exercise (Partitioning Around Medoids [PAM] clustering of Q72–Q95 responses). Each metric indicates the number of clusters at which different aspects of the clustering is optimised (i.e., the best number of distinct profile groups to classify similar respondents by responses). Average Silhouette Width (a) indicates optimal cluster separation when maximised (dashed line). Within Sum of Square (b) indicates better compactness when minimised, i.e., the ‘elbow’ at five clusters indicates diminishing returns beyond this point. The Gap statistic (c) indicates goodness-of-fit, and the point at which additional clusters do not significantly improve fit is indicated by the dashed line. Respondents were divided into six fisher profiles based on the agreement between the latter two diagnostics (b, c). See section 3.7.2 for more details on clustering methods. ....181

Figure 111. Diagnostic metrics for the Value Proposition-based profiling exercise (Partitioning Around Medoids [PAM] clustering of Q96 responses). Each metric indicates the number of clusters at which different aspects of the clustering is optimised (i.e., the best number of

distinct profile groups to classify similar respondents by responses). Average Silhouette Width (a) indicates optimal cluster separation when maximised (dashed line). Within Sum of Square (b) indicates better compactness when minimised, i.e., the ‘elbow’ at five clusters indicates diminishing returns beyond this point. The Gap statistic (c) indicates goodness-of-fit, and the point at which additional clusters do not significantly improve fit is indicated by the dashed line. Respondents were divided into five Value Proposition profiles based on the agreement between the first two diagnostics (a, b), and the Gap statistic local maxima (c) at five clusters. See section 3.7.2 for more details on clustering methods.....182

Figure 112. Diagnostic metrics for the Eudemonic-based profiling exercise (Partitioning Around Medoids [PAM] clustering of Q99–Q106 responses). Each metric indicates the number of clusters at which different aspects of the clustering is optimised (i.e., the best number of distinct profile groups to classify similar respondents by responses). Average Silhouette Width (a) indicates optimal cluster separation when maximised (dashed line). Within Sum of Square (b) indicates better compactness when minimised, i.e., the ‘elbow’ at four clusters indicates diminishing returns beyond this point. The Gap statistic (c) indicates goodness-of-fit, and the point at which additional clusters do not significantly improve fit is indicated by the dashed line. Respondents were divided into four Eudemonic profiles based on the agreement between the latter two diagnostics (b, c) along with the Average Silhouette Width local maxima at four clusters (a). See section 3.7.2 for more details on clustering methods. ....183

Figure 113. Diagnostic metrics for the Flathead fishing orientation (consumptive orientation-based) profiling exercise (Partitioning Around Medoids clustering of Q99–Q106 responses). Each metric indicates the number of clusters at which different aspects of the clustering is optimised (i.e., the best number of distinct profile groups to classify similar respondents by responses). Average Silhouette Width (a) indicates optimal cluster separation when maximised (dashed line). Within Sum of Square (b) indicates better compactness when minimised, i.e., the ‘elbow’ at two clusters indicates diminishing returns beyond this point. The Gap statistic (c) indicates goodness-of-fit, and the point at which additional clusters do not significantly improve fit is indicated by the dashed line. Respondents were divided into two Flathead fishing orientation groups based on the agreement between the first two diagnostics (a, b) along with the Gap statistic having nearly plateaued at this point (a). See section 3.7.2 for more details on clustering methods. ....184

Figure 114: Frequency of respondents’ perspectives on the most effective measures for rebuilding flathead stocks (responses to Q118 (“...lastly, is there anything else that we haven’t covered that you would like to say to us about the sand flathead fishery or its management?”) based on coding structure presented in Table 3.....187

## Tables

Table 1. Response profile for the Flathead Focus Survey. ....	24
Table 2. coding structure used to analyse respondent answers to Q32 of the flathead focus survey (“What do you think would be the best way to help rebuild the sand flathead fishery...”). .....	80
Table 3. Correlation between respondents’ perception of the state of the Sand Flathead stock in Tasmania and satisfaction with their catch of Sand Flathead by number and fish size using Spearman’s rank correlation coefficient ( $\rho$ ) for ordinal data. All correlations were significant at $p < 0.005$ . ....	180
Table 4. Summary coding from 1,266 free-text responses to a question asking for any further comment on the Sand Flathead fishery or its management.....	185

## 2 Introduction

Sand Flathead *Platycephalus bassensis* are the most popular species targeted by recreational fishers in Tasmania. They are found in estuarine and coastal waters to 100 m but are most common in shallow waters on sandy or muddy substrates (Edgar 2008). Prior to the second half of the 20th century the species was generally unpopular among Tasmanian consumers and had little commercial importance. This unpopularity was due to its 'ugly' appearance, commonness, and its reputation as a scavenger (Frijlink and Lyle 2013). Since then, Sand Flathead have become a popular species amongst recreational fishers, valued for their accessibility, abundance (Henry and Lyle 2003), and good eating qualities (Yearsley et al. 1999). However, the commercial fishery has remained relatively small, particularly compared with the preferred target species Tiger Flathead *Neoplatycephalus richardsoni* (Frijlink and Lyle 2013).

Commercially, Sand Flathead are caught primarily by hook and line, with some by-catch from the Danish seine and gillnet fisheries. Annual commercial catches have been less than five tonnes since 2009/10 (Fraser et al. 2022).

The recreational harvest of Sand Flathead was estimated at 184.4 t in 2017/18 (Lyle et al. 2019), approximately 98% of the combined commercial and recreational harvest for that year (Fraser et al. 2022).

While Sand Flathead are found state-wide, recreational catch and effort is greatest close to large population centres or popular coastal areas. In 2017/18, just over half of the estimated total flathead catch (i.e., all species), of which 96% was Sand Flathead, was from the southeast coast, with the central east (including Great Oyster Bay) and northwest coasts also important regions (Lyle et al. 2019).

Since 2012, IMAS has conducted fishery independent surveys on Sand Flathead populations around Tasmania. Initially confined to southeast and east coast areas where stocks are subject to heavy recreational fishing pressure, the surveys found low abundance of legal sized fish. Since 2021, the survey has expanded to other regions with a focus on popular fishing areas ([Fishery Independent Surveys \(tasfisheriesresearch.org\)](https://tasfisheriesresearch.org)). From this data, recent stock assessment reports indicate very high levels of fishing mortality which will need to be reduced considerably to allow for rebuilding of the stock biomass (Krueck et al. 2020, Fraser et al. 2022).

On 22 December 2022 the fishery was officially changed from 'depleting', where it had been since first assessed in 2014/15 (Emery et al. 2016), to a 'depleted' classification (Fraser et al. 2022).

The recreational Sand Flathead fishery is managed by the Department of Natural Resources and Environment Tasmania (NRE Tas), mainly through catch and size limits. At the commencement of this project (February 2023), Sand Flathead had a daily bag limit of 20 fish and a minimum legal size of 32 cm. On 18 April 2023 the Minister for Primary Industries and Water (henceforth referred to as the Fisheries Minister) announced an interim management measure reducing the daily bag limit to 10 fish and increasing the minimum legal size to 35 cm. These measures were implemented for the period from 20 April to 31 October 2023, while further management changes were being considered by NRE Tas.

The key focus of managing a fishery is maintaining a sustainable stock level. However, a growing focus of modern fisheries management is considering the views, needs and aspirations of

different fisher 'types' and other fishery stakeholders (Bennett et al. 2017, Arlinghaus et al. 2019, Cooke et al. 2019, Hyder et al. 2020). This is because fisheries management changes typically have different social and economic implications across the stakeholder spectrum (Chan et al. 2018, Haase et al. 2022). Moreover, for regulations to be highly effective, they must be understood and largely supported by fishers, and aligned with public expectations (Veiga et al. 2013, Pita et al. 2020, van den Heuvel et al. 2020).

This can be particularly challenging in a recreational fishery due to the large number of participants. The last Tasmanian Statewide Recreational Fishing Survey in 2017/18 estimated that 106,000 people fished at least once over a 12 month period, equating to a recreational fishing population of almost one in four Tasmanians (Lyle et al. 2019). This population is diverse and complex, spanning demographics, fishing preferences (including where they fish) as well as personal values, beliefs, attitudes, and motivators.

A key challenge of fisheries managers is shifting community views that recreational fisheries cannot deplete a fish stock. It is commonly thought that only commercial fishing can have such large impacts, often manifested through images and stories about commercial overfishing (Cooke and Cowx 2004). While there are many examples where recreational fishing has depleted fish stocks (Cooke and Cowx 2004, Lewin et al. 2006, Arostegui et al. 2021), this is harder for some people to conceptualise as the impacts of individual fishers are typically minimal. However, the cumulative effort of many recreational fishers can have significant impacts. In 2017/18, it was estimated that approximately 70,000 recreational fishers caught Sand Flathead. Recognising this contribution to stock depletion is critical for acceptance of management interventions to rebuild the stock.

Perspectives and aspirations of the recreational fishing community are often highly divergent. Recognising diverse groups (and their relative prominence) and understanding what they value about fishing provides fisheries managers greater potential to enhance these values (Cooke et al. 2013, Martin et al. 2017, Mackay et al. 2018). This may occur through tailoring management strategies to maximise fisher acceptance and more targeted (and therefore more effective) communication and education initiatives.

In this study we have applied a range of profiling techniques used by marketers and behavioural scientists. The main approach is a 'Market Segmentation Analysis' (herein referred to as Segmentation Analysis). To understand respondent's values and drivers we applied a series of psychographic profiling questions. These were defined in part by the review of Graba-Landry et al. (2023).

Firstly, we explored the high-level value principles that occur in the transaction between humans and their environment. These can be reflected by Aristotle's concept of eudemonia – which identifies an individual's long-term values associated with leading a meaningful life and flourishing (Nagel 1972). Shin et al. (2022) conceptualised eudemonic values with guidance from Self-Determination Theory and values derived from the Value-Belief-Norm (VBN) theory of environmentalism to understand how a suite of values affected pro-environmental behaviour by recreational anglers in the United States. Defining these values from respondents is useful as they tend to reflect relatively long-term motivational forces (Vaske and Donnelly 1999). We apply a similar approach in this study as an antecedent to other value concepts.

Next, we looked to determine what motivated respondents to go fishing. Motivations are the psychological outcomes desired from a fishing experience (Knopf et al. 1973, Fedler 1984). Fishers tend to be motivated by both non-catch and catch aspects (or orientations) of the fishing experience (Arlinghaus 2006, Anderson et al. 2007). Non-catch motivations include nature based (i.e., being outdoors), or socially based (i.e., spending time with friends or family, or spending time alone) aspects that can be independent of whether a fish is caught—these motivations are common among many recreational fishers (Holland and Ditton 1992).

Catch motivations can be defined by an individual's 'catch orientation', which relates to the degree to which an angler values the catch-related outcomes of the angling experience (Sutton and Ditton 2001, Arlinghaus 2006). These include the value placed on catching at least one fish, large fish, many fish, trophy fish, and releasing fish (Magee et al. 2018). Catch orientation also influences fishing norms (Kagervall et al. 2014). For example, if fishers prefer to release fish, then their personal norm is likely to engage in catch and release fishing, whereas fishers who are opposed to releasing fish will likely have a personal norm to harvest fish (Kagervall et al. 2014).

Understanding what motivates people to go fishing is an important component of contemporary fisheries management and provides a platform to assess 'fisher satisfaction'. Satisfaction is the difference between desired outcomes (motivations) and the perceived fulfillment of those outcomes (Peterson 1974).

An individual's motivators and catch orientation may vary across fishing modes. For example, while fishing inshore with a rod and line, an individual may be motivated by the experience rather than catching fish for consumption. On the other hand, when fishing for lobster, their motivation may be centred around catching specifically for consumption. As such the final segmentation component we assess is the interaction between a subset of fishing motivators and catch orientations and common fishing modalities in Tasmania.

Recovering a stock predominantly depleted by recreational fishing creates unique challenges and opportunities that transcend regulatory constraints on catch and effort. Consistent with emerging approaches to managing non-commercial fisheries, fishers may be encouraged to voluntarily reduce fishing impacts through attitude and behaviour changes. This includes through carefully designed and targeted communication, education and stewardship initiatives (Danylchuk et al. 2018, Tracey et al. 2023).

The research aims to better understand fishing-related values, motivations, behaviours, attitudes and perceptions among Tasmanian Sand Flathead fishers to:

- Develop management settings to recover the Sand Flathead fishery that maximise acceptance among fishers; and
- Inform the development, promotion, and targeting of engagement and outreach activities that consider fisher diversity; and
- Identify candidate species for transferring recreational fishing effort as the sand flathead fishery rebuilds.

### 3 Methods

Tasmanian recreational fishers were surveyed using a questionnaire. The design of the survey instrument (the Flathead Focus Survey (FFS)) considered recurring IMAS recreational fishing surveys (see for example Lyle et al. (2014) & (2019)), and a literature review of factors influencing recreational fishers' acceptance of management measures and adoption of environmentally responsible behaviours (see Graba-Landry et al. (2023)).

The FFS questionnaire was extensive, spanning numerous topics. As well as soliciting activity and demographic profiling information, questions sought information relating to fisher attitudes, perceptions and preferences. This included value orientation, fishing motivations, consumptive orientation, preferred modes of fishing, catch and consumption preferences, fisher satisfaction, fisher literacy and attitudes to Sand Flathead management. In total, the FFS questionnaire asked 119 questions (Appendix 2).

The survey was delivered via two modes:

1. Through the *Tasmanian State-wide Recreational Fishing Survey 2022/23 (RFS)*. Interviewees were recruited from a random stratified sampling frame of Tasmanian residents (Lyle et al. 2019) During survey screening in September and October 2022, respondents indicating an intention to fish for Sand Flathead were invited to participate in the FFS. This was conducted later over the phone by trained interviewers.
2. A self-selected online survey was administered via the Survey Monkey platform and advertised via a range of social media platforms (i.e., Facebook) and mailing lists and notifications by NRE Tas, The Tasmanian Association of Recreational Fishing (TARFish), Marine and Safety Tasmania (MAST) and IMAS. This survey was accessible to all people with an interest in the Tasmanian Sand Flathead fishery.

#### 3.1 Survey Response

A total of 1,453 respondents completed surveys deemed sufficient for analysis: 143 and 1,310 full and partial responses from the telephone survey and online survey, respectively (Table 1). The number of respondents providing data for each question varied due to questionnaire attrition; the number of respondents completing each question is also shown in Table 1.

## SURVEY OF RECREATIONAL FISHERS IN TASMANIA WITH A FOCUS ON SAND FLATHEAD

Table 1. Response profile for the Flathead Focus Survey.

Category	Number	removed from sample
<b>Phone interview responses</b>		
Gross sample	240	-
Full responses	135	
Partial responses	8	
Full refusals	90	Removed
Non-contacts	7	Removed
<b>Net sample</b>	<b>143</b>	
<b>Online interview responses</b>		
Gross responses	1,577	-
Non-starters	158	Removed
Only demographic information	45	Removed
Only demographic and basic participation information	64	Removed
No demographic information	46	
<b>Net sample</b>	<b>1,310</b>	
<b>Total net sample</b>	<b>1,453</b>	

### 3.2 Understanding recreational Sand Flathead fishers through segmentation analysis

To understand the diversity of recreational Sand Flathead fishers, segmentation analyses were conducted on responses to profiling questions relating to demographics, fishing behaviour, preferred fishing location and psychographics (e.g., values, motivations and consumptive orientation). Results can be used to inform targeted communication and education strategies. These include strategies aligned with fisher perceptions of Sand Flathead stock health, and attitudes to Sand Flathead management.

#### 3.2.1 Demographic segmentation

Demographic variables (and response categories) used for profiling were:

- Age – <18, 18–29, 30–44, 45–59, 60–74, and 75+ years of age,
- Gender – male, female, other; and,
- Level of education – Year 9 or below, Year 10 or above, or completed Year 12 / TCE / or equivalent.

Country of birth was also asked, however, this was not included in subsequent analyses as the lack of diversity (most respondents were born in Australia) precluded meaningful insights.

#### 3.2.2 Behavioural (fishing) segmentation

Behavioural parameters (and response categories) used for profiling fishers in this study were:

- Avidity – days fished (any species) in the 12 months prior to the survey (less than 5 days, 5–9 days, 10–14 days, 15–19 days, 20 or more days).
- Centrality of recreational fishing to lifestyle – Compared to other hobbies, activities or sports, how important fishing is rated on an ordinal data scale of 1–10, with '1' being least and '10' being most important.

## SURVEY OF RECREATIONAL FISHERS IN TASMANIA WITH A FOCUS ON SAND FLATHEAD

- Years of experience fishing for flathead (all species) – less than 5 years, 5–9 years, 10–14 years, 15–19 years, 20 or more years.
- Avidity for flathead fishing – how often respondents fished for flathead in the 12 months prior to the survey (less than 5 days, 5–9 days, 10–14 days, 15–19 days, 20 or more days).
- Centrality of Sand Flathead to fishing experience – Compared to fishing for other species, how important is fishing for Sand Flathead, rated on an ordinal data scale of 1–10, with '1' being least and '10' being most important.
- Primary flathead fishing platform – Shore only, predominantly shore, mainly shore, equal shore and boat, mainly boat, predominantly boat, boat only.

### 3.2.3 Geographic segmentation

Respondents were asked where they most commonly fished across 16 reporting regions (Figure 1). Depending on the number of responses from each region, some pooling of regions occurred which is reported in the Results section 4.

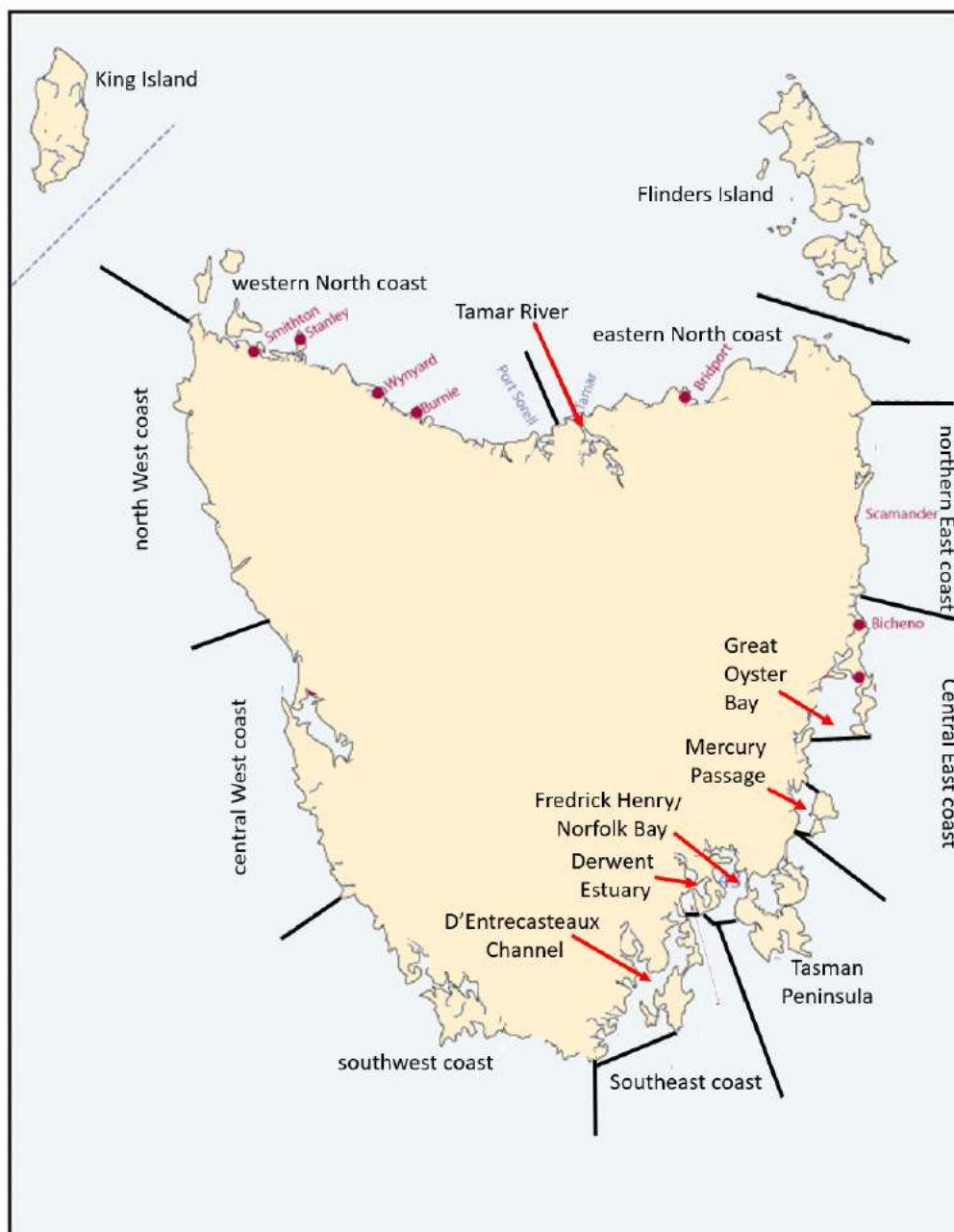


Figure 1. Tasmanian regions presented in the survey as options to select for 'main region fished for flathead'.

### 3.2.4 Psychographic segmentation

#### 3.2.4.1 Eudemonic profiling

Eudemonic profiling can be used to understand the propensity of individuals for pro-environmental behaviours, including behaviours to minimise impacts on over-fished species. In this study we draw from several behavioural sciences models (see Introduction) to define respondent affinity to three domains as determined by their agreement with nine statements:

- Biospheric – the importance of the environment and the quality of nature to oneself:
  - *I like the visual beauty of nature.*
  - *Protecting the environment, preserving nature.*
  - *Feeling close to nature when I am fishing.*
- Altruistic – motivated by a desire to benefit someone other than oneself for that person’s sake:
  - *I like it when everyone gets along on a fishing trip.*
  - *I care that my friends and family have a good time on a fishing trip.*
  - *I like it when everyone on a fishing trip catches a fish.*
- Egoistic – the fulfilment of one’s own gratification or desires:
  - *I like to influence where friends and family go fishing & what we target.*
  - *I like to be the leader or ‘Captain’ on a fishing trip.*
  - *I am competitive with my friends and family when I go fishing.*

Responses were reported on an ordinal data scale from 1 – 10; where 1 was the lowest and 10 the highest score.

#### 3.2.4.2 Fishing motivation profiling

Understanding fishers’ motivations to go fishing can guide the development of management settings with a view to maximising the value of fishing opportunities. In this study, we provided 10 fishing motivations/statements encompassing both catch and non-catch motivations. Responses were captured using a 5-point modified Likert scale: *Not at all important, Not all that important, Unsure, Quite important, Very important.*

- Non-catch orientated motivations:
  - *To be outdoors ... in the fresh air ... to enjoy nature.*
  - *To relax or unwind.*
  - *To spend time with friends.*
  - *To spend time with family.*
  - *To be on your own ... to get away from people.*
- Catch orientated motivations:
  - *To catch fresh fish for food.*
  - *To catch fish to share with friends and family.*
  - *For the enjoyment or sport of catching fish.*
  - *To catch a trophy fish.*
  - *To compete in fishing competitions.*

#### 3.2.4.3 Sand Flathead consumptive orientation profiling

Numerous factors motivate individuals to fish. However, catch-related aspects of recreational fishing are often complex and may require a deeper understanding. In the context of recreational fishing, consumptive orientation encompasses an angler’s inclination to catch fish,

retain or release fish, and the significance placed on both the quantity and size of fish (Graefe 1980, Anderson et al. 2007).

In this study we sought agreement with a set of statements aligned with four widely recognised dimensions of consumptive orientation ((Anderson et al. 2007) all modified to relate specifically to Sand Flathead.

- Attitudes towards catching any Sand Flathead
  - *A fishing trip can still be successful, even if no Sand Flathead are caught*
  - *If I thought I wouldn't catch any Sand Flathead on a trip, I wouldn't go fishing*
  - *I'm not satisfied unless I catch at least some Sand Flathead*
  - *I wouldn't go fishing as much if I couldn't catch Sand Flathead*
- Attitudes toward catching numbers of Sand Flathead
  - *The more Sand Flathead I catch the happier I am*
  - *A successful fishing trip is one in which many Sand Flathead are caught*
  - *Bagging out on Sand Flathead is the best indicator of a good fishing trip*
  - *I would rather keep just enough Sand Flathead for a feed than take the bag limit*
- Attitudes toward catching large/trophy Sand Flathead
  - *I'd rather catch one or two bigger Sand Flathead than ten smaller fish*
  - *The bigger the Sand Flathead I catch the better the fishing trip*
  - *I prefer to fish for Sand Flathead where I know I may catch a very big one*
- Attitudes towards retaining Sand Flathead
  - *I usually eat the Sand Flathead I catch*
  - *I'm just as happy if I don't keep the Sand Flathead I catch*
  - *I want to keep all the legal sized Sand Flathead I catch*

Responses indicated agreement on a 5-point Likert-type scale: *Strongly disagree, Disagree, Neutral, Agree, Strongly agree.*

#### 3.2.4.4 Motivation intersected with fishing mode profiling

Data were collected to create a typology assigning fishers into groups intersecting fishing motivation with fishing mode (see Methods section 3.7.2). Here, respondents ascribed a level of importance (from 1 to 10) to four motivation dimensions (consumption, experiential, social and trophy seeking) for each of six fishing modes, listed below:

- inshore line fishing – shore or boat-based targeting inshore species in estuaries and other near coastal waters,
- deep water line fishing – offshore angling from a boat targeting deeper water species,
- game fishing – targeting large pelagic species, using rod and line,
- freshwater line fishing – fishing in freshwater systems such as lakes or rivers,
- dive collection – harvesting invertebrates or fish, by spearfishing or hand collection; and,
- potting /ring fishing – using pots or rings to collect invertebrates.

### 3.3 Fishery literacy

Fisher acceptance of catch constraints necessary to recover a poorly performing fishery is generally enhanced if the fishers have a good understanding of the fishery, particularly the

reasons for poor performance and its recovery needs. In this report, this understanding is referred to as 'fishery literacy'.

A common perception that recreational fishing cannot wholly or largely deplete fish stocks and threaten the sustainability of aquatic ecosystems has been demonstrated to be untrue in a growing number of studies (Cooke and Cowx 2004, Lewin et al. 2006).

Denial can significantly impede the process of creating change by serving as a psychological barrier that hinders individuals or groups of people from acknowledging the need for transformation (Bunker and Alban 1997). When confronted with denial, there is a reluctance to accept the reality of existing problems, making it challenging to initiate meaningful and effective change initiatives (Armenakis et al. 1993).

Fishery literacy was measured as a response to a question (Q18) about the relative proportions of Sand Flathead statewide catches taken by the recreational and commercial sectors. Statewide recreational fishing survey catch estimates (Lyle et al. 2019) and commercial catch reporting indicate that the recreational sector accounts for approximately 98% of Sand Flathead harvest in Tasmania. This information is publicly available, and has been communicated across many platforms, including social media, articles, reports, and public meetings.

Respondents were assigned to fishery literacy categories based on the accuracy of their responses (by quartile, from most to least accurate): "High", "Medium", "Low", and "Poor". 'Unsure' responses were treated separately.

## 3.4 Analysis

### 3.4.1 Comparisons of question responses between subgroups

Kolmogorov-Smirnov (KS) tests were used to test for statistically significant differences in responses to questions among subgroups. A two-sample Kolmogorov-Smirnov test ( $\alpha = 0.05$ ) was used throughout to test for statistically significant differences between data collection methods and between demographic profiles of FFS respondents with to those from the 2017/18 Statewide survey (calibrated to represent the Tasmanian recreational fishing community (Lyle et al. 2019).

Where no significant differences were identified between collection methods, data were pooled in subsequent analyses. If significant demographic differences were identified between surveys, consideration of bias in the responses is required. This is because the respondent driven recruitment to the online survey is unlikely to approximate a representative cross-section of the Tasmania recreational fishery; the probabilistic survey design of the RFS is likely to be more representative. Not all specific demographic questions asked in the FFS could be assessed for representativeness, as they were not asked during the last RFS (Lyle et al. 2019).

KS tests were applied between responses to different questions (for questions with the same response scale). Likert-scale and ordinal response data were treated as interval data for KS testing (e.g., assuming equal distance between scale levels). Pairwise KS tests were conducted to test for differences in responses among all combinations of multiple subgroups, with  $p$  values corrected for multiple comparisons using the Holm (1979) method. Statistical significance was determined at  $\alpha = 0.05$ . Significant differences among response distributions are indicated with

a compact letter display (Piepho 2004) on the bar plots, such that groups that are not statistically different ( $p > 0.05$ ) share at least one letter.

For questions where responses were not ordinal/interval (e.g., Gender) or had too few response choices for representation as a distribution to be appropriate ( $\leq 3$ ), pairwise Pearson's Chi-squared tests were used instead of KS tests. Statistical analyses (including clustering, see below) were conducted in the R statistical environment v. 4.1.3.

### 3.4.2 Profile clustering

To identify groups of respondents with similar characteristics, partitional clustering was conducted on subsets of the survey response data with a Partitioning Around Medoids (PAM; Kaufman and Rousseeuw 1990) algorithm. PAM clustering identifies 'medoids', or representative respondents in the data, and clusters observations around them, iterating until the distance between the respondents and the medoid of each cluster is minimised. PAM clustering was conducted on four subsets of survey data from the psychographic profiling questions (described in Section 3.6):

- Eudemonic profiling
- Fishing motivation profiling
- Consumption orientation profiling
- Motivation intersected with fishing modality profiling

The ordinal responses to the questions in each subset were treated as interval data (i.e., assuming equal distance between each response level) for the purpose of cluster analysis.

PAM Clustering was conducted with the R package 'cluster v 2.1.2' (Maechler et al. 2021), using Manhattan distance (the distance between respondents is the sum of the distances across each question/sub question in the data subset, as opposed to the modulus of that vector as would apply in the case of the Euclidean distance). The optimal number of clusters ( $k$ ) to partition each data subset was selected based on plots of three diagnostic criteria:

- 1) Total within-cluster sum of square (WSS): lower values of WSS indicate more compact clusters so when WSS is plotted vs  $k$ , an 'elbow' or  $k$  value beyond which adding an additional cluster results in relatively little decrease in WSS can be identified.
- 2) Average silhouette width: a measure of the average distance between clusters that increases with cluster cohesiveness and separation. The value of  $k$  at which the average silhouette width is maximised is the optimum; and
- 3) Gap statistic: a bootstrapped comparison of the total within-cluster variation calculated from sample data versus that calculated from randomised null uniform distribution data. The optimal  $k$  value is the lowest  $k$  at which the gap statistic is within one standard deviation of the gap statistic at  $k+1$  (i.e., where adding an additional cluster does not significantly improve cluster quality).

The diagnostic plots were generated with the R package *factoextra* v. 1.0.7 (Kassambara and Mundt 2020) with  $k$  ranging from 1 to 10 and the gap statistic calculated with 100 bootstraps.

For each of the four psychographic response data subsets that were clustered, the k value that optimised a majority (i.e.,  $\geq 2$ ) of the diagnostic criteria described above was selected. The response data of the medoid respondent of each cluster was plotted to exemplify response profile of each cluster. Plots of the cumulative distributions of the response data among each cluster's respondents were visually examined to discern identifying characteristics of each cluster.

### 3.4.3 Sentiment quotes

Throughout the report there are sentiment quotes from respondents who provided a free-form response in an open-ended question (Q118: *"Is there anything else you would like to tell us?"*). These are shown in quotation text boxes.

### 3.4.4 Qualitative analysis of survey responses

#### 3.4.4.1 Analysis of free text responses.

Analysis of free text responses provided by respondents to Q32 and Q118 was undertaken using NVivo 1.2. Responses were subject to a spelling and grammar check and arranged by paragraph such that one paragraph accorded to the free-text response data provided by one respondent. An initial review of 10% of the respondent data was undertaken by social scientists to develop an initial single level thematic coding matrix. A review meeting was then held, and the final coding was by consensus. Manual coding was then undertaken for the remaining free-text data for that question. Histograms of the number of references each thematic code were reported for this analysis.

#### 3.4.4.2 Analysis of ranking data for hypothetical packages of management measures.

Respondents were asked to indicate their support for several packages of management measures (hypothetical scenarios comprising several management tool settings) to recover Sand Flathead stocks (Q25–Q31). Support ranged from 1 (*do not support at all*) to 10 (*support very strongly*). We applied a proportional-odds logit model to identify the effects of each management tool presented in each scenario (i.e., bag limit reduction, boat limit implementation, minimum size increase, maximum size implementation, and 18 mo. closure). This type of model requires predictor variables (i.e., individual management measures) to be binary (two options). Accordingly, two of the management tools had multiple variations aggregated together: implementation (vs not implemented) was treated the same for maximum size limits (whether 38 cm or 40 cm) and boat limits (whether 15 or 20 fish). Thus, the binary predictors modelled were bag limit (5 vs 10 fish), Minimum Size Limit (32 vs 35 cm), Boat Limit, Maximum Size Limit, and 18 mo. closure (these latter three assessed as 'Yes' or 'No'). For Q29, which included separate bag limits for the E/SE and elsewhere (5 vs 10), the bag limit was treated as 5 since that would be the implementation in the main area fished by most respondents (Figure 30). The model was fit with the R package 'ordinal' (Christensen 2022) with a random effect for individual respondent to control for individual-level variation.

The effect of each management measure was assessed by comparing marginal means between options (e.g., the difference in mean support response between Boat Limit implemented vs not implemented while holding all other management measures constant). The estimated marginal means were plotted and the differences were significance tested with Tukey corrections for multiple comparisons with the R package *emmeans* v. 1.8.7 (Lenth 2023).

## 4 Results & Discussion

### 4.1 Who responded to the survey?

#### 4.1.1 Demographic segmentation

##### 4.1.1.1 Age and gender

The most highly represented age group was 45–59, accounting for 34% of all responses followed by 60–74 (33%), 30–44 (20%), over 75 (4%) and under 18 years (<1%) (Figure 2). Males accounted for 87% of responses (Figure 2). There was no significant difference in the age group distribution between the online survey and the phone survey (Kolmogorov-Smirnov (KS):  $D = 0.667$ ,  $p = 0.14$ ).

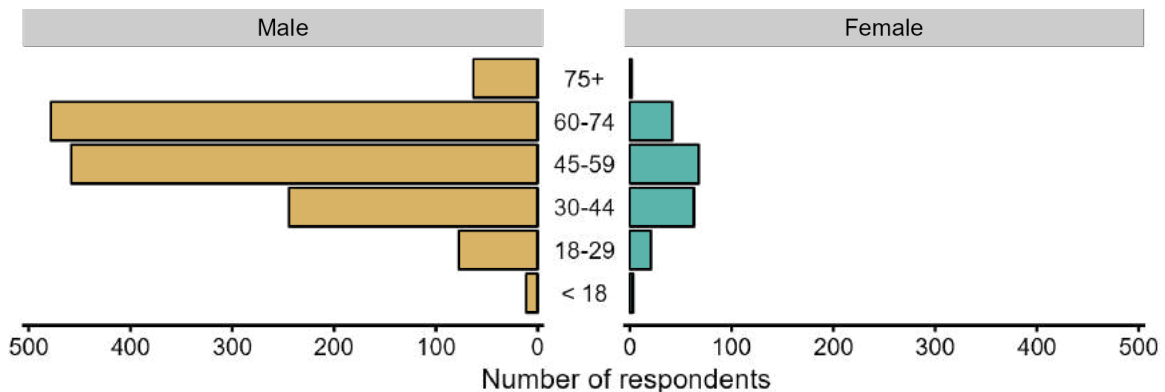


Figure 2. Gender and age group profile of survey respondents ( $n = 1,402$ , with 6 reporting 'other' for gender). Vertical axis numbers represent age groups.

To determine the representativeness of respondents to the FFS compared to all Tasmanian recreational fishers, their age and gender, as well as avidity (see section 4.1.3.1) were compared with the calibrated demographic profiles presented in the 2017/18 Statewide recreational fishing survey (Lyle et al. 2019). The Statewide survey represents the cross-section of the recreational fishing sector due to its probabilistic design. The FFS respondents however may not be representative of the broader cross-section of Tasmanian fishers because a) those recruited from the RFS were typically the 'main' fisher in the household and likely to be more avid than the broader recreational fishing population, and b) online respondents were self-selected and are therefore likely to be biased towards being more invested in the fishery.

There was a significant difference between both the age (Kolmogorov-Smirnov test  $D = 0.231$ ,  $p < 0.0001$ ) and gender ( $\chi^2 = 273$ ,  $p < 0.01$ ) profiles between the FFS and RFS surveys (Figure 3). In view of categorical age and gender survey comparisons in Figure 3, respondents to the flathead survey comprised proportionally fewer females and a far greater proportion of older age groups, most notably a substantially smaller representation of fishers under the age of 30.

These results suggest that younger fishers and females are under-represented in this study, and results throughout this report should be considered accordingly.

## SURVEY OF RECREATIONAL FISHERS IN TASMANIA WITH A FOCUS ON SAND FLATHEAD

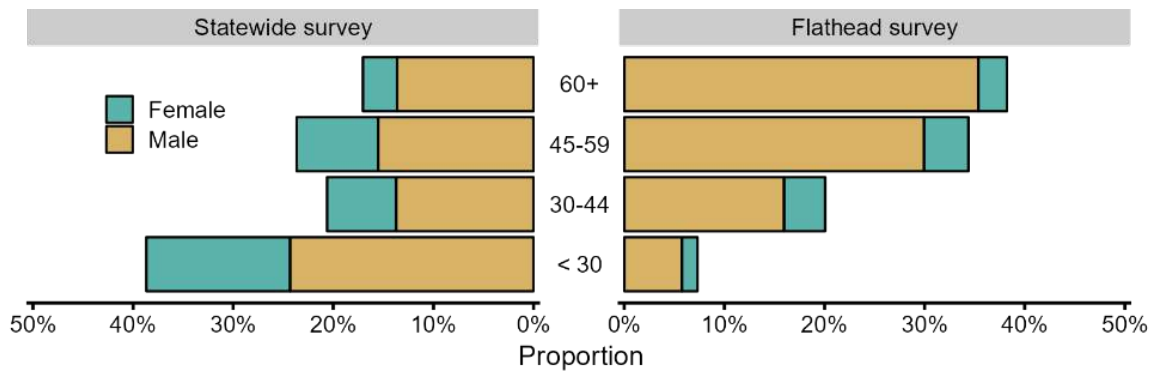


Figure 3. Gender and age group of survey respondents comparing between the 2017/18 statewide survey (Lyle et al. 2019) and the flathead focus survey. Vertical axis numbers represent age groups.

### 4.1.1.2 Education profile

Respondents were asked to indicate their highest level of education (Figure 4). Almost two-thirds reported completing Year 12 or above. Approximately 30% indicated completing Year 10 or above and approximately 5% indicated completing year 9 or less. There was no significant difference in the proportional response profile between the survey collection modes (KS:  $D = 0.667$ ,  $p = 0.6$ ).

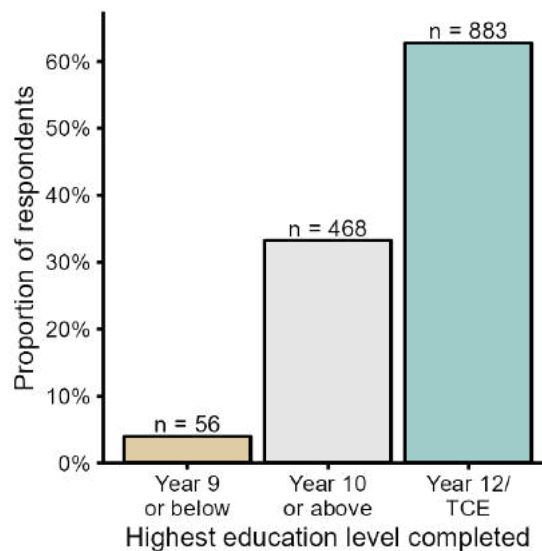


Figure 4. Education profile of survey respondents ( $n = 1,407$ , one respondent reported as 'Unsure').

### 4.1.2 Fishery literacy

Among respondents that estimated the proportion of sand flathead catch taken by the recreational and commercial sectors in response to Q18 ( $n = 1,091$ ), only 9% of respondents estimated the commercial share of total Sand Flathead catch in Tasmania was less than 10% (i.e., fairly accurate relative to the known value of 2% proportion of catch attributed to the commercial sector). Approximately equal numbers (23–28%) of responses indicated that the commercial share was: < 20%, 20 to 39%, 40 to 69%, or 70–100% (Figure 5). Based on the accuracy (i.e., difference from 2%) of responses in each of these quartiles, respondents in each were assigned fishery literacy ratings of "High", "Medium", "Low", and "Poor", respectively (Figure 5). A similar proportion of respondents reported they were "Unsure" ( $n = 340$ ; Figure 5). The high proportion of inaccurate or 'unsure' responses presumably indicates poor communication or acceptance of evidence-based information regarding the Sand Flathead fishery. Understanding the role of the recreational sector in the decline of the fishery is a critical

prerequisite for fisher accountability, including acceptance of an appropriate management response.

The results indicate a need for significant efforts by managers, researchers, and key stakeholders to provide clear and reliable information accessible to, and that can be understood and accepted by recreational fishers.

There was not a significant difference between the fishery literacy scores depending on survey mode ( $D = 0.03, p = 1$ ), however, a higher proportion of those reporting through the telephone survey responded that they were 'UNSURE' rather than providing an estimate.

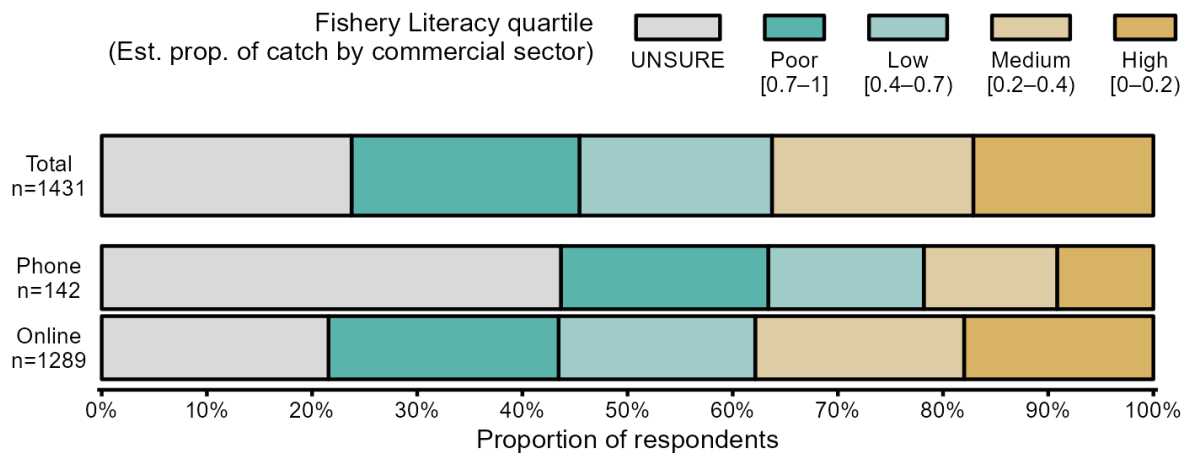


Figure 5. Quartile ranking of fishery literacy relating to the Sand Flathead fishery in Tasmania ( $n = 1,091, 340$  respondents reported as 'Unsure').

#### 4.1.2.1 Species identification

A high proportion (92%) of respondents indicated they were confident in distinguishing a Sand Flathead from a Tiger Flathead *Platycephalus richardsoni* (Figure 6). Online respondents reported a higher degree of confidence (94%) than respondents recruited through the Statewide survey (75%) ( $p < 0.001$ ). Females, 30–44 relative to 60–74 year olds, those with less years' experience fishing for Sand Flathead, those with a higher level of education, *Inshore Fishers* (including the *inshore and freshwater profile*) and *Casual anglers* relative to *Sport anglers* and *Community anglers* were all significantly less confident in identifying the two species (Figure 66). These Psychographic identifiers are described in Section 4.1.5.

The self-reported high degree of certainty reported in this study mirrors the results obtained from boat ramp surveys, where both Sand Flathead and Tiger Flathead were identified with a high degree of accuracy (Lyle and Campbell 1999, Lyle et al. 2002).

There is anecdotal evidence from face-to-face engagements with fishers that the ability to distinguish Sand Flathead from other species, in particular Bluespotted Flathead may not be as high. Future engagement work should look to further test species identification and design communication material to assist in developing the knowledge base of recreational fishers. This is particularly relevant as species identification is a key component of remaining compliant to current fisheries management regulations relating to species specific catch limits.

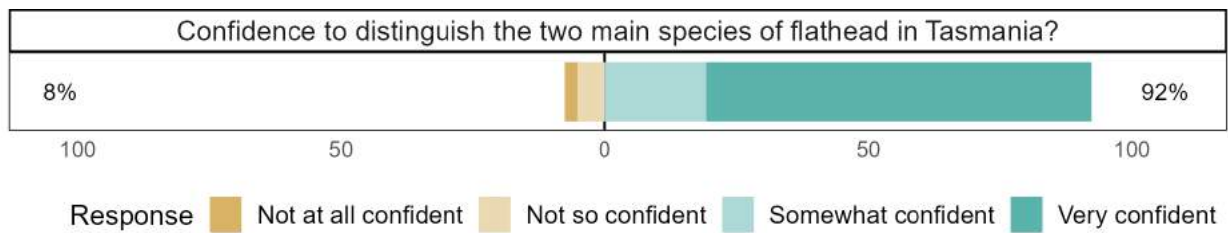


Figure 6. Percentage of responses indicating the confidence of respondents to identify a Sand Flathead vs a Tiger Flathead (n = 1,453, 4 reported a response of 'unsure' and 5 responded "I didn't know there were different species").

### 4.1.3 Behavioural (fishing) segmentation

#### 4.1.3.1 Recreational fishing avidity

Avidity was measured by the number of days a respondent fished within 12 months prior to the survey. Forty-two percent of respondents reported fishing (any kind) on 20 or more days, which was considered to be highly avid (Figure 7). There was a relatively even distribution of responses for the remaining four (less avid) avidity categories of between 12% and 17% (Figure 7).

There was a significant difference (KS:  $D = 0.215$ ,  $p < 0.0001$ ) in the proportional avidity profiles of respondents to the FFS compared with the 2017/18 Statewide recreational fishing survey (Lyle et al. 2019). Respondents in the FFS survey were notably more prevalent in the higher avidity categories, particularly those who engaged in fishing for 20 days or more (Figure 7). This indicates that the FFS results are skewed towards people that spend more time fishing (high avidity) than the broader Tasmanian recreational fishing sector. Consideration is therefore required that those that fish less frequently are under-represented in the results.

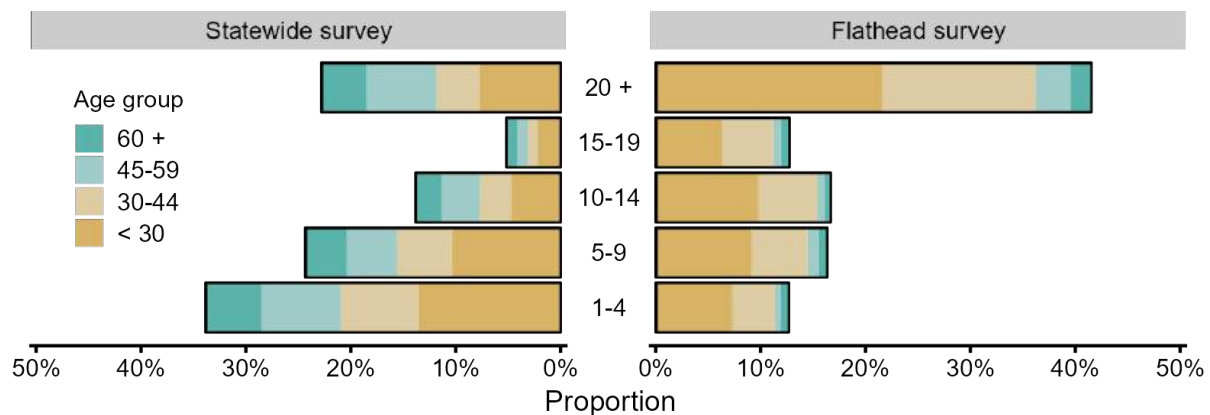


Figure 7. The number of days fishing by survey respondents comparing between the 2017/18 statewide survey (Lyle et al. 2019) and the flathead focus survey (n = 1,533, four respondents reported as 'Unsure'). Vertical axis numbers represent the number of days fished as groupings, i.e., 1–4 days fished in the 12-month preceding the survey. The legend colours represent the age groups within each avidity grouping.

#### 4.1.3.2 Years of experience fishing for flathead

Respondents were asked how many years' experience they had fishing for flathead (all species). Most respondents (78%) indicated more than 20 years while the remaining 22% were spread fairly evenly across the four lesser categories (Figure 8). There was no significant difference in proportional response profiles between the online and telephone survey modes (KS:  $D = 0.8$ ,  $p = 0.08$ ).

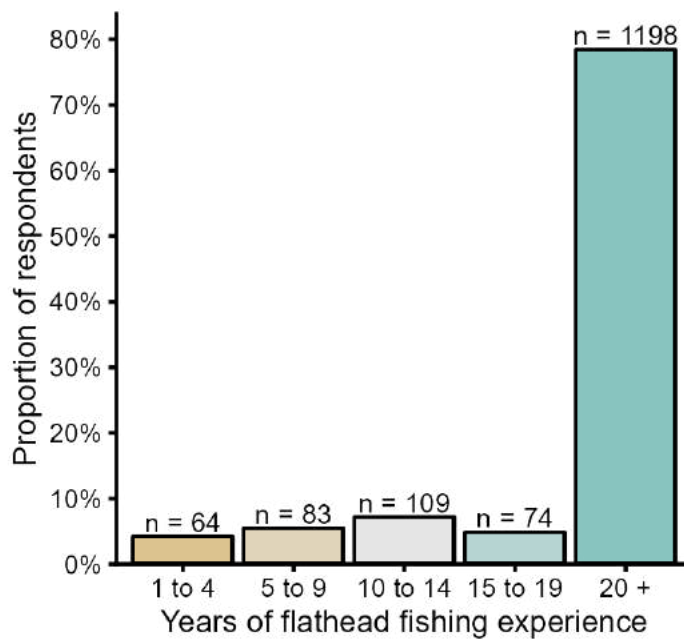


Figure 8. Experience flathead fishing profiles for survey respondents shown as proportional distribution across five sample bins (n = 1,445).

#### 4.1.3.3 Flathead fishing avidity

Twenty-nine percent of respondents reported fishing for flathead on 20 or more days in the 12 months before being surveyed (Figure 9). Of the remainder, 38% reported flathead fishing less than 10 days and 33% more than 10 days (Figure 9). This indicates that recreational fishers who target Sand Flathead were dominant in the survey response profile.

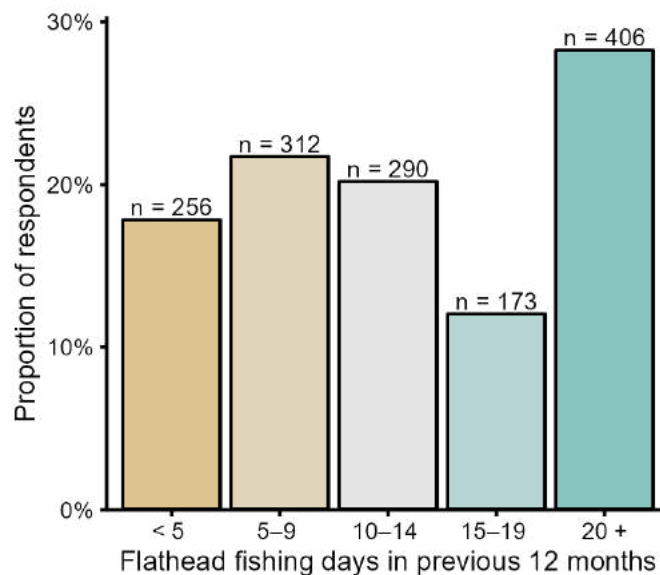


Figure 9. The number of days fishing for flathead by survey respondents shown as proportional distribution across five sample bins (n = 1,437).

#### 4.1.4 Centrality of recreational fishing

##### 4.1.4.1 Centrality of fishing to lifestyle

When asked how important fishing was compared to other hobbies, activities, or sports, over 80% of respondents indicated that recreational fishing was important to extremely important, based on response scores greater than 5. Thirty-two percent reported that it was their most important activity (Figure 10).

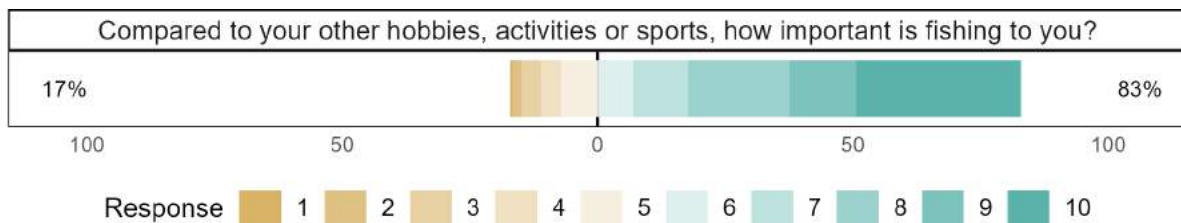


Figure 10. The centrality of fishing to the lifestyle of respondents compared to their other hobbies, activities, or sports (n = 1,321).

Online survey participants were significantly (KS test  $D = -0.23$ ,  $p < 0.001$ ) more likely to rank recreational fishing of higher importance (84% scoring greater than 5) than the telephone survey participants (73% scoring greater than 5).

Male, highly avid fishers, and those with a lower level of education as well as the *Influencer* Eudemonic profile reported fishing to be more central to their lifestyle. For modality profiles, *Inshore Fishers* and *Inshore Fishers & Divers* were more likely to rate recreational fishing as less central to their lifestyle than *Casual* and *Independent Anglers* (Appendix 1: Figure 67).

#### 4.1.4.2 Centrality of Sand Flathead to overall fishing experience

When asked how important fishing for Sand Flathead was compared with fishing for other species, three out of four respondents indicated an importance score of greater than five (Figure 11). This indicates that Sand Flathead are an important species to target for most respondents, with *most important* (10) being the most frequent response (28% of respondents). The centrality of flathead is further supported by the majority of respondents giving it their highest importance rating for both catching and eating among the species-specific questions (Q39–Q53 & Q55–Q69; see section 4.7).

Sand Flathead were significantly less central to the overall fishing experience compared to other species of less avid fishers and those with a shorter history of targeting flathead. *Inshore Fisher* and *Marine Generalists* rated Sand Flathead significantly higher in terms of centrality relative to other species in their overall fishing experience than *Generalists* did. Similarly, the *Balanced* eudemonic profile was more likely to rate Sand Flathead as more central than the *Influencer* and *Collaborator* profiles and for the *Community* motivated anglers relative to the *Casual* or *Leisure* anglers. *Harvest-* relative to *Recreation-oriented* Sand Flathead fishers were also more likely to rate Sand Flathead highly relative to fishing for other species (Appendix 1: Figure 68).

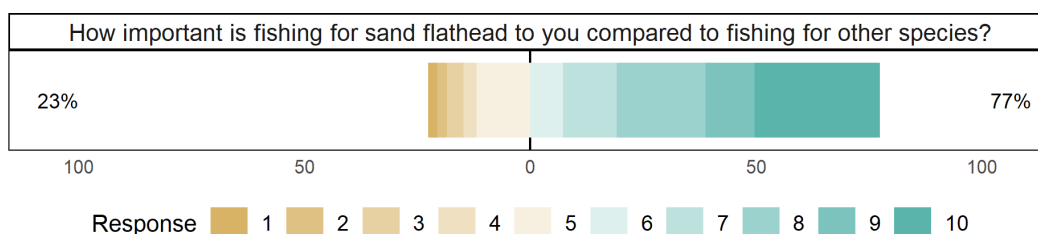


Figure 11. Respondent answer to a question relating to the centrality of Sand Flathead to their recreational fishing experience (n = 1,390).

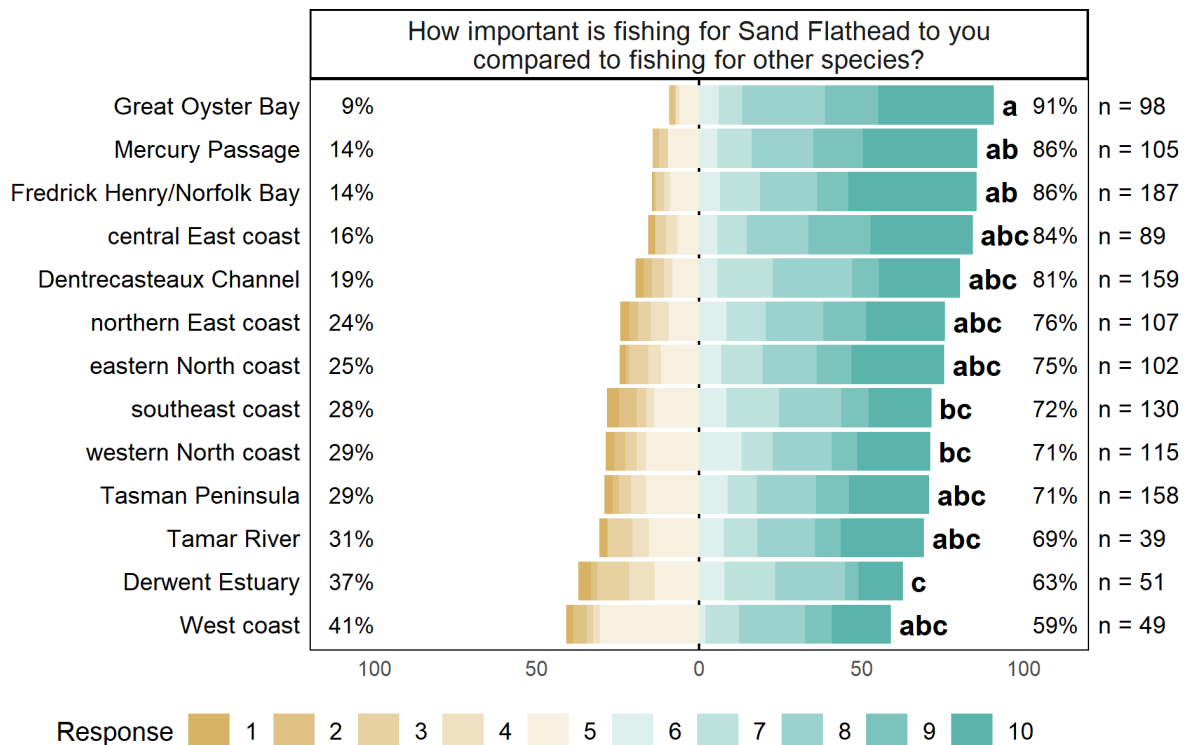


Figure 12. How important are Sand Flathead to the overall fishing experience of respondents by the main region they fish for Sand Flathead.

Sand Flathead were an important species for respondents who predominantly fish for the species in areas popular for recreational fishing including Great Oyster, Mercury Passage and Fredrick Henry and Norfolk Bays as well as the east coast in general (Figure 12). Sand Flathead were less important compared with other target species for those fishing the West coast, the Derwent Estuary and Tamar River (Figure 12).

Just under half of the respondents agreed with the statement “if I couldn’t catch Sand Flathead I would go fishing less” (Figure 13). There were no significant differences among responses to this question across any of the segmentation factors assessed (Appendix 1: Figure 69). There was, however, a significant negative correlation (Spearman’s  $\rho = -0.28, p < 0.001$ ) between responses to this question and the previous (“How important is fishing for Sand Flathead...”), indicating the more important Sand Flathead was considered relative to other species, the less likely respondents were to agree that they would fish less if they could not catch Sand Flathead.

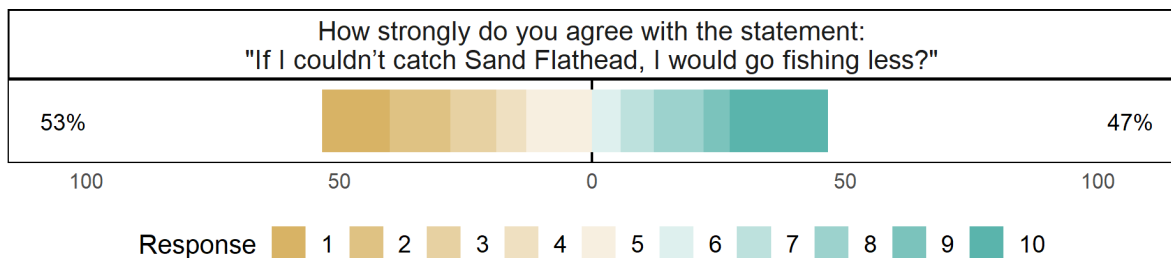


Figure 13. Respondent answers to questions relating to whether they would go fishing less if they couldn’t catch Sand Flathead (n = 1,390).

By region fished, the strongest responses for a reduction in fishing if Sand Flathead could not be caught came from waterways closest to major metropolitan areas, including the Tamar River and the Derwent Estuary (Figure 14). The lowest responses were mainly from east and north coast regions except for the northern East coast. There was a significant difference between

some of the regions, particularly Mercury Passage where fishers were less likely to reduce their fishing than other regions (Figure 14).

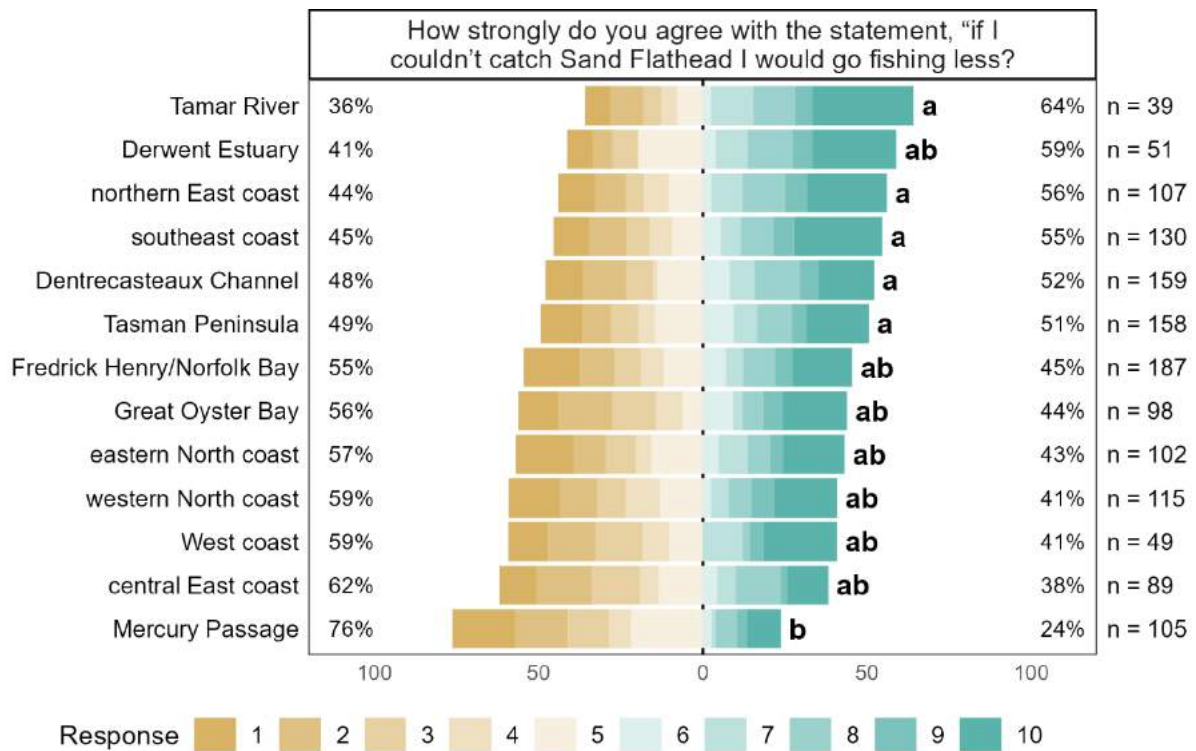


Figure 14. Respondent thoughts on whether they would go fishing less if they couldn't catch Sand Flathead.

#### 4.1.4.3 Fishing platform

Eighty-eight percent of respondents indicated that they fished either exclusively, predominantly, or mainly from a boat, while 9% indicated they fished either exclusively, predominantly, or mainly from the shore. The remaining 3% indicated fishing 'equally from both boat and shore' (Figure 15). There was a significant difference in fishing platform between the survey collection methods (KS:  $D = 0.211, p < 0.01$ ), a higher proportion reported fishing from shore exclusively in the phone survey. Therefore, some consideration of an under-representation of shore-based fishers is required when interpreting results.

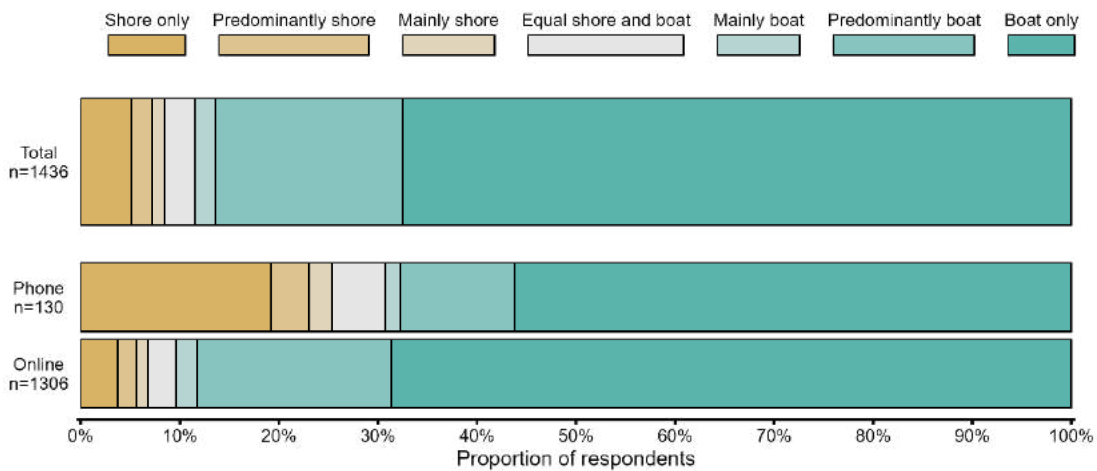


Figure 15. Platform respondents' fish for flathead from profiles (n = 1,436).

### 4.1.5 Psychographic segmentation

#### 4.1.5.1 Eudemonic profiling

Responses indicated a high level of alignment with all biospheric and altruistic statements. The responses to the three egoistic statements were polarised (Figure 16).

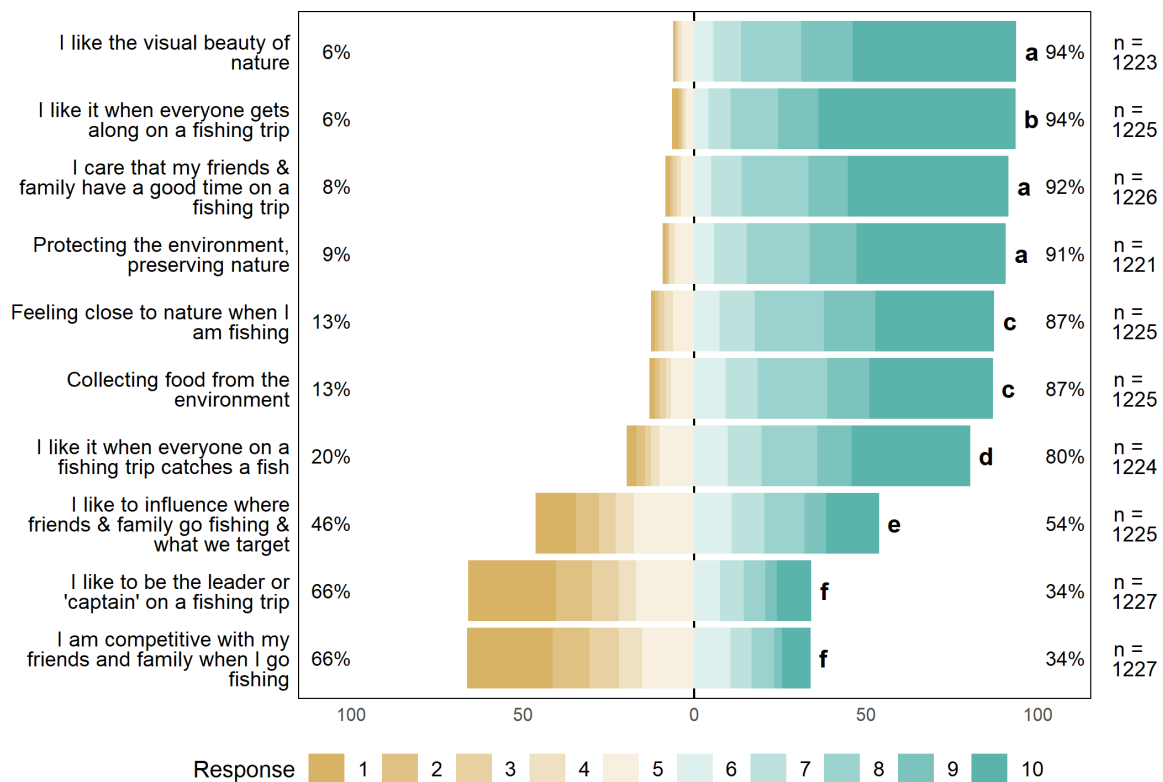
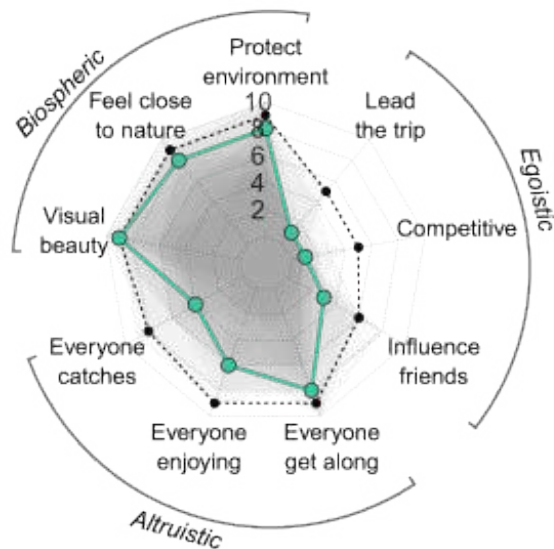


Figure 16. Response profiles to proposition statements to elicit a respondent profile related to bio-spheric, altruistic and egoistic values.

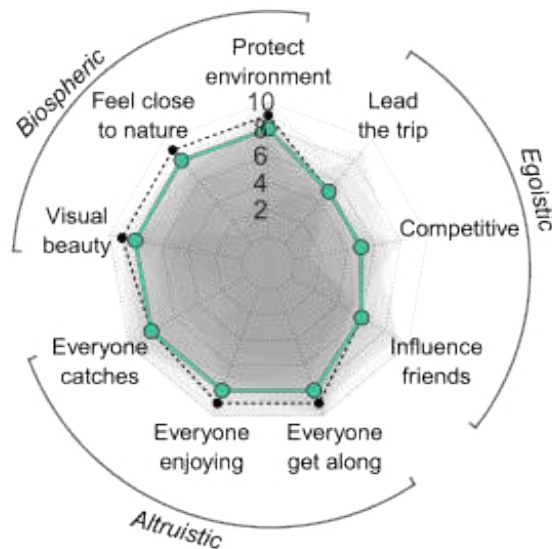
#### 4.1.5.2 Eudemonic cluster segments

The most typical eudemonic profile (medoid) of all respondents was characterised by high affinity to biospheric values (ranking scores of 9 or 10 for each of the three biospheric questions), high affinity to the altruistic values (ranking scores of 8 or 9 for each of the three altruistic questions) and a medium affinity to the egoistic values (ranking scores between 4 and 6 for each of the egoistic questions) represented by the black dashed line in Figure 17).

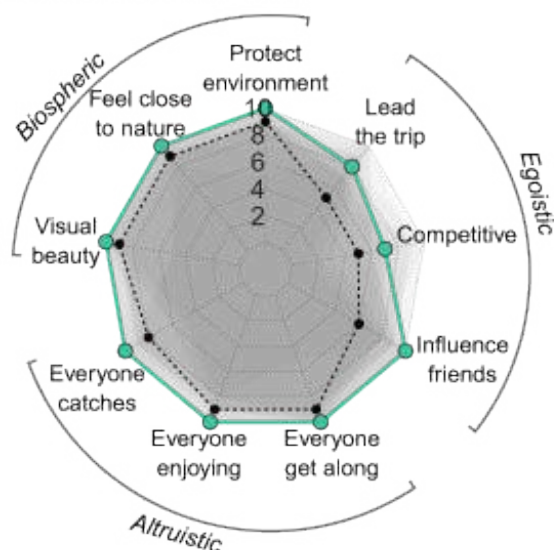
**A. Easy-going (n = 209)**



**B. Balanced (n = 389)**



**C. Influencer (n = 275)**



**D. Collaborator (n = 341)**

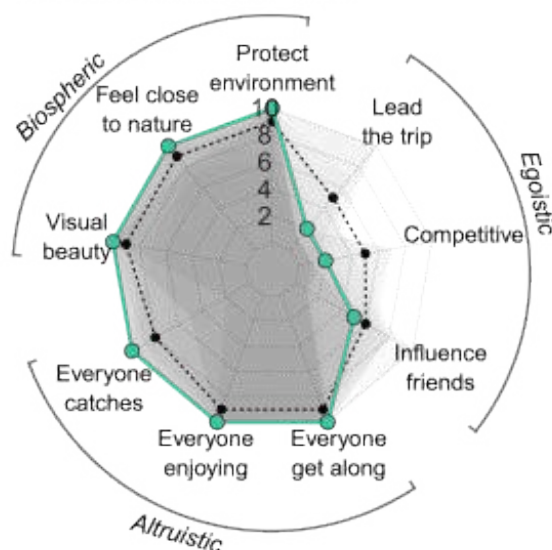


Figure 17. Profiles of the four eudemonic groups identified through cluster analysis of responses to Q99 – 108 (Appendix 2), characterised by the most-representative respondent (or ‘medoid’; green line). The black dotted line indicates the medoid of all respondents when not partitioned into groups. These questions ask respondents to rate the degree to which they find personal alignment with different human values (three in each of three eudemonic categories, in italics). A random selection of 50 respondents in each group are depicted by shaded polygons to illustrate intra-group variation.

Cluster analysis of the Eudemonic profiling questions identified four unique groupings (Appendix 4: Figure 112). We have defined these segments as (A) ‘Easy-going’, (B) ‘Balanced’, (C) ‘Influencer’, and (D) ‘Collaborator’. The *Balanced* and *Collaborator* segments represent 32% and 28 percent of respondents respectively, and the *Easy-going* and *Influencer* segments accounted for 23% and 17% (Figure 17).

**Eudemonic cluster profile A: Easy-going**

The *Easy-going* profile was characterised by similar biospheric values to the medoid of all respondents but reported far lower alignment to altruistic and egoistic values except for the response to the altruistic question “Everyone getting along on a trip” (Figure 17). In general, the *Easy-going* profile was less likely to report high alignment with biospheric values than the other three profiles and less likely to report high alignment with altruistic and egoistic values as the other profiles (with the exception that they had a similar disinterest in “leading a trip” as

the *Collaborator* profile (Figure 18). *Easy-going* fishers were more likely to be female and less likely to be avid than *Balanced* or *Influencer* fishers (Figure 19).

#### **Eudemonic cluster profile B: *Balanced***

The *Balanced* fishers were characterised by similar values for all three eudemonic attributes to the medoid of all respondents (Figure 17). *Balanced* fishers were more likely to report greater alignment for two of the three biospheric questions than *Easy-going* fishers, but less likely to be highly aligned to biospheric values than both the *Influencer* and *Collaborator* profiles. Their altruistic alignment was greater than the *Easy-going* fishers but less than the other two profiles. Their altruistic alignment was less than the *Influencers* and greater than the *Easy-going* and *Collaborator* profiles (Figure 18). Members of the *Balanced* profile were less likely to be female than the *Easy-going* and *Collaborator* profiles. Further, they were more likely to be more avid fisher than the *Easy-going* profile and less likely to be as avid as the *Influencer* profile (Figure 19).

#### **Eudemonic cluster profile C: *Influencer***

The *Influence* profile was characterised by higher attribution to all three eudemonic components than the medoid of all respondents (Figure 17). The biospheric and altruistic responses of the *Influencer* profile were more likely to be highly aligned than both the *Easy-going* and *Balanced* profiles, like the *Collaborator* profile. Their egoistic alignment was significantly greater than that of all other profiles (Figure 18). Members of the *Influencer* profile were more likely to be male than the *Easy-going* and *Collaborator* profiles and more likely to be more avid than the other three Eudemonic profiles (Figure 19).

#### **Eudemonic cluster profile D: *Collaborator***

Like the *Influencers*, *Collaborators* were characterised by greater alignment to both biospheric and altruistic eudemonic values relative to the medoid of all respondents, but with a far lower alignment to egoistic values (Figure 17). The biospheric and altruistic responses of the *Collaborator* profile were more likely to report greater alignment than either the *Easy-going* or *Balanced* profiles, like the *Influencer* profile. Their egoistic alignment was less than the *Influencer* and *Balanced* profiles but greater than the *Easy-going* profile for two of the three egoistic questions (Figure 18). Members of the *Collaborator* profile were more likely to be female than the *Balanced* and *Influencer* profiles, and less likely to be as avid as the *Influencer* profile (Figure 19).

SURVEY OF RECREATIONAL FISHERS IN TASMANIA WITH A FOCUS ON SAND FLATHEAD

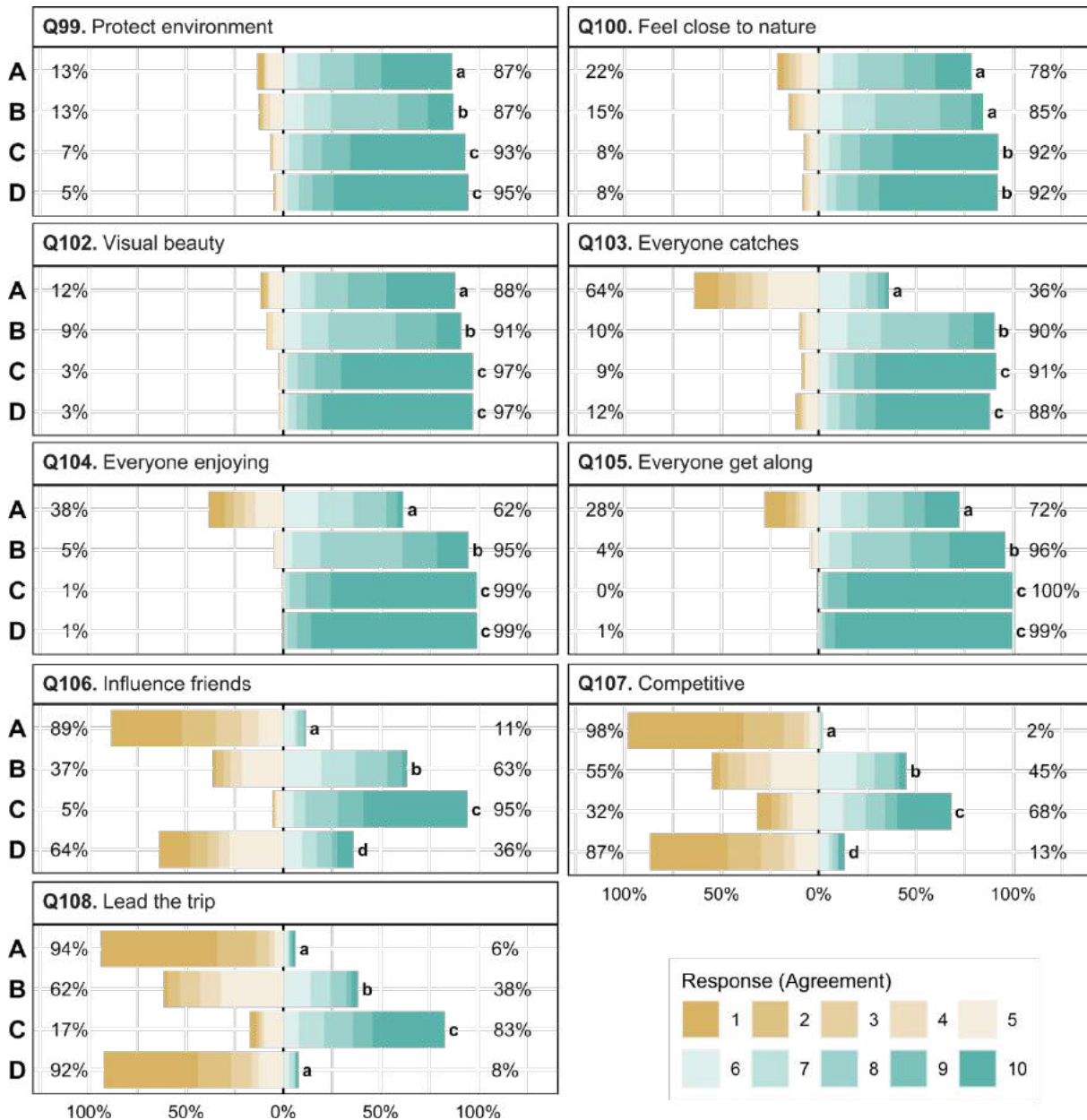


Figure 18. Responses to questions regarding eudemonic values ( $n = 1,214$ ), stratified by the Eudemonic profiles identified through cluster analysis of the response data (y axis; A: 'Easy-going'; B: 'Balanced'; C: 'Influencer'; D: 'Collaborator' on each panel correspond to the labels in Figure 17).

SURVEY OF RECREATIONAL FISHERS IN TASMANIA WITH A FOCUS ON SAND FLATHEAD

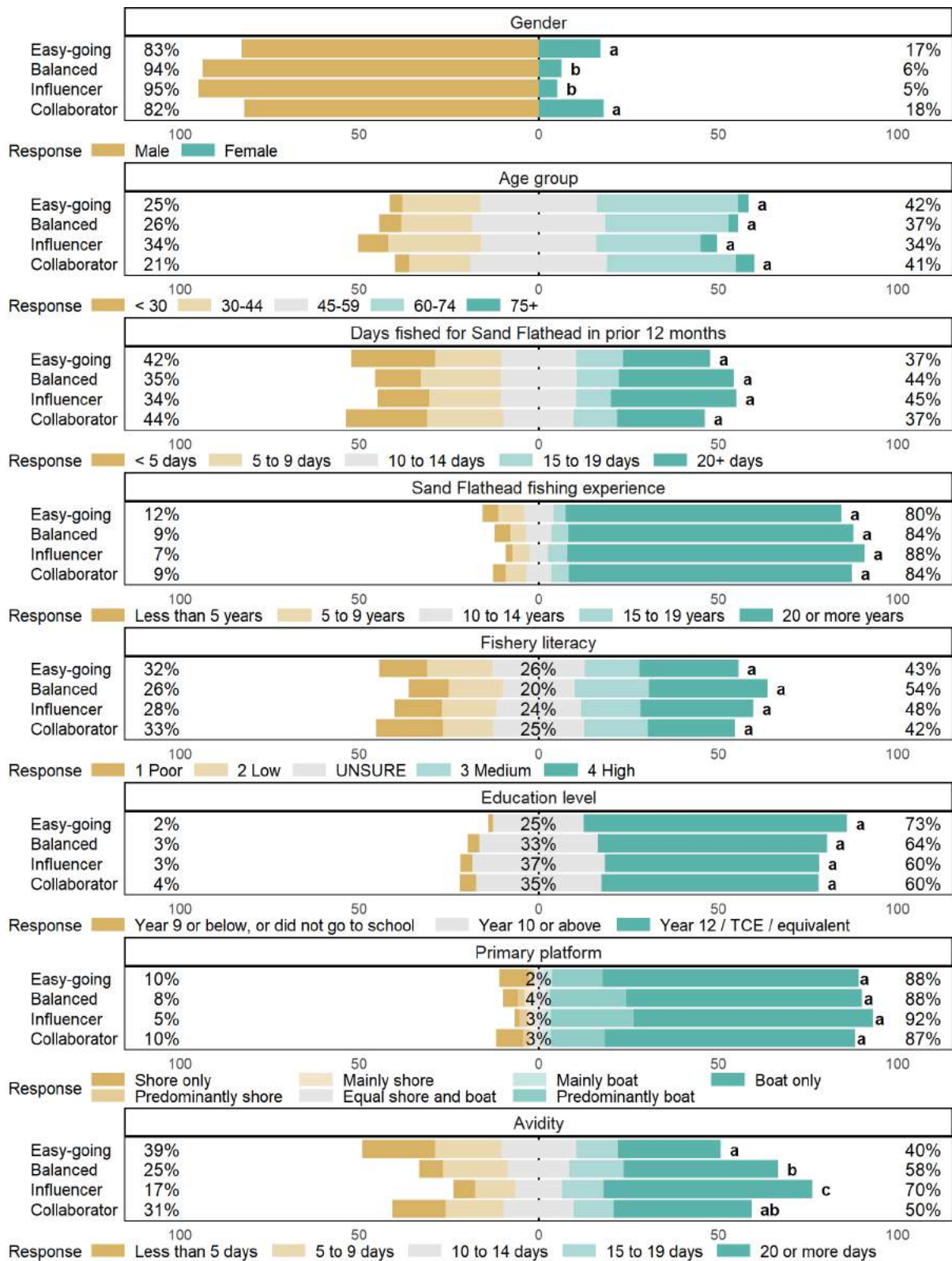


Figure 19. Comparison of demographic and recreational fishing profiles of eudemonic clusters. Groups that share a letter were not statistically significantly different.

4.1.5.3 Fishing motivation profiling

Most respondents indicated that all the reasons to fish were quite or very important, except for trophy and competition fishing (Figure 20). This indicates motivations to participate in recreational fishing for flathead are multi-faceted. The top two ranked fishing motivations were non-catch related, with the top ranked “to be outdoors...in the fresh air...to enjoy nature”,

ranked significantly higher than any other motivator. The third ranked “to catch fresh fish for food” was the only catch motivated response ranked in the top five (Figure 20). The top four ranked motivations were all reported to be *very important* by most respondents.

“Fishing for me is about the family outing.”

The lowest ranked motivations were related to competition or trophy fishing and were not important to most respondents (Figure 20).

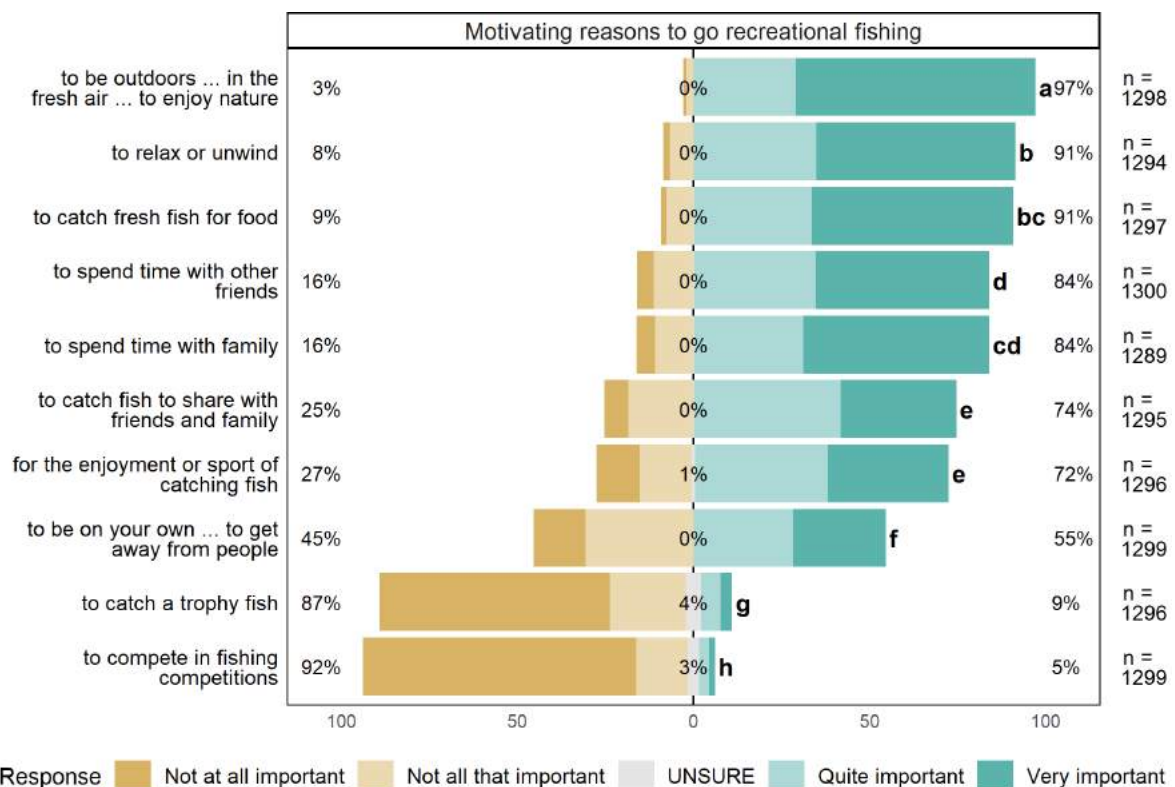


Figure 20. Respondent answer profile to a range of questions on what motivates them to go recreational fishing.

#### 4.1.5.4 Fishing motivation cluster segments

The most typical fishing motivation profile (medoid) of all respondents was characterised by all non-catch related motivations identified as *Quite important*, except for the question related to being *Out in nature* which was identified as *Very important*. There was also strong affinity to three of five catch orientated motivations, including *Catching fish for food*, *The sport of catching fish* and *Sharing catch with family and friends*. Fishing for competition or trophies did not rate as a motivator (represented by the black dashed line in Figure 21).

Cluster analysis of the fishing motivation profiling questions identified five unique groupings (Appendix 4: Figure 111). We have defined these segments as (A) *Casual anglers*, (B) *Sport anglers*, (C) *Leisure anglers*, (D) *Community anglers*, and (E) *Independent anglers*. Respondents were reasonably balanced across clusters A – D, with 21–24% in each, with *Independent anglers* accounting for the remaining 10% (Figure 21).

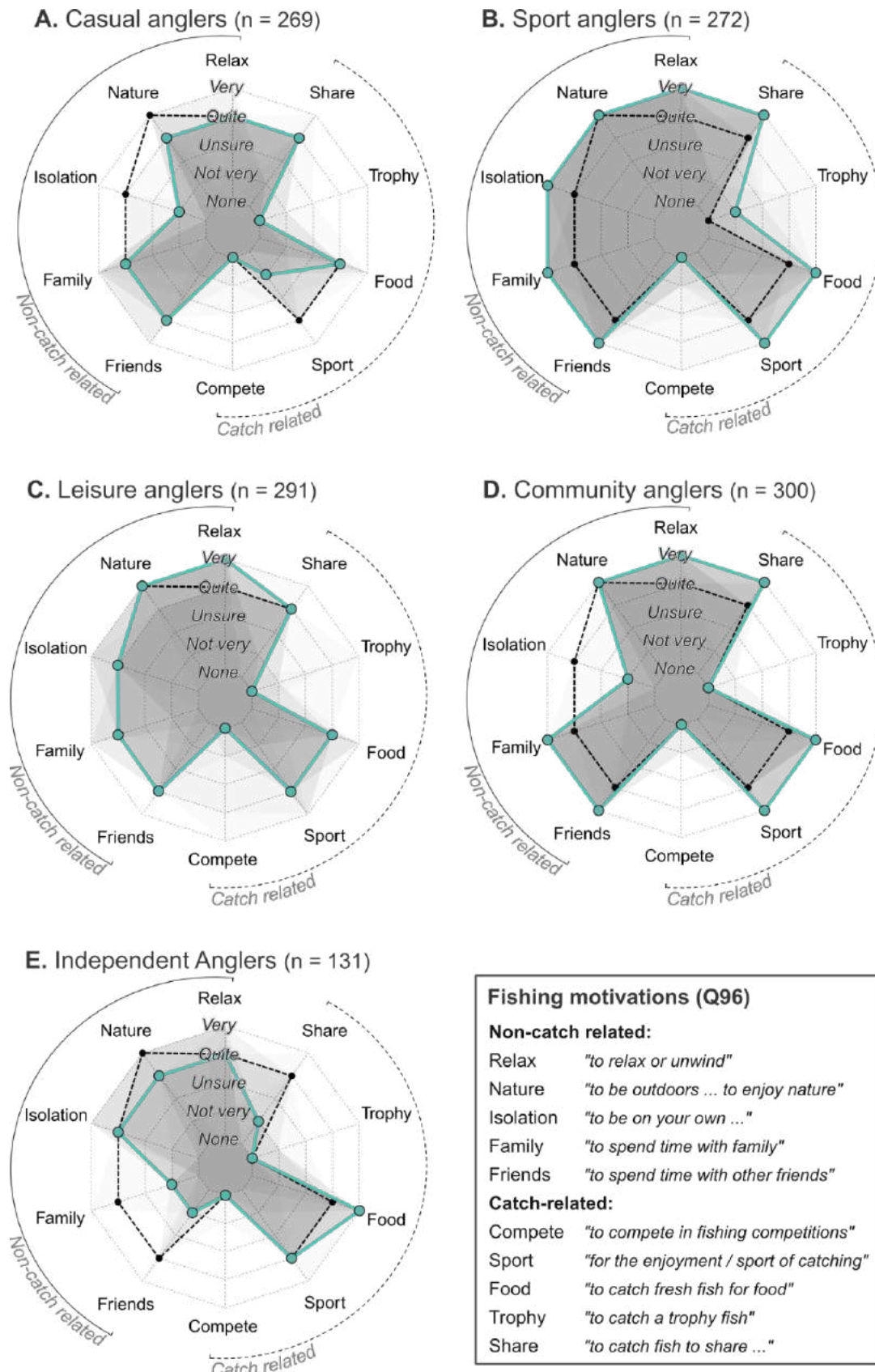


Figure 21. Five fishing motivation profiles identified through cluster analysis of responses to Q96, represented by medoid (most representative respondent; green line) of each. The radial axis represents the level of importance placed on each motivation (italicised labels; note that "Not very" and "None" correspond to responses "Not all that important" and "Not at all important"). The black dotted line indicates the medoid of all respondents (i.e., when not partitioned into clusters) for comparison. Fifty randomly selected respondents in each profile group are depicted by the faint shaded polygons to illustrate variation in each cluster.

SURVEY OF RECREATIONAL FISHERS IN TASMANIA WITH A FOCUS ON SAND FLATHEAD

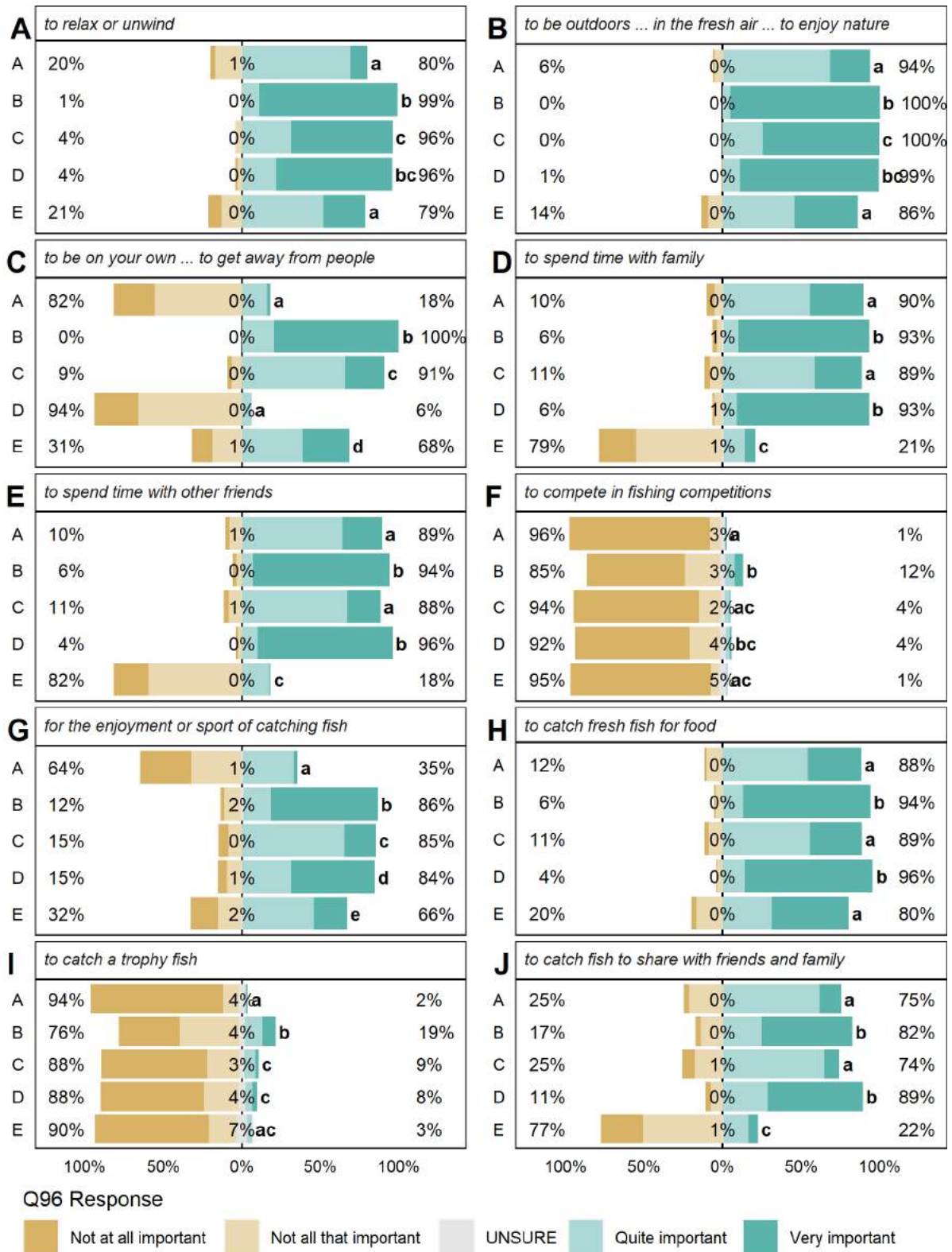


Figure 22. Responses to Q96 sub questions (Importance of motivating reasons to go fishing; n = 1,263), by Fishing Motivation profiles identified through cluster analysis of the response data (y axis; Profiles A-E on each panel correspond to the Profile labels in Figure 21).

**Fishing motivation cluster profile A: Casual anglers**

Casual anglers had a similar degree of motivation from spending time with family and friends as well as catching and sharing fish for food to the medoid of all respondents, but were less motivated by being in nature, the sport of fishing and much less motivated by fishing to be on

their own (Figure 21). There were multiple significant differences between *Casual anglers* and the other fishing motivation cluster groups (Figure 22). The greatest differences were *Casual anglers* being less motivated by both the experience of fishing than all other profiles and fishing to get away from people than all other profiles apart from *Community Anglers*. *Casual anglers* were more likely to be older than *Sport anglers*, have fished less for Sand Flathead in the last 12 months than *Community anglers*, and were less avid than *Sport anglers*, *Leisure anglers*, or *Community anglers* (Figure 23).

#### **Fishing motivation cluster profile B: *Sport anglers***

*Sport anglers* were more highly motivated by all non-catch orientation factors than the medoid of all respondents, as well as catch related motivators including the enjoyment of fishing (sport) and capture of fish for food. They were also the only group to have a higher motivation to catch a fish for trophy or memento than the survey population medoid, although this was still rated as not all that or not at all important by most respondents in this profile (Figure 21). There were multiple significant differences between *Sport anglers* and the other fishing motivation clusters (Figure 22). The greatest differences were being more motivated by getting away from others to fish and competing in fishing competitions and catching a 'trophy' than all other profiles. *Sports anglers* were more likely to be younger than all other motivation profiles and more avid than *Casual anglers*, *Leisure anglers* and *Independent anglers*. (Figure 23).

#### **Fishing motivation cluster profile C: *Leisure anglers***

*Leisure anglers* had a similar profile to the medoid of all respondents, except for being more highly motivated by fishing to relax (Figure 21). There were multiple significant differences between *Leisure anglers* and the other fishing motivation clusters (Figure 22). The greatest difference was being the group second-most motivated by getting away from others to fish. *Leisure anglers* were more likely to be older and less avid than *Sport anglers* but were more avid than *Casual anglers* (Figure 23).

#### **Fishing motivation cluster profile D: *Community anglers***

*Community anglers* were more motivated by spending time with family and friends, relaxing and catching fish both for the experience and for food as well as sharing fish for food than the medoid of all respondents. They were much less motivated by fishing for isolation (Figure 21). There were multiple significant differences between *Community anglers* and the other fishing motivation clusters (Figure 22). The greatest difference was being the least motivated group to fish to get away from other people. *Community anglers* were more likely to be older than *Sport anglers*, fished more for Sand Flathead in the last 12 months, and more avid than *Casual anglers* (Figure 23).

#### **Fishing motivation cluster profile E: *Independent anglers***

*Independent anglers* were less motivated by non-catch factors including spending time with family and friends or in nature. They were also much less motivated by catching fish to share but more motivated by catching fish for food than the medoid of all respondents (Figure 21). There were multiple significant differences between *Independent anglers* and the other fishing motivation clusters (Figure 22). The greatest differences were being the group least motivated by spending time with family, or friends, or to catch fish to share with friends and family than all other groups. *Independent anglers* were more likely to be less avid and older than *Sport anglers* (Figure 23).

SURVEY OF RECREATIONAL FISHERS IN TASMANIA WITH A FOCUS ON SAND FLATHEAD

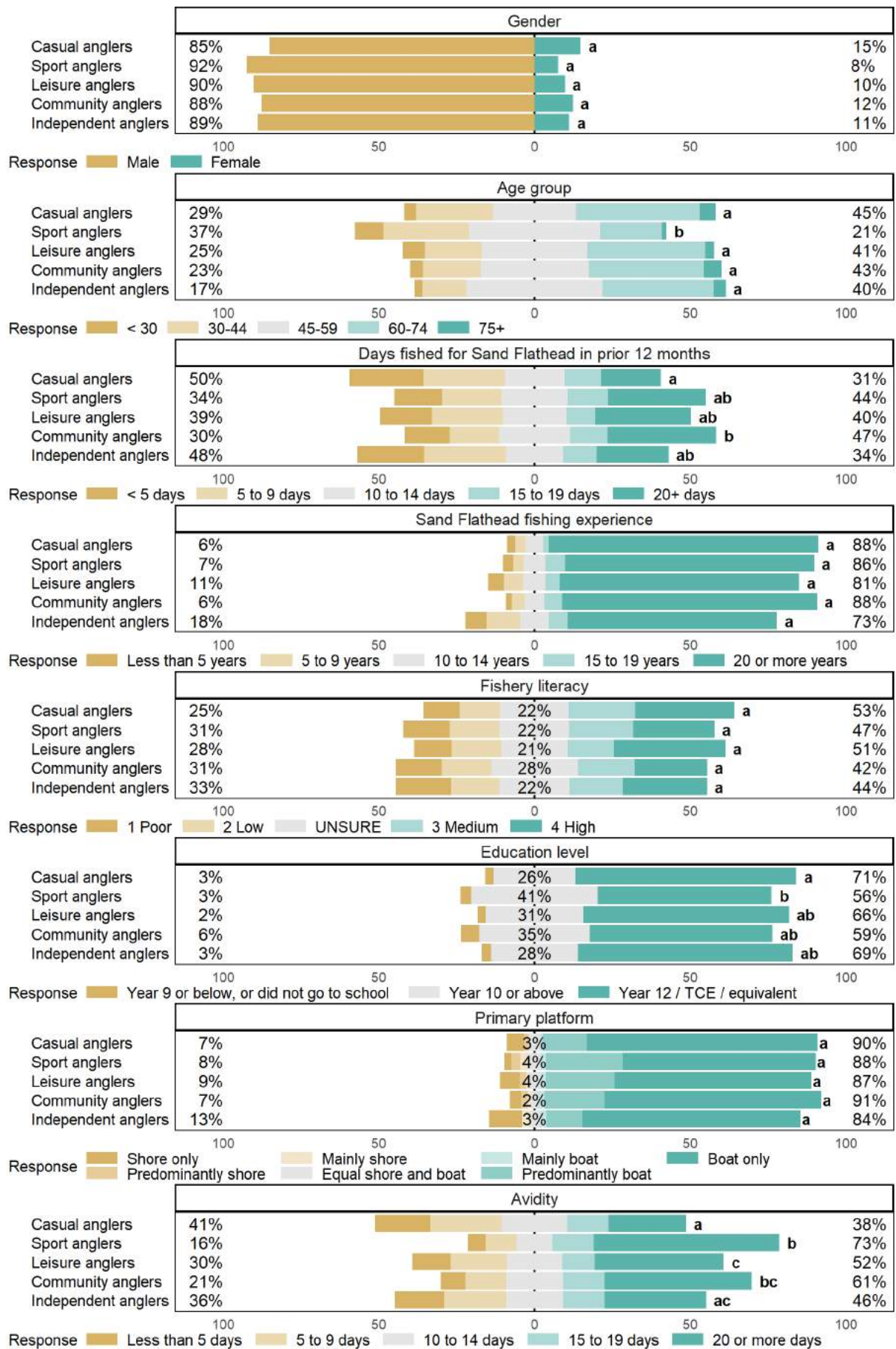


Figure 23. Demographic and recreational fishing question responses stratified by Fishing motivation profiles. Groups that do not share letters are significantly different.

#### 4.1.5.5 Sand Flathead fishing orientation profiling

##### ***Attitudes towards catching any Sand Flathead***

Almost two-thirds of respondents indicated that a fishing trip can still be considered successful even if no Sand Flathead are caught (Figure 24). This supports earlier results identifying that the experience of recreational fishing for Sand Flathead is important. The majority receive benefit from just engaging in the fishing experience.

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*“It’s enjoyable fishing. It’s great to take your grandkids fishing and it needs to be there for future generations to do the same.”*

---

Further supporting the importance of the experiential value of recreational fishing, most non-neutral responses disagreed with the statement ‘*if I thought I wouldn’t catch any Sand Flathead on a trip, I wouldn’t go fishing*’. It is likely the broad value (both experiential and consumptive) attained from other species reported in Section 4.7 also negates the need to no longer participate in recreational fishing. Although, most non-neutral responses indicated that respondents may not go fishing ‘as much’ if they couldn’t catch Sand Flathead (Figure 24).

While there was some support for a closure of the fishery in other sections of this report, responses to Q98 indicates that from most non-neutral responses, respondents would prefer to at least be able to catch some Sand Flathead, indicating that a reduced bag limit rather than a closure would be preferable.

##### ***Attitudes toward catching numbers of Sand Flathead***

Most respondents (83%) agreed that when they fish, they only take enough for a feed, with only 13% agreeing that taking the bag limit was a sign of a good trip (Figure 24). A polarised result was reported for the two statements relating to ‘success’ and ‘happiness’ derived from catching more fish. A slight majority disagreed with these statements, but they were relatively balanced with approximately a third disagreeing, neutral and agreeing.

##### ***Attitudes toward catching large/trophy Sand Flathead***

Three out of five respondents agreed they would prefer to catch one or two larger Sand Flathead than ten smaller fish (Figure 24). Similarly, most non-neutral responses indicated that they prefer to fish where there is a good chance of catching a big fish (Figure 24). Although, there was a polarised response to the question relating to fish size caught to the quality of the trip with slightly more non-neutral respondents (38%) disagreeing with the statement than agreeing (36%). It is likely that this question is confounded by the experiential value of the fishing trip while the previous two statements related to specifically to fish size.

Forty five percent of respondents disagreed with the statement ‘I want to keep all the legal sized Sand Flathead I catch’ and a further 21% were neutral (Figure 24). This indicates some propensity to not take all legal-size fish they catch and may indicate that encouraging voluntary reduction of catch could further reduce fishing mortality.

There are likely several reasons for the preference to catch fewer but larger fish. Given the identification of a strong consumptive value orientation within the Sand Flathead fishery, larger fish provide a higher meat yield relative to smaller fish. Secondly, catching larger fish is

generally perceived as a more enjoyable experience due to the increased challenge and excitement during the interaction with the fish while being retrieved with the fishing equipment, increasing the experiential value of the fishery.

**Attitudes towards retaining Sand Flathead**

The strongest response to the Sand Flathead fishing orientation was towards the consumption of the species. Over nine out of 10 respondents reported that they usually eat the Sand Flathead they catch (Figure 24). The importance of the consumptive value of the species was further supported with most non-neutral responses disagreeing with the statements that they would be just as happy if they didn't keep the Sand Flathead they caught, although the majority of non-neutral responses indicated they did not necessarily want to keep all the legal-size fish caught indicating again scope for voluntary action to further reduce fishing mortality.

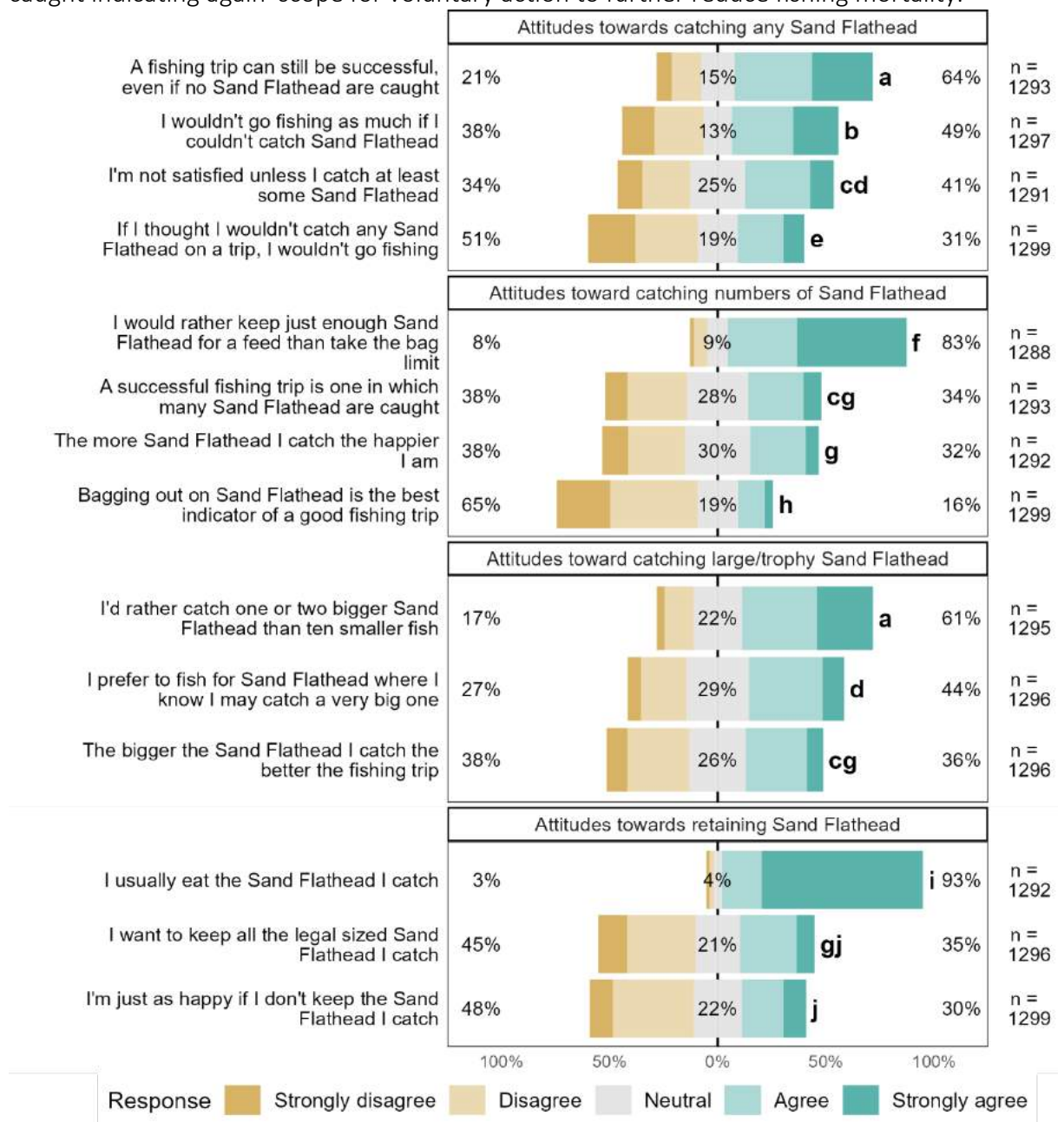
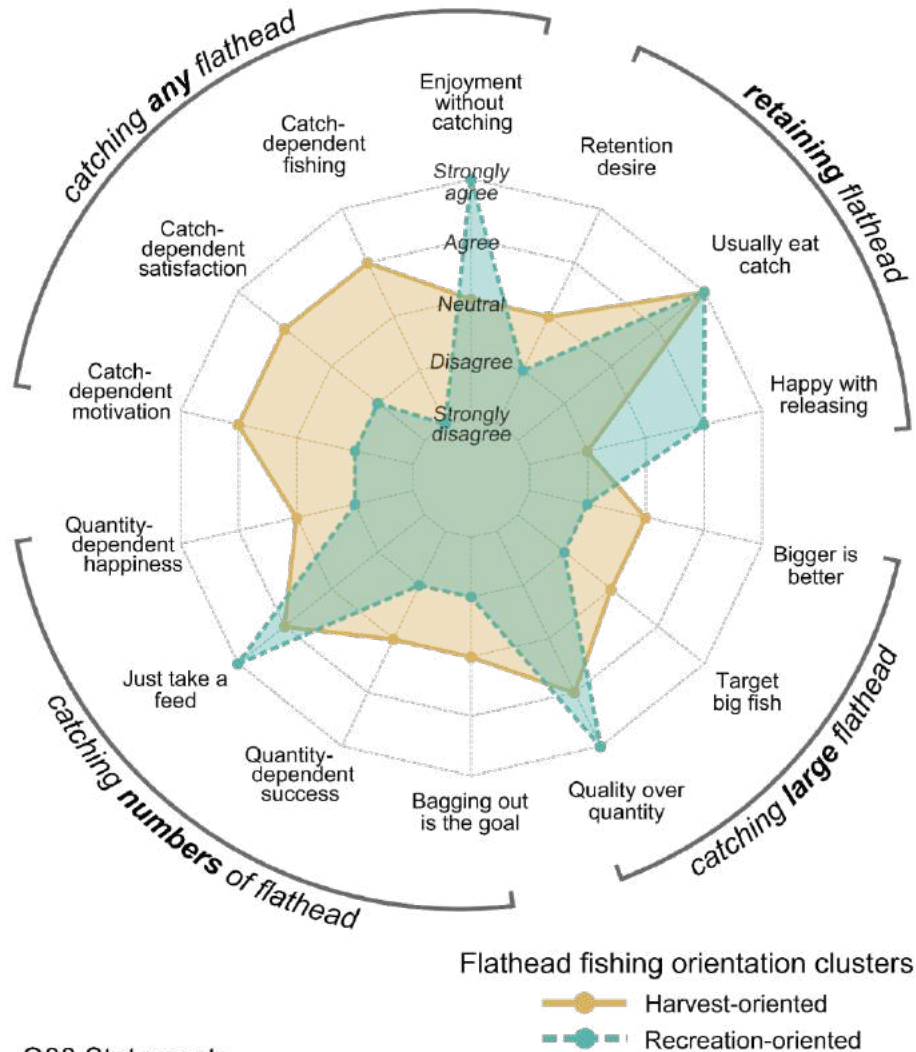


Figure 24. Respondents' attitudes to a range of questions relating to recreationally fishing for Sand Flathead.

4.1.5.6 Sand Flathead fishing orientation cluster segments

Cluster analysis of the Sand Flathead fishing orientation profiling questions identified two unique groupings (Appendix 4: Figure 111). We have defined these segments as (A) *Harvest-orientated* ( $n = 754$ ), and (B) *Recreation-orientated* ( $n = 493$ ) (Figure 25). The majority (60%) were defined as *Harvest-orientated*. Members of the *Harvest-orientated* cluster were more likely to have more years' experience fishing for flathead, fish from a boat and be less avid than those in the *Recreation-orientated* cluster (Figure 27).



**Q98 Statements**

- Catch-dependent fishing** *If I thought I wouldn't catch any Sand Flathead on a trip, I wouldn't go fishing*
- Enjoyment without catching** *A fishing trip can still be successful, even if no Sand Flathead are caught*
- Catch-dependent satisfaction** *I'm not satisfied unless I catch at least some Sand Flathead*
- Catch-dependent motivation** *I wouldn't go fishing as much if I couldn't catch Sand Flathead*
- Quantity-dependent happiness** *The more Sand Flathead I catch the happier I am*
- Quantity-dependent success** *A successful fishing trip is one in which many Sand Flathead are caught*
- Bagging out is the goal** *Bagging out on Sand Flathead is the best indicator of a good fishing trip*
- Just take a feed** *I would rather keep just enough Sand Flathead for a feed than take the bag limit*
- Quality over quantity** *I'd rather catch one or two bigger Sand Flathead than ten smaller fish*
- Bigger is better** *The bigger the Sand Flathead I catch the better the fishing trip*
- Target big fish** *I prefer to fish for Sand Flathead where I know I may catch a very big one*
- Usually eat catch** *I usually eat the Sand Flathead I catch*
- Happy with releasing** *I'm just as happy if I don't keep the Sand Flathead I catch*
- Retention desire** *I want to keep all the legal sized Sand Flathead I catch*

Figure 25. Two Sand Flathead fishing orientation profiles identified through cluster analysis of responses to Q98, represented by medoid (most representative respondent) of each. The radial axis indicates respondent agreement with each orientation statement.

**Differences between Harvest- and Recreation-orientated response profiles**

*Harvest-orientated* respondents were significantly more focused on fishing trips where not only were fish caught, but where many fish were caught, including a preference for taking the bag limit with fish size being less of a motivating factor. Although, they were also significantly more interested in fishing where they are likely to catch bigger fish than *Recreation-orientated respondents*. They were also significantly more likely to want to retain and consume the fish they catch (Figure 25, Figure 26). In summary, they were significantly more driven by the quantity and or size of fish retained.

*Recreation-orientated* respondents were significantly more likely to have less years' experience fishing for flathead, more likely to fish from the shore and be more avid than the *Harvest-orientated respondents* (Figure 27).

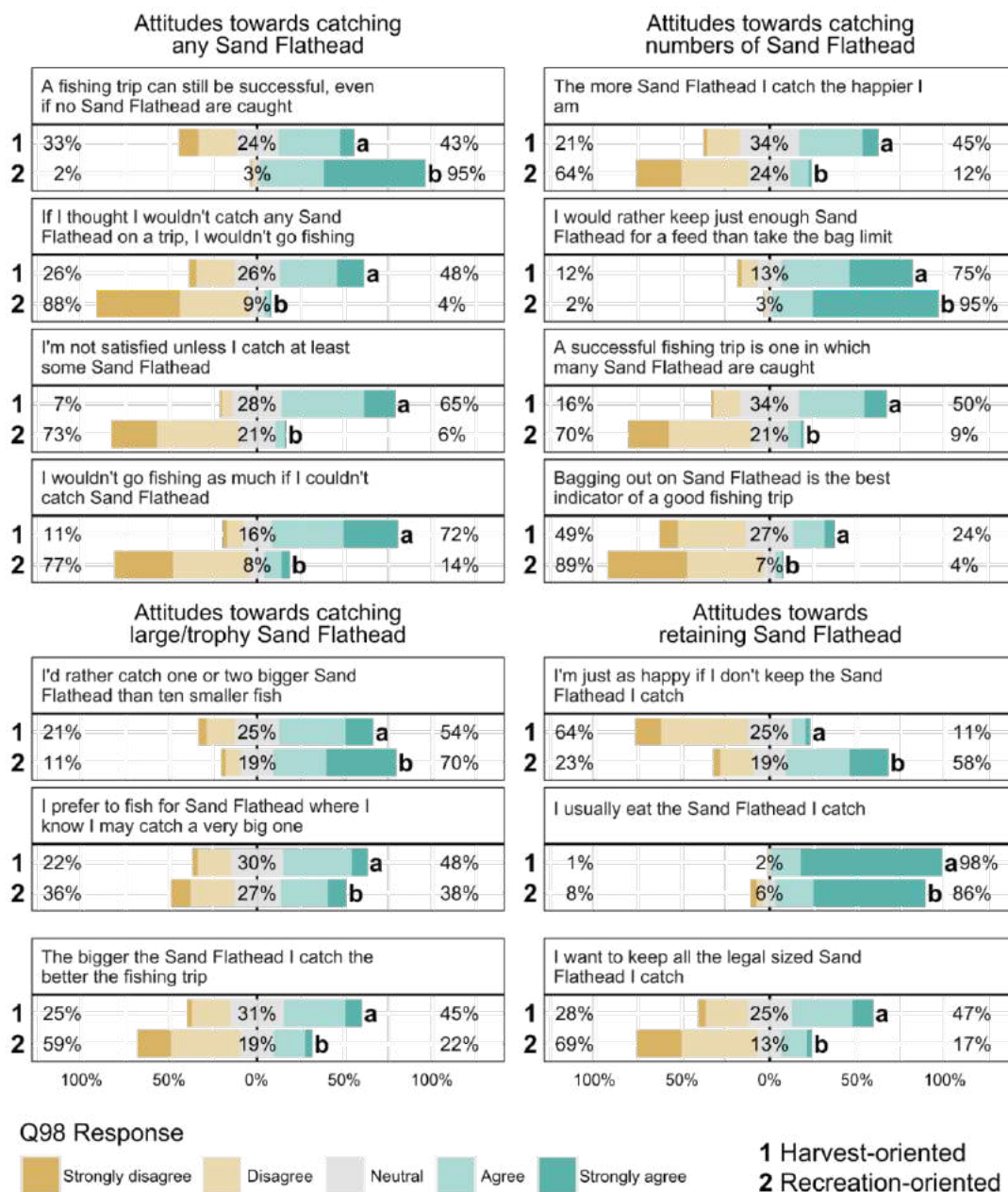


Figure 26. Responses to Q98 sub questions (n = 1,247), by Sand Flathead fishing orientation profiles identified through cluster analysis of the response data.

SURVEY OF RECREATIONAL FISHERS IN TASMANIA WITH A FOCUS ON SAND FLATHEAD

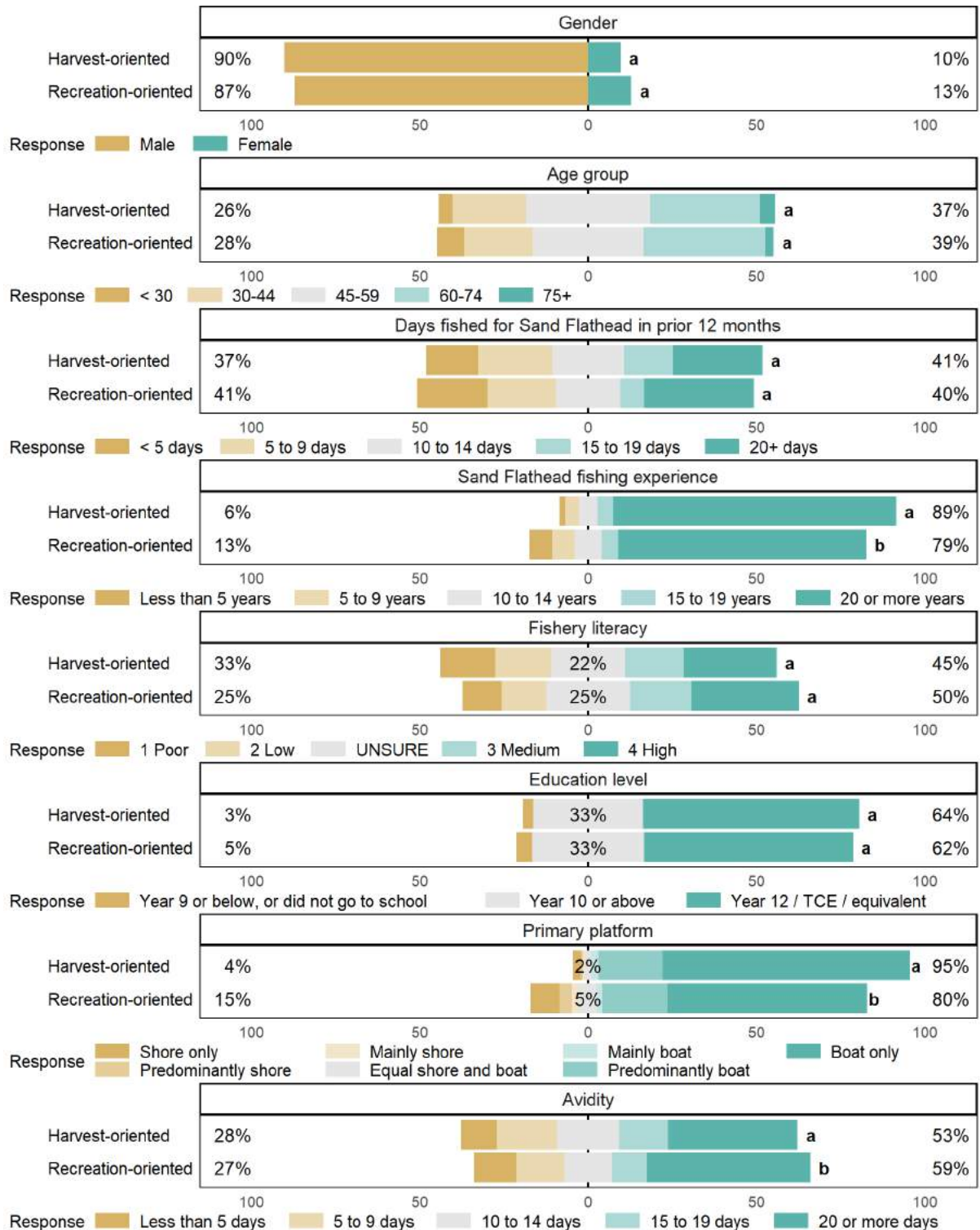


Figure 27. Demographic and recreational fishing question responses stratified by Sand Flathead fishing orientation profiles. Groups that do not share letters are significantly different.

4.1.5.7 Fishing modality and motivation orientation profiling

The modality/motivation combination with the greatest level of participation was *Consumption orientated inshore line fishing*, capturing 98% and 45% reporting a score of 10 (highest importance) (Figure 28). The second and third highest ranked activities were for the same modality, for experiential and social motivations with 95% and 92% participating, respectively.

This indicates that inshore line fishing is the most important mode of fishing to the respondent community.

The other modalities (deep water line fishing, game fishing, dive harvest, freshwater line fishing, and potting) were all engaged in by a majority of respondents for consumption, social, and experiential motivations (54 - 71% of respondents Figure 28).

Seeking trophies was the least popular motivating factor across modalities, with a minority of respondents engaging in the practice (except for when inshore line fishing, with 51%). For respondents that did report being motivated to engage in fishing activities to seek trophies, the practice was notably less important than all other motivations.

SURVEY OF RECREATIONAL FISHERS IN TASMANIA WITH A FOCUS ON SAND FLATHEAD

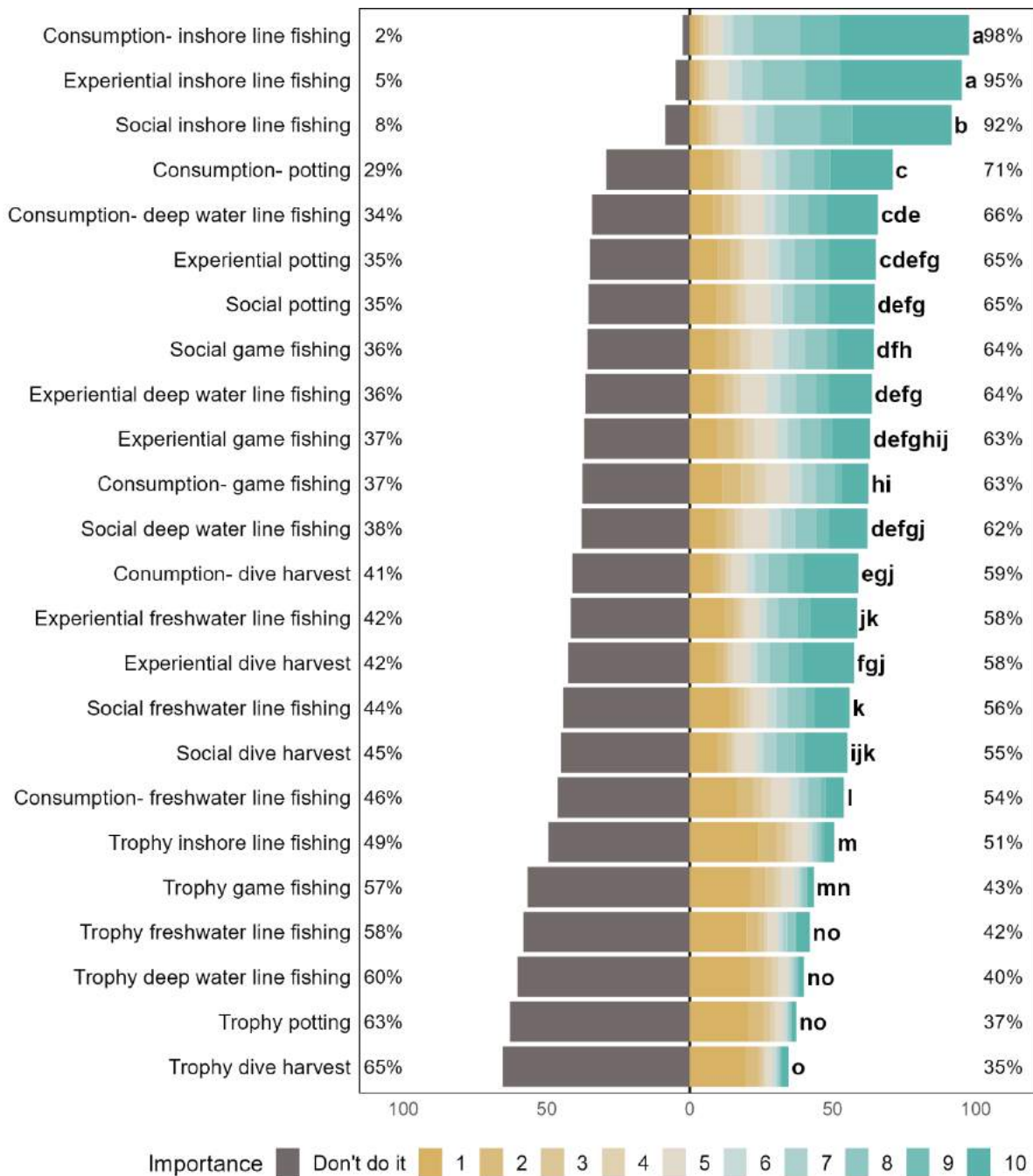
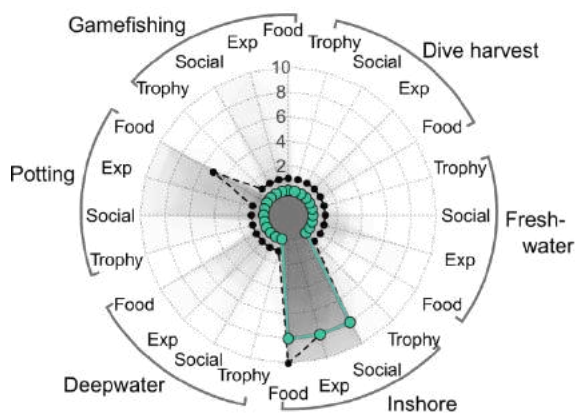


Figure 28. Responses to different types of recreational fishing activities (modes) and reasons for doing them (motivation orientations) scored by how important each combination type is to the respondent from one being not at all important to 10 being very important. Grey bars indicate the percentage of respondents that reported they did not do the activity.

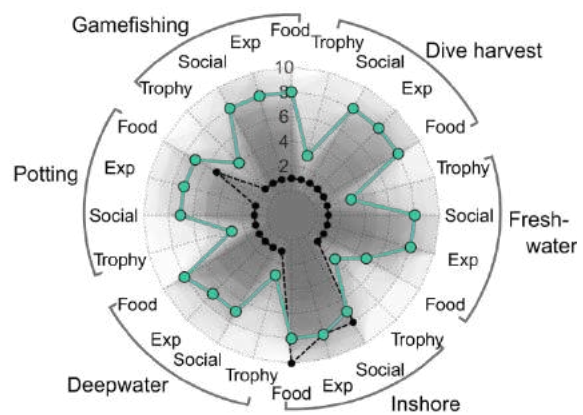
4.1.5.8 Fishing modality and motivation orientation cluster segments

Cluster analysis of the fishing motivation / modality profiling questions identified six unique groupings (Appendix 4: Figure 110). We have defined these segments as (A) *Inshore Fishers*, (B) *Generalists*, (C) *Inshore & Freshwater Fishers*, (D) *Marine Line Fishers*, (E) *Marine Generalists* and (F) *Inshore Fishers & Divers*. The greatest proportion of respondents (27%) were represented by cluster A, with the remainder balanced across clusters B – F, 14–16% in each (Figure 29).

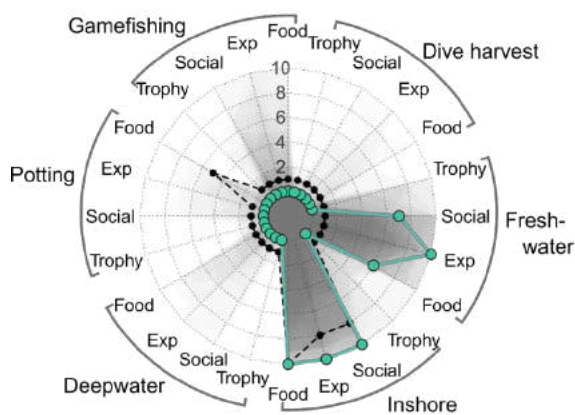
**A. Inshore Fishers (n = 351)**



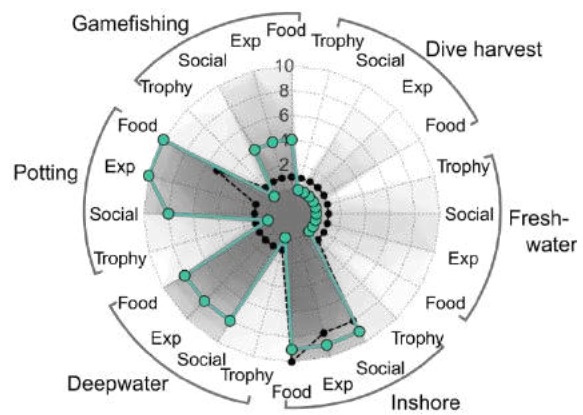
**B. Generalists (n = 192)**



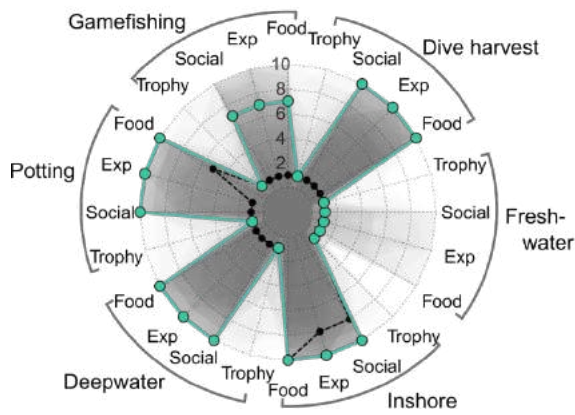
**C. Inshore & Freshwater Fishers (n = 199)**



**D. Marine Line Fishers (n = 182)**



**E. Marine Generalists (n = 191)**



**F. Inshore Fisher-Divers (n = 206)**

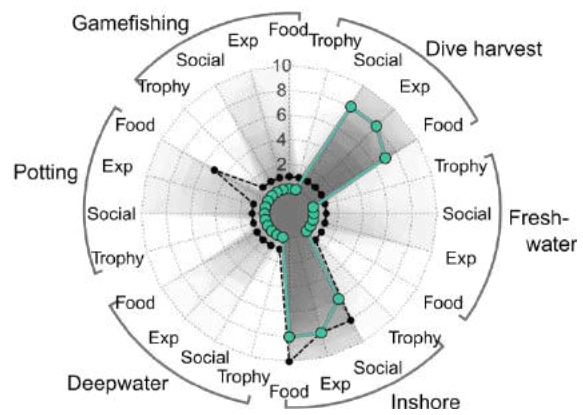


Figure 29. Fisher modality and motivation profiles identified through clustering respondents by responses to Q72–Q95. Green points on each ‘radar’ plot indicate the responses of the representative respondent (the ‘medoid’) of each profile, and for comparison, the black points indicate the responses of the medoid of all respondents (when not clustered into different profiles). The faint filled polygons are the response profiles of fifty random respondents classified in each profile. Responses are grouped by modality, for example within ‘Gamefishing’ are responses to Q72–Q75 regarding each motivation pertaining to this modality: Food = “...for tuna, billfish or pelagic shark for food”; Exp = “...for personal enjoyment of the activity”; Social = “...to share catch or the experience with others”; and Trophy = “...for a ‘trophy’ or memento”.

SURVEY OF RECREATIONAL FISHERS IN TASMANIA WITH A FOCUS ON SAND FLATHEAD

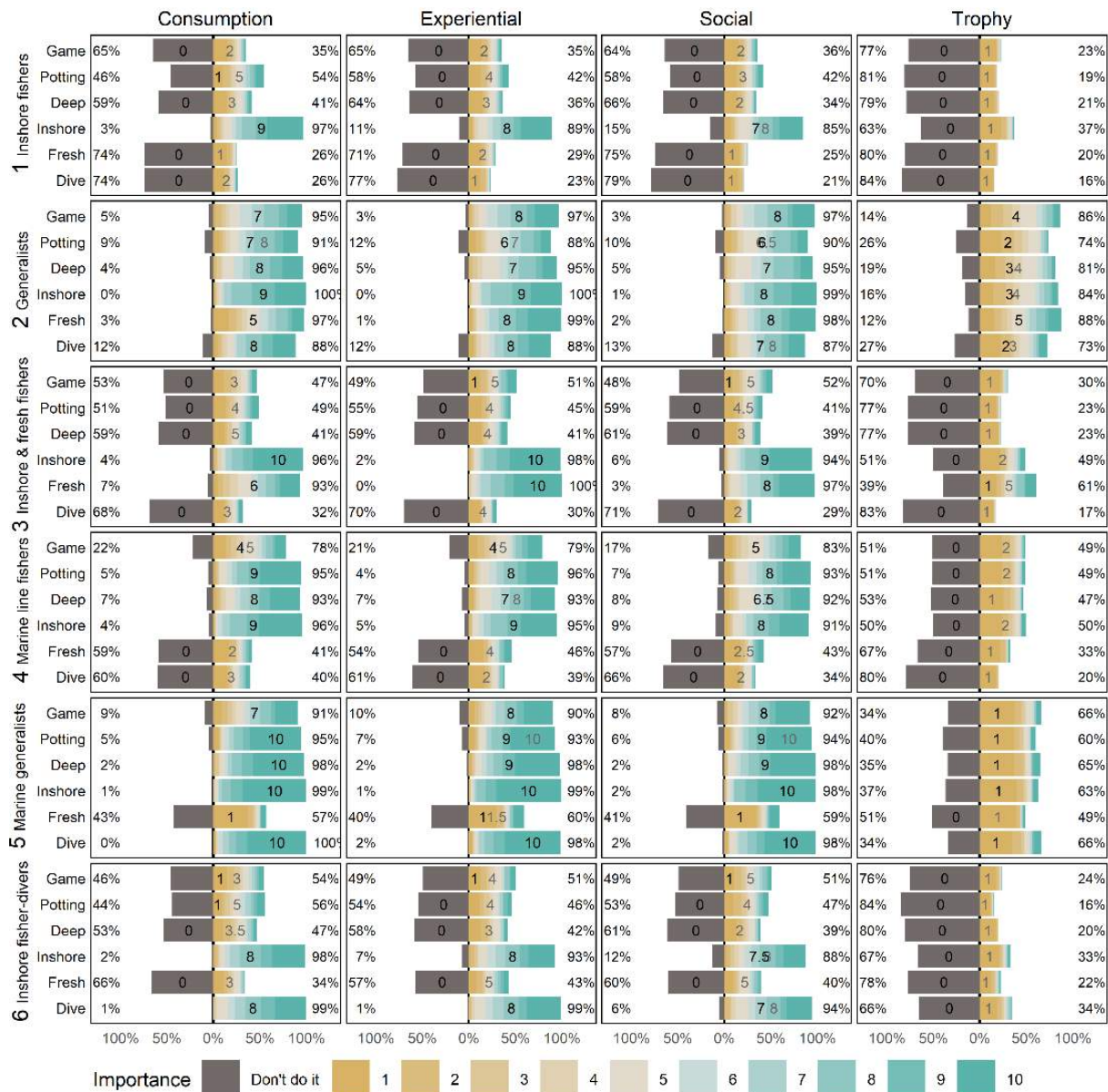


Figure 30. Responses to the recreational fishing modality questions Q72–Q95, by fisher profile cluster (rows). Each of these questions asked the importance of a unique combination of fishing method and reason for participation, which are stratified on the y and x axes, respectively. The black numbers on bars indicate the median response including respondents that reported not participating in the activity (treating “Don’t do it” as 0 importance), and grey values indicate the median only among respondents that did report participating in the activity.

Fishing motivation / modality cluster profile A: *Inshore Fishers*

*Inshore Fishers* had a very strong affinity to inshore line fishing for consumption, experiential and social values, similar to the medoid of all respondents (Figure 29). Just over half also engaged in potting/ringing for consumption (Figure 30). The greatest difference between *Inshore Fishers* and all other profiles was that they were far less likely to do or be motivated by any other fishing modality. *Inshore Fishers* were more likely to be female than *Generalists* or *Marine Generalists* (although still 82% were male) and older than *Generalists*, *Marine Generalists*, and *Inshore Fishers & Divers*. They fished less for flathead in the last 12 months than both *Marine Generalists* and *Marine Line Fishers*. They also had lower Fishery Literacy and

less likely to have completed Year 12 or an equivalent education than *Inshore Fishers & Divers* and were less avid than all other groups except *Inshore Fishers & Divers* (Figure 31).

**Fishing motivation / modality cluster profile B: *Generalists***

*Generalists* were the only profile group in which most respondents engaged in all fishing modalities. Of all profile groups, they also reported the greatest importance on trophy seeking as a fishing motivation across all fishing modalities (Figure 29 and Figure 30). *Generalists* were more likely to be male, younger, and more avid than *Inshore Fishers* and younger than *Marine Line Fishers* and *Inshore and freshwater line fishers* (Figure 31).

**Fishing motivation / modality cluster profile C: *Inshore & Freshwater Fishers***

*Inshore & Freshwater Fishers* had a very similar profile to *Inshore Fishers* with the exception that they were also highly engaged in freshwater line fishing, particularly for experiential and social values (Figure 29 and Figure 30). They were more likely to be older than both *Generalists* and *Marine Generalists*. Fished less for flathead in the last 12 months than both *Marine Generalists* and *Marine Line Fishers*. More likely to fish from shore than *Marine Line Fishers* (although only 21% fish from shore equally or more than on a boat) and a lower degree of fishery literacy and less education than *Inshore Fishers & Divers*. They are also more likely to be more avid than *Inshore Fishers* but less so than *Marine Generalists* (Figure 31).

**Fishing motivation / modality cluster profile D: *Marine Line Fishers***

*Marine Line Fishers* had a high degree of engagement and placed high importance on inshore and deep-water line fishing for all motivational values except for 'Trophy' fishing. They were also highly engaged and valued potting/ringing for consumption. Most respondents in this group also engaged in 'Gamefishing', but with less importance on this modality (Figure 29 and Figure 30). They were older than both *Generalists* and *Marine Generalists* and fished more for flathead in the last 12-months than *Inshore Fishers* and *Inshore & Freshwater Fishers*. They had a lower degree of fishery literacy and education than *Inshore Fishers & Divers* and were more likely to fish from a boat than *Generalists* or *Inshore & Freshwater Fishers*. They were also more avid than *Inshore Fishers* or *Inshore Fishers & Divers* (Figure 31).

**Fishing motivation / modality cluster profile E: *Marine Generalists***

*Marine Generalists* had a high degree of engagement and placed high importance on all marine based recreational fishing modalities for all motivational values except for 'Trophy' fishing. Most respondents in the group also engage in Freshwater line fishing but with low importance placed on this for all values. They are distinguished from *Marine Line Fishers* by the high importance placed on the Dive harvest modality (Figure 29 and Figure 30). *Marine Generalists* were more likely to be male than *Inshore Fishers* and younger than *Inshore Fishers*, *Inshore & Freshwater Fishers* and *Marine Line Fishers*. They had fished more for flathead in the last 12 months than *Inshore Fishers*, *Inshore & Freshwater Fishers*, or *Inshore Fishers & Divers*. They had a lower level of education than *Inshore Fishers & Divers* and were more avid than *Inshore Fishers*, *Inshore and freshwater line fishers* and *Inshore Fishers & Divers* (Figure 31).

**Fishing motivation / modality cluster profile F: *Inshore Fishers & Divers***

*Inshore Fishers & Divers* had a high degree of engagement and placed high importance on both inshore line fishing and dive harvest fishing modalities for all motivational values except for 'Trophy' fishing (Figure 29 and Figure 30). They were younger than *Inshore Fishers* and fished less for flathead in the last 12-months than *Marine Generalists*. They had a higher level of

SURVEY OF RECREATIONAL FISHERS IN TASMANIA WITH A FOCUS ON SAND FLATHEAD

fishery literacy than *Inshore Fishers*, *Inshore & Freshwater Fishers*, or *Marine Line Fishers*. They also had a higher level of education than all other profiles except *Generalists* and were less avid than both *Generalists* and *Marine Generalists* (Figure 31).

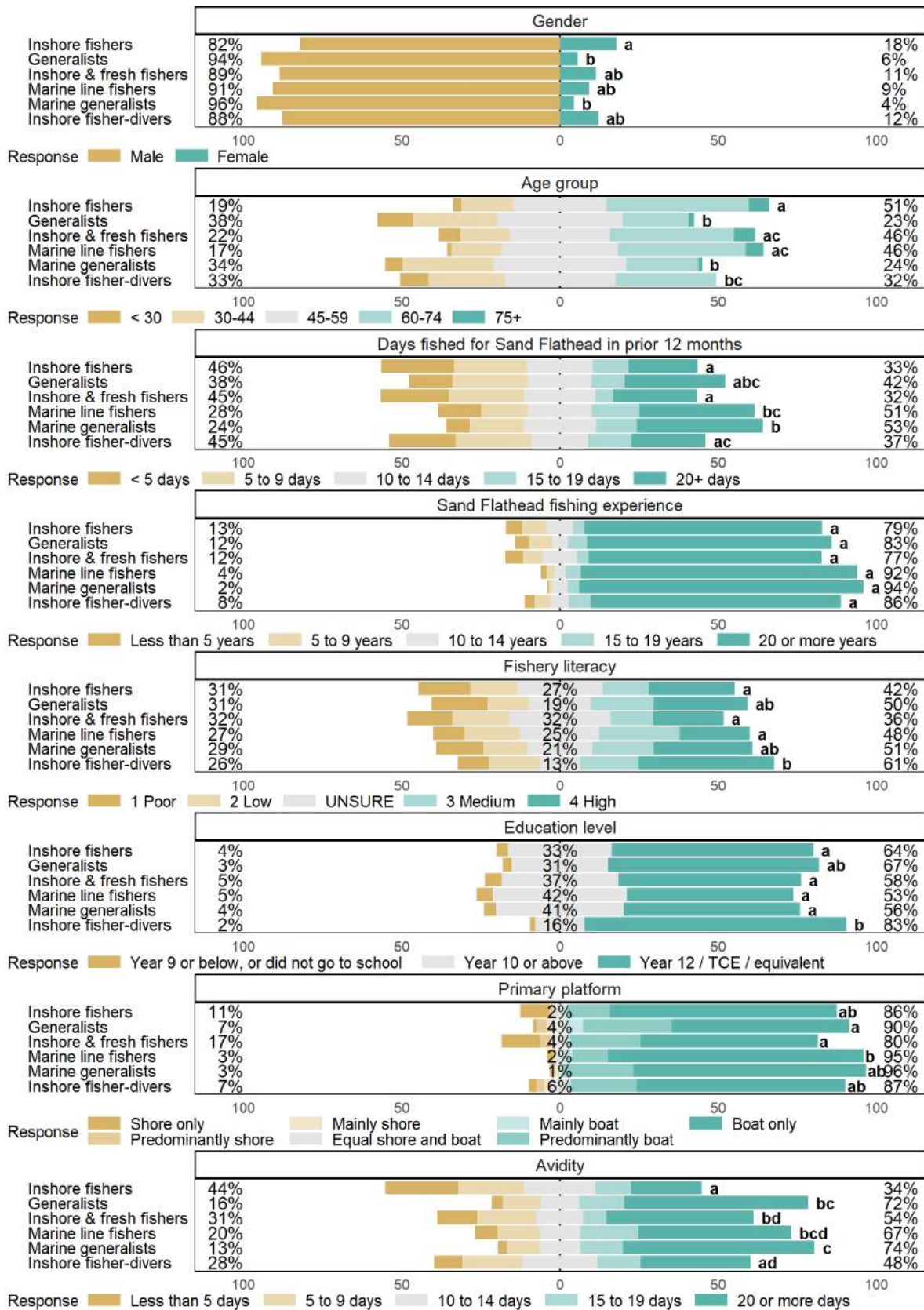


Figure 31. Comparison demographic and recreational fishing-related question responses across fishing modality/motivation profile groups identified through cluster analysis.

## 4.2 Flathead fishery dynamics

### 4.2.1 Flathead species catch composition

By far, the most caught species of flathead was Sand Flathead which comprised at least 67% of the total flathead catch for 90% of respondents (Figure 32A). It was the only flathead species caught by 36% of respondents while 61% caught both sand and tiger flathead. A further 10.2% reported catching other flathead species (Figure 32B). In descending order, these were Bluespotted Flathead *Platycephalus speculator*, Dusky Flathead *Platycephalus fuscus*, Rock Flathead *Platycephalus laevigatus* and Toothy Flathead *Platycephalus aurimaculatus*. It is worth noting that there have been no confirmed catches of Dusky Flathead in Tasmania, further, their known distribution is limited to waters off mainland Australia.

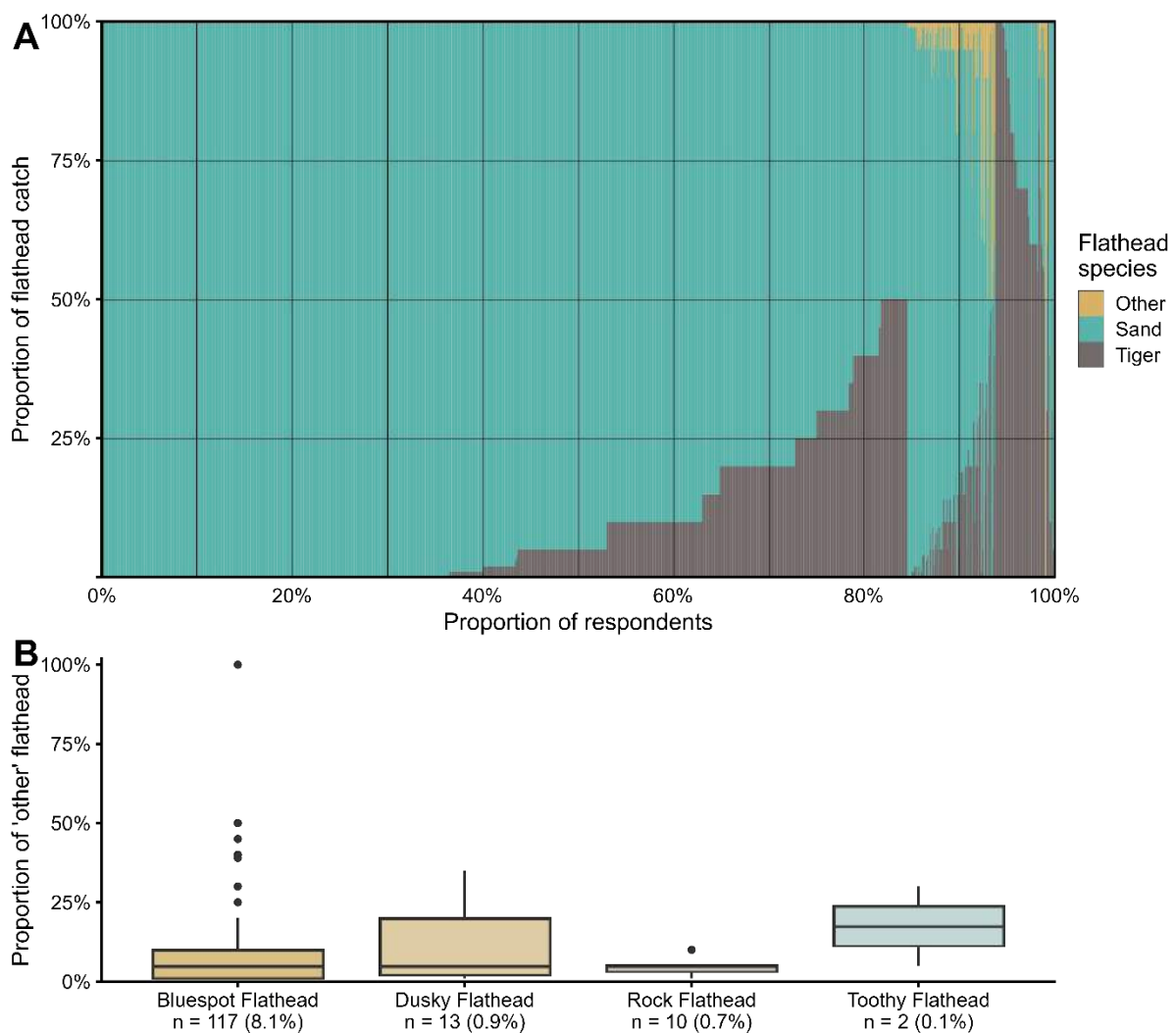


Figure 32. A: Catch composition of the flathead species caught in Tasmania, by individual respondent. Each vertical bar represents the proportional flathead catch of respondents ( $n = 1,439$ ). B: Breakdown of "Other" flathead species caught. Percentages in the x axis labels indicate the proportion of respondents that reported catching each species.

### 4.2.2 Regions fished for Sand Flathead

If a reporting region had less than 30 responses it was collapsed within a greater region. As such, George's Bay and Flinders Island were grouped into the northern East coast, the three west coast regions were grouped together, and King Island was grouped into the western North coast.

The most nominated region was Fredrick Henry and Norfolk Bays (13%), followed by the Tasman Peninsula, D’Entrecasteaux Channel, and the Southeast Coast (i.e., all regions located in southeast Tasmania) (Figure 33). This is consistent with the most recent statewide effort and catch data for Sand Flathead in Tasmania (Lyle et al. 2019). The next most common regions were the Western North Coast (8%) and Eastern North Coast (7%), followed by the east coast regions (ranging from 5% and 7%) (Figure 33). The Derwent Estuary, West Coast and Tamar River had the lowest proportion of responses (ranging from 2% to 4%).

There was a significant difference between proportional response profiles for regions fished from the two data collection methods (KS:  $D = 1.0$ ,  $p = <0.001$ ). For telephone survey respondents, the largest segment fished the D’Entrecasteaux Channel (20% of phone respondents) followed by Frederick Henry and Norfolk Bays (14%), whereas for online survey respondents, Fredrick Henry and Norfolk Bay was the largest region (14%), followed by the Tasman Peninsula (12%) and then the D’Entrecasteaux Channel at 10% of respondents (Figure 33). This difference may be driven by the stratified random sampling of the Statewide survey and/or reflect the importance of Sand Flathead in different regions driving self-recruitment, however a reliable sample size was available for all regions after grouping.

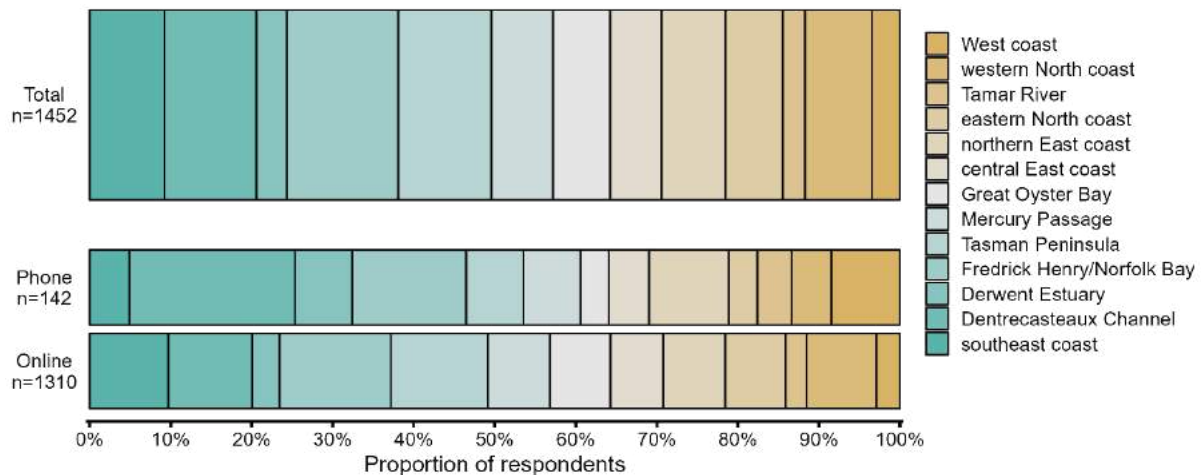


Figure 33. The proportional frequency of respondents based on the regions where they primarily fish for Sand Flathead.

### 4.3 What did respondents say about Sand Flathead?

#### 4.3.1 Perceptions on the status of Sand Flathead in Tasmania

Almost two in three respondents thought the Tasmanian Sand Flathead stock was in a *poor* to *very poor* condition. A further, 23% thought it was *ok* while 14% thought it was in a *good* or *very good* condition (Figure 34).

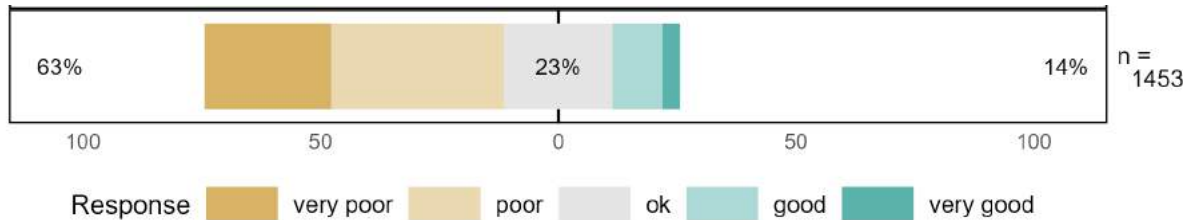


Figure 34. The opinion of survey respondents on the condition of the Sand Flathead stock in Tasmania (n = 1,453, 20 respondents provided a response of 'unsure').

Less avid, higher educated and fishers with greater fishery literacy as well as *Inshore Fishers & Divers*, and respondents in the *Casual anglers* and *Leisure anglers* motivation profiles were all significantly more likely to consider the Sand Flathead stock to be in a poor condition. Further, *Recreation-* relative to *Harvest-oriented* Sand Flathead fishers were significantly more likely to consider the stock to be in a poor condition (Appendix 1: Figure 70).

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*Free text response examples reflecting the sentiment that the stock is in poor condition:*

*“It is depleted and needs urgent further management on both commercial and recreational basis.”*

*“Fishing for Sand Flathead is in real trouble !! - last few years has been the worst for fishing in Frederick Henry / Norfolk Bays in my lifetime (I am 74 years of age).”*

*“Observations over the last 20 years is it has just been over-fished. Too many people taking too many flatheads that has depleted stocks. 15 years ago, we would get 50 in 1hr of fishing. Now it is more like 5-10 in about an hour.”*

*“The depleted flathead population must be fixed. Bigger boats going out further isn't the answer.”*

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*Free text response examples reflecting the sentiment that the stock is not in poor condition:*

*“I believe the fishery is not depleted I catch plenty and there are a lot of undersized fish thrown back... I believe the size limit is too high as Male fish are mainly smaller than 320. Therefore, mainly female breeding fish are being caught.”*

*“I haven’t found a decline in the sand flathead fish stocks here around the Freycinet Peninsula.”*

*“In my experience flathead fishing has not declined and in fact possibly improved in the areas we fish. We are happy to travel a little further to access fish and I believe this is reflected in our catch results.”*

*“I have previously stated I have been fishing for 50 years and stocks of sand flathead where I fish are still excellent.”*

There were also significant differences in perceptions of stock quality depending on the main region fished by respondents (Figure 35). Five of the six regions where the stock was reported to be in poorest condition were in the southeast of Tasmania, with the worst condition reported for the D’Entrecasteaux Channel. Respondents who fished the Tamar River also reported poor stock conditions. The North and West coast regions were considered in the least poor condition.

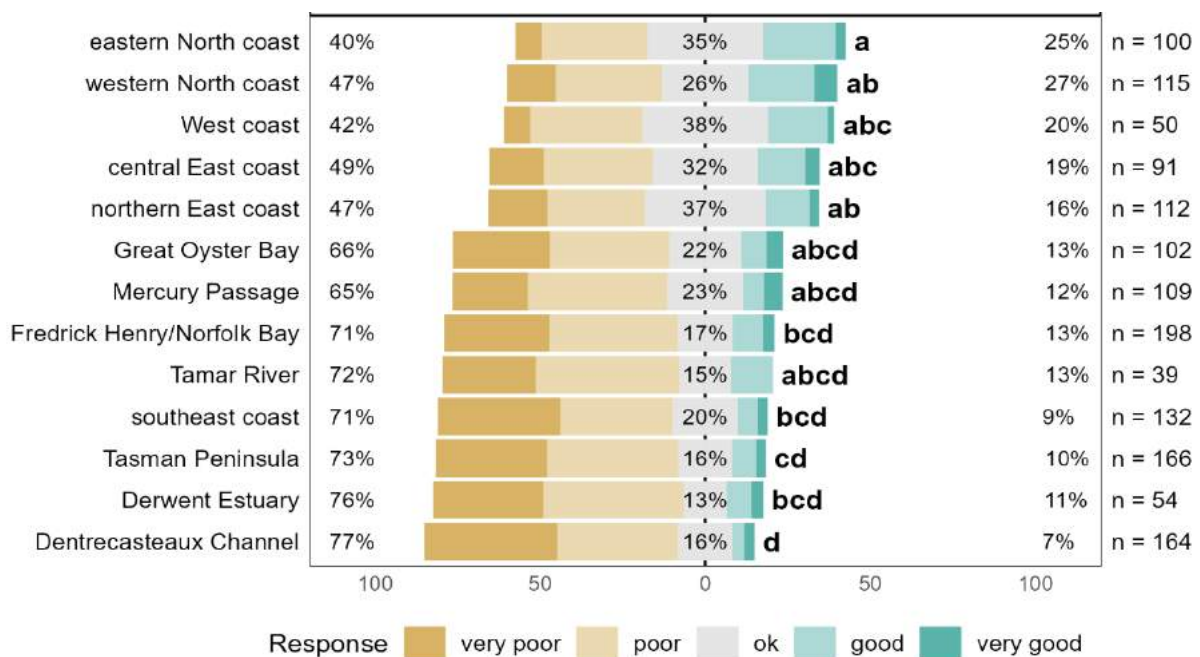


Figure 35. The opinion of survey respondents on the condition of the Sand Flathead stock in Tasmania based on where they spend most of their time fishing (n = 1,453, 20 respondents provided a response of ‘unsure’).

The responses align closely with the results of the IMAS fishery independent survey, particularly in relation to the state of the stock based on size structure of Sand Flathead caught in each region (Coulson et al. 2022, Fraser et al. 2022). This, in combination with the broad agreement of poor stock condition state-wide but recognition of it being worse in some areas supports regional stock management.

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*“Please close fishing to sand flathead or reduce limits in areas where it is actually depleted and not everywhere because it’s not depleted everywhere I fish, all the open places like Marion Bay, Maria island and out of Eagle Hawk Neck and Mercury Passage are still fishing very well especially out of Bicheno where fishing has been fabulous for tiger and sand flathead , just restrict the in-close waters where stocks are actually low.”*

*“Northwest is not too bad in my opinion.”*

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#### 4.3.2 Satisfaction with the Sand Flathead fishery

##### 4.3.2.1 Satisfaction with the number of Sand Flathead caught

Fifty-three percent of respondents were *not very satisfied* or *not at all satisfied* with the number of Sand Flathead caught in the previous 12 months. The remaining 47% were either *quite satisfied* or *very satisfied* (Figure 36).

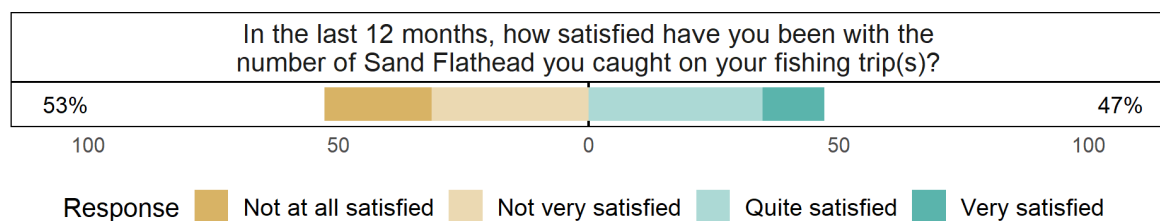


Figure 36. The satisfaction level of respondents based on the number of Sand Flathead caught (n = 1,429, 6 respondents provided a response of ‘unsure’).

Females, less avid and those fishers who were shore-based were all significantly less likely to be satisfied with the number of Sand Flathead caught (Appendix 1: Figure 71).

The main region fished was also a significant determinant of satisfaction. The highest satisfaction was reported from the northeast corner of Tasmania and the west coast. Regions on the east coast and the western side of the north coast were roughly evenly polarised between positive and negative responses (Figure 37).

The six bottom ranked regions all had greater than 50% dissatisfaction and, except for the Tamar River, were in southeast Tasmania. The lowest ranked was the D’Entrecasteaux Channel where only three out of every seven respondents were satisfied.

SURVEY OF RECREATIONAL FISHERS IN TASMANIA WITH A FOCUS ON SAND FLATHEAD

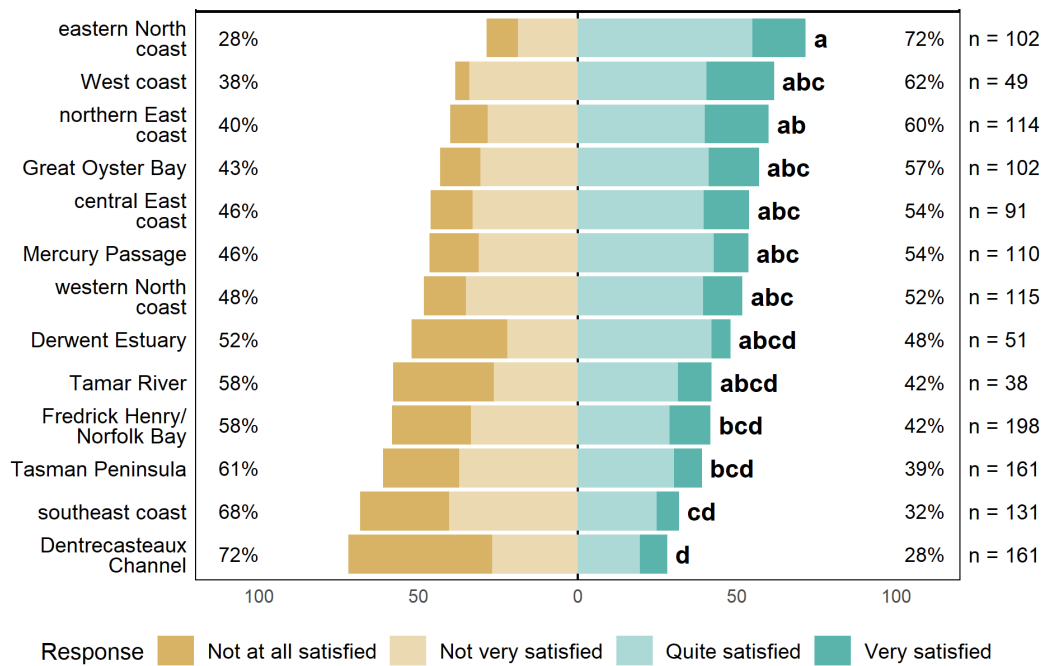


Figure 37. Fisher satisfaction based on the number of Sand Flathead caught based on where they spend most of their time fishing for Sand Flathead.

4.3.2.2 Satisfaction with the size of Sand Flathead caught

Satisfaction with the ‘size’ of Sand Flathead caught was lower than for the ‘number’ of fish caught. Sixty-two percent of respondents indicated being *not very satisfied* or *not at all satisfied* with Sand Flathead size while the remaining 38% were *quite satisfied* or *very satisfied* (Figure 38).

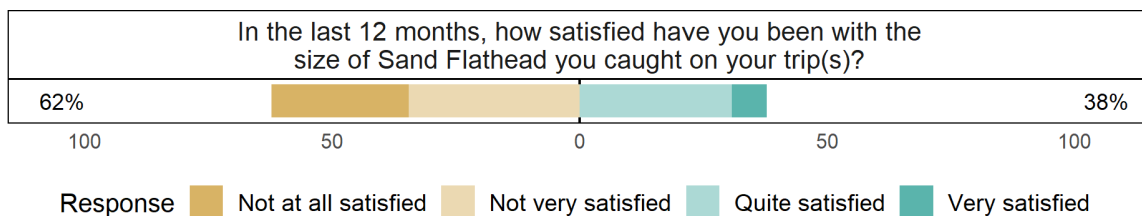


Figure 38. Fisher satisfaction based on the size of Sand Flathead caught (n = 1,430, 7 respondents provided a response of ‘unsure’).

Less avid and more highly educated fishers were significantly less likely to be satisfied with the size of Sand Flathead caught. *Inshore line fishers* relative to *Marine Line Fishers*, and *Leisure anglers* and *Independent anglers* relative to *Community anglers* were also significantly less likely to be satisfied with the size of Sand Flathead they caught. *Recreation-orientated* respondents were also significantly less likely to be satisfied than *Harvest-orientated* respondents (Appendix 1: Figure 72).

Main region fished was a significant determinant with a similar regional response pattern to that reported for the number of fish caught. The highest satisfaction with fish size was reported from the northeast corner of Tasmania. Five of the six lowest ranked regions were in the southeast, with 67-85% of respondents dissatisfied. The lowest ranked was the Tamar River with around one in ten respondents satisfied (Figure 39).

SURVEY OF RECREATIONAL FISHERS IN TASMANIA WITH A FOCUS ON SAND FLATHEAD

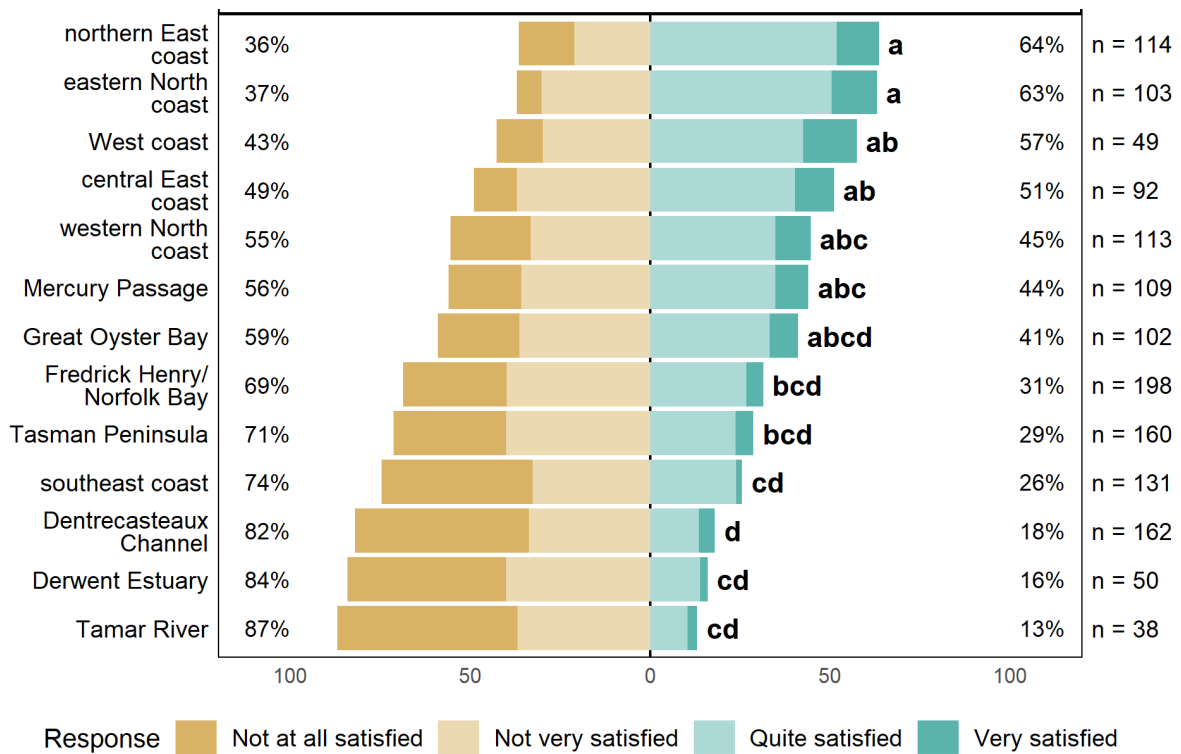


Figure 39. Respondent satisfaction with the size of Sand Flathead where they spend most of their time fishing.

In summary, more than half of respondents were dissatisfied with their fishing experiences for Sand Flathead with a stronger dissatisfaction rating based on the size rather than the number of fish caught.

*“There are high numbers of sand flathead in the Derwent and Huon estuaries, but very few legal sized ones. No-one takes the Derwent flathead (heavy metals).”*

*“A lot of small fish not many of size I usually catch around 100 and keep two.”*

There was a highly significant correlation ( $\rho = 0.66, p < 0.0001$ ) between satisfaction and perceptions on stock status, and this persisted across all regions (Appendix 3: Table 4). This implies that stock rebuilding, particularly the biomass of larger fish will increase satisfaction for fishers.

#### 4.3.3 Perceptions on causality of Sand Flathead stock depletion

Respondents were asked to ascribe the level of impact of five potential causes of Sand Flathead depletion: 1) commercial fishing; 2) recreational fishing; 3) marine farming; 4) environmental factors, and 5) climate change (Figure 40).

Commercial fishing was perceived to be the most impactful (59% suggesting a medium to high impact) followed by recreational fishing, marine farming, environmental factors, and climate change. All factors were significantly different from each other (Figure 40).

*“Commercial fishing the only issue.”*

*“I believe that commercial trawlers that are plundering Tasmanian waters are having a huge impact on the fishery. Put a stop to nets that scoop up all the fish from the bottom including the Sand Flathead. This is the crux of the problem.”*

*“Stop Commercial fishing...that’s the problem not the recreational fishers getting a feed.”*

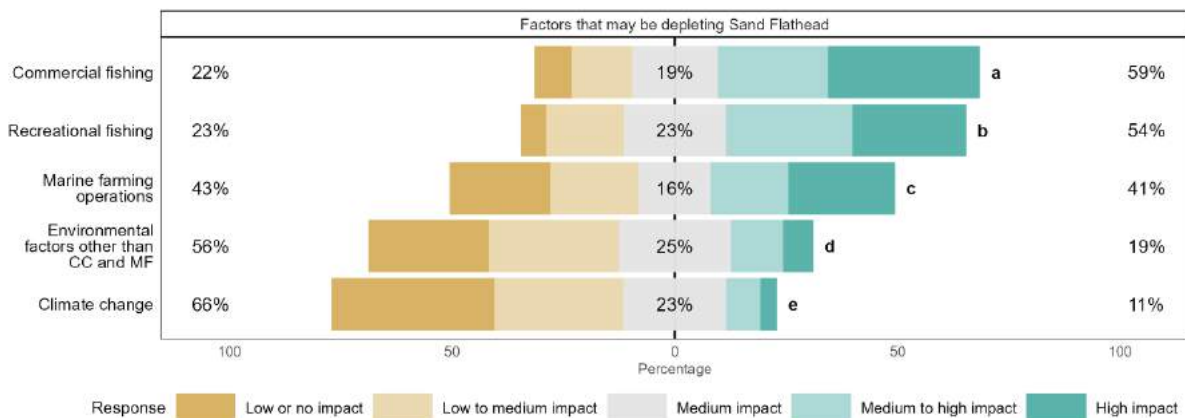


Figure 40. Respondent perceptions on the impact of various factors that might be impacting the Sand Flathead stocks in Tasmania.

Respondents were more likely to think Sand Flathead have been depleted by commercial fishing if they were 60-74 compared to less than 44 years old, highly avid fishers relative to occasional fishers, had a lower level of education and were *Harvest-* rather than *Recreation-oriented* Sand Flathead fishers (Appendix 1: Figure 73). There were no differences based on where they fished most (Figure 41).

Younger, more highly educated, and *recreation-oriented* fishers were more likely to think that depletion is primarily driven by recreational fishing (Appendix 1: Figure 74). There was no difference based on where they fished most (Figure 41).

*“There is a huge increase in the number of boats and the number of people fishing for Sand Flathead. These boats are often full of people, not just 1 or 2 like in the past.”*

*“Recreational fishing is the problem due to rules not being strict enough.”*

*“There seems to be many more boats on the water fishing (and larger sized boats) covering more ground, therefore contributing to the decline in flathead stocks.”*

Respondents were more likely to perceive high impact from marine farming if they were female, had poor, low or medium fishery literacy and were assigned to the *Collaborator* eudemonic profile (Appendix 1: Figure 75). Those that fished mainly in the D'Entrecasteaux Channel were significantly more likely to consider marine farming a driver of stock depletion than those that fished on the north coast or Great Oyster Bay (Figure 41).

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*"Fish farms are creating a powdered film like substance on the seabed where I once dived and fished in clear water at Conningham. Flathead can't survive in this."*

*"Fish farms seem to be depleting the stocks in my area."*

---

Respondents were more likely to perceive high impact from environmental factors other than climate change if they were female, exclusively shore-based and fished between 5–9 days compared with 15–19 days per year (Appendix 1: Figure 76). There was no significant difference in this perception based on where they fished most (Figure 41).

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*"More research as to the impact of freshwater runoff as the flathead dispersed the last big rain event."*

*"I often fish in remote areas and have noticed that flathead is harder to catch in both popular fishing areas and the remote areas. I think there may be some environmental influences other than overfishing. I'm also very concerned about the number of undersized fish taken at public pontoons and jetties on the Tamar."*

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Respondents were more likely to perceive high impact from climate change if they were female and had a high degree of fishery literacy (Appendix 1: Figure 77). There was no significant difference in this perception based on where they fished most (Figure 41).

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*"Warmer waters and changing currents may result in less sandy patches and more weed = less fish."*

*"Water temps have an effect."*

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SURVEY OF RECREATIONAL FISHERS IN TASMANIA WITH A FOCUS ON SAND FLATHEAD

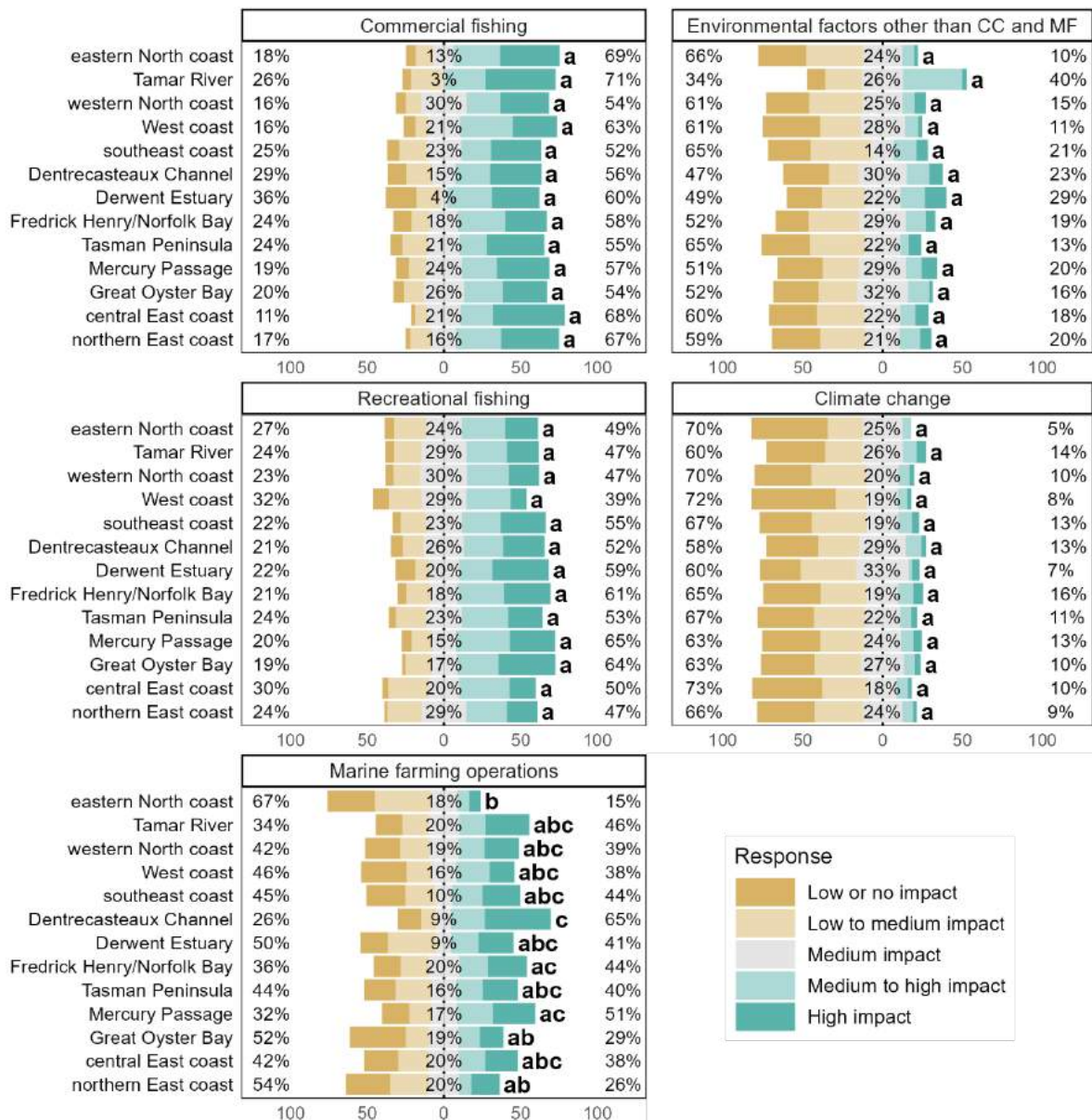


Figure 41. Respondent perspective on the drivers of depletion of Sand Flathead stocks based on where they spend most of their time fishing.

4.3.4 Perceptions on a further depleted stock on fishing in Tasmania

The top four ranked impacts of a further depleted Sand Flathead stock had very similar response profiles and were not significantly different in their ranking, ranging from 49% to 53% of respondents reporting a perceived impact greater than *medium impact* and 26% to 30% reporting a *medium impact* (Figure 42).

SURVEY OF RECREATIONAL FISHERS IN TASMANIA WITH A FOCUS ON SAND FLATHEAD

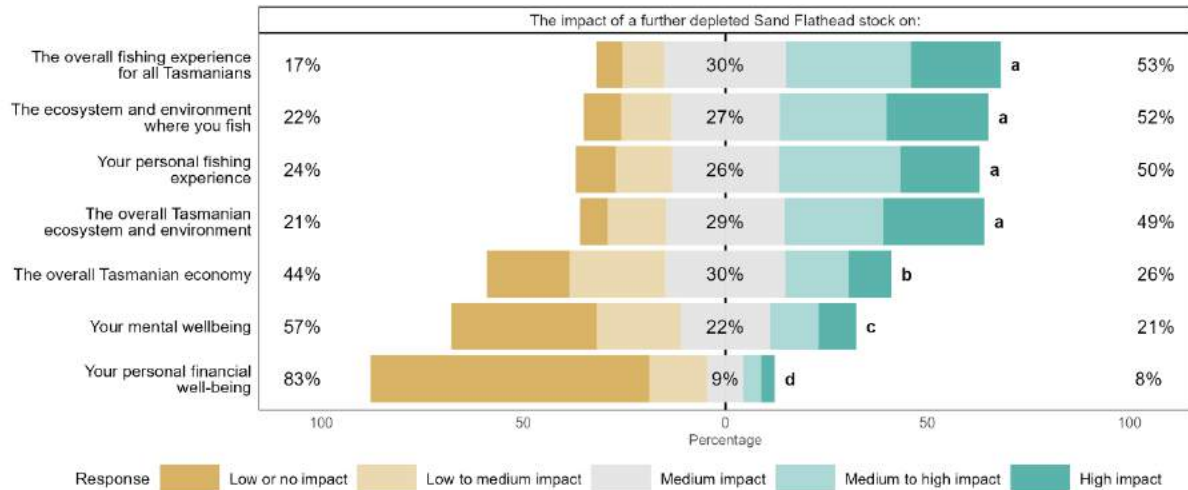


Figure 42. Respondent perceptions on the impacts to them on reduced access to Sand Flathead for reasons relating to depletion of the stock or management interventions that may reduce the number of fish that could be harvested with the intention of rebuilding stocks.

Respondents that rated the impact of further depletion of the stock to have a higher impact on ‘the overall experience for all Tasmanians’ were more likely to be 30–44 than those in the 60–74 years of age group. Respondents in the *Sport angler* relative to the *Casual angler* motivation profiles were more likely to rank this impact higher as were the *Influencer* and the *Collaborator* eudemonic profiles relative to the *Balanced* profile, as were the Sand Flathead fishers that were *Harvest-oriented* (Appendix 1: Figure 78).

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*“There is no doubt a depletion of the size and population of flathead and it would be a real shame to see this worsen. They are a staple of fishing within Tasmania and Australia and can be caught and enjoyed from an early age, we must turn it around here in Tasmania for the generations to come.”*

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Respondents younger than 45 relative to those older than 75 years, those with a higher degree of fishery literacy and those that had completed Year 12 were all significantly more likely to report that a further depletion of the stock would have a greater impact of the ecosystem and environment where [an individual] fish[es]’ (Figure 42). *Inshore Fishers & Divers* were also more likely to anticipate higher impact than *Marine Line Fishers* as were *Collaborators* relative to *Balanced* Eudemonic profiles (Appendix 1: Figure 79).

Respondents who fished mainly or exclusively from a boat were significantly more likely to report a higher impact on their personal fishing experience than exclusive shore fishers and *Harvest-orientated* fishers (Appendix 1: Figure 80).

Females, those that had completed Year 12 rather than Year 10 at school, *Collaborator* relative to *Balanced* Eudemonic profiles as well as Sand Flathead fishers that were *Recreation-orientated* relative to *Harvest-orientated* were significantly more likely to report a higher impact to the ‘overall Tasmanian ecosystem and environment’ from a further depleted stock (Appendix 1: Figure 81).

The remaining three domains were of the lowest overall ranking regarding perceived impact and were all ranked significantly lower than the preceding ranked question. *Sport anglers* relative to *Casual anglers* and *Marine Line Fishers* relative to *Inshore Fishers* thought that a further depleted stock would have a higher impact on ‘the overall Tasmanian economy’ (Appendix 1: Figure 82).

*“If catch limits are reduced to the numbers being proposed, it would be pointless me fishing for food as I can't keep enough to feed my family. This has been a tradition for my family over many years. I simply don't and will not buy fish, if I can't catch it, I don't eat it. The money generated to the state from recreational fishing will be lost.”*

*Casual anglers* and Sand Flathead fishers who were *Recreation-orientated* were significantly less likely to report a lower impact to their mental health (Appendix 1: Figure 83).

Respondents that fished less than 15 days and *Harvested-orientated* fishers were significantly more likely to report a higher impact to their personal financial wellbeing (Appendix 1: Figure 84).

#### 4.3.5 Personal impact from reduced ability to catch Sand Flathead

The impact of reduced access to catch Sand Flathead due to a depleted stock (i.e., *Not being able to catch many because of a depleted stock* and *Not being able to catch many big ones because there are none available*) were ranked significantly greater than the impact of reduced access due to management intervention (i.e., *Not being able to keep many because of low catch limits and/or size limits*).

This infers a preference for reduced catches through management changes rather than stock depletion.

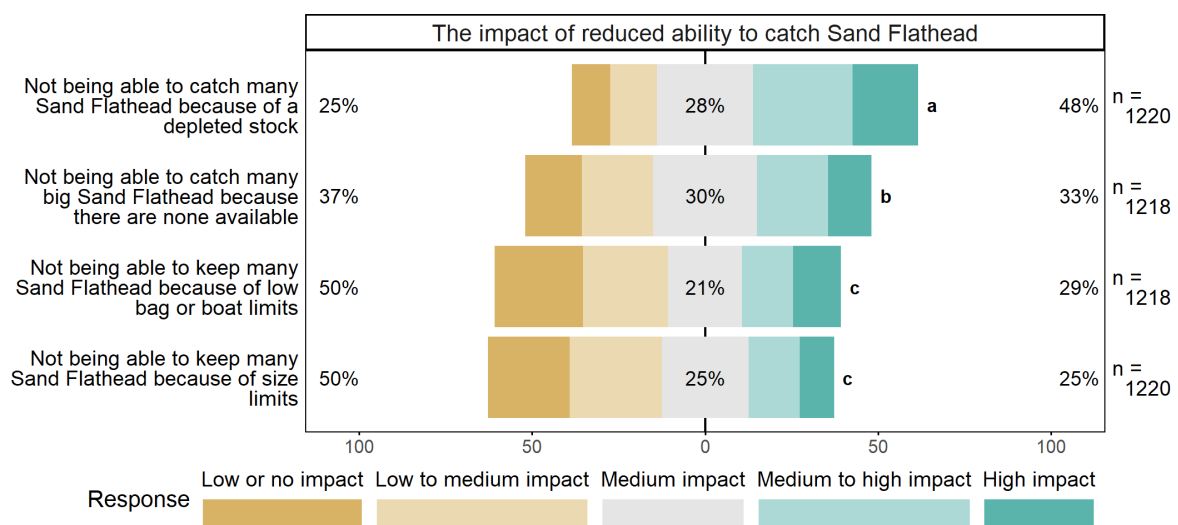


Figure 43. Respondent perceptions on the impacts to them on reduced access to Sand Flathead for reasons relating to depletion of the stock or management interventions that may reduce the number of fish that could be harvested with the intention of rebuilding stocks.

Not being able to catch many Sand Flathead because of a depleted stock had a statistically greater impact than that reported for other scenarios. The impact of this was significantly greater for Sand Flathead fishers that were *Harvest-* rather than *Recreation-oriented* (Appendix 1: Figure 85).

There were also very few significant factors based on perceived impacts of not being able to take many large Sand Flathead because they were not available in the stock. *Balanced* relative to *Easy-going* eudemonic profiles and *Harvest-* relative to *Recreation-oriented* Sand Flathead fishers were more likely to be more highly impacted (Appendix 1: Figure 86).

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*"Lots of flatties about but smaller on average, we throw back 3 out of 5 some days."*

*"I fish in Norfolk and Blackman bays from a small boat mainly and there are very few size fish, we never bag out and rarely get enough for a 'feed', just a 'taste'. My views on decreased bag limits etc reflect this as if we do get onto a few I would like to catch a feed and I often fish on my own so a limit of 5 would be very annoying."*

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Those most impacted by not being able to catch many fish due to management changes were fishers that were more avid, more experienced, had a lower degree of fishery literacy, less educated, fished from boat only, Marine Line Fishers and Marine Generalists relative to Inshore Fishers & Divers, Community anglers relative to Independent anglers, *Balanced* relative to *Easy-going* and *Harvest-* relative to *Recreation-oriented* fishers (Appendix 1: Figure 87).

Except for fishing platform and years' experience, significant factors were the same for the impact of taking less big fish due to management changes (Appendix: Figure 88).

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*"If the size limit is increased to 35 then I wouldn't bother going fishing. I'd sell the boat and just buy frozen fish from overseas at the shop. Fresh fish is too expensive. It would not be worth maintaining and paying all the fees and safety equipment to keep a boat running."*

*"...if the new rules are too harsh many won't fish as it won't be worth their while to spend money on everything from fuel to fishing gear, food, boats etc.. "*

*"Due to the lack of sand flathead we have caught in recent years, and the poor condition of flathead caught in the Port Arthur area (over 50% size fish covered with blackspots on the eatable flesh) I sold my boat last October and*

*no longer go fishing, the cost keeping the boat out ways the very few edible fish we would catch in the future."*

---

#### 4.4 Perceptions on current management controls for recreationally caught Sand Flathead

There was strong agreement for “swift and appropriate management” to ensure the fishery is managed sustainably, with 84% of respondents *agreeing* or *strongly agreeing* (Figure 44). The least avid fishers were more likely to agree as were those with high fishery literacy. *Influencers* and *Collaborator* relative to *Balanced Eudemonic* profiles as well as Sand Flathead fishers that were *recreation-oriented* were also more likely (Appendix 1: Figure 89).

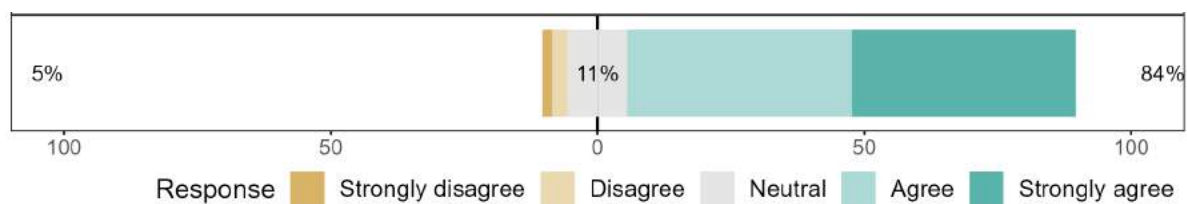


Figure 44. Response profile to Q113f "Please respond whether you agree or disagree to the following question "Swift and appropriate management to ensure a fishery is managed sustainably is important for recreational fishers."

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*"I have been providing feedback about decreasing size and numbers of flathead for years. Most people, including fisheries management staff have been aware of this for years. It appears lobbying from rec fish groups has prevented stronger management actions, so now it is beyond bleeding obvious we need to do something serious, not just another size limit twiddle. The flathead fishing experience needs to be brought back to its iconic former glory in Tasmania, available for all including children, not just those with big boats who can get to remote regions. With climate change and pollution to contend with, then flathead have enough problems without overfishing from ever increasing population."*

*"Something needs to be done urgently."*

*"Whatever you come up with go hard and do it now. The fishery is under the pump and needs help. Don't worry about the handful of people who complain, the silent majority would support the changes. As I mentioned previously, I have been fishing in the channel since 1987, I have a 4.5m tinnie and my son and I are on the water 4 x a week from Nov to March and this year is the worst it's been and it's only going to get worse if nothing is done. Banning all nets would be another way you could help not only the flatties but all fish species."*

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#### 4.4.1.1 Perceptions on a bag limit of 20 fish per person

Respondents' views were sought on the appropriateness of the Sand Flathead bag limit (20 per person per day) and minimum legal-size (32 cm) prevailing at the time of the survey.

Nearly two out of three respondents thought the bag limit was *too high*, with one in four stating it was *much too high*. About one in three thought it was 'about right' and 3% thought it was 'too low' (Figure 45).

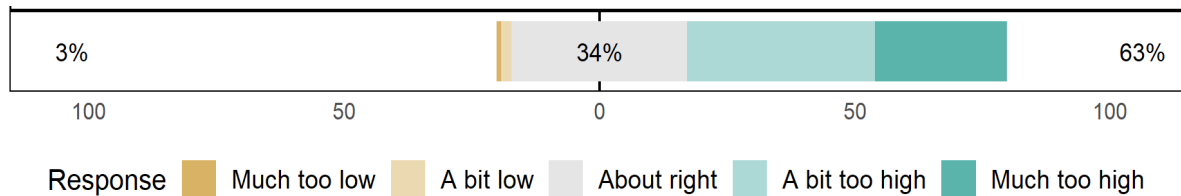


Figure 45. Respondents' perceptions on the bag limit of 20 fish per person per day at the time of the survey (n=1,443, with a further four responding they were 'UNSURE').

Fishers were more likely to view the prevailing bag limit as being too high if they were young, less avid, more highly educated, shore based and more fishery literate and those that fished exclusively from shore. *Inshore Fishers & Divers* (compared with *Marine Line Fishers* and *Marine Generalists*), *Easy-going fishers* and *balanced fishers* compared with *Influencers* and Sand Flathead fishers who were *Recreation-* rather than *Harvest-oriented* were also more likely to state a bag limit of 20 is too high (Appendix 1: Figure 90).

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*“Please reduce bag limits for recreational fishers and reduce commercial limits.”*

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There were also significant differences relating to region most fished – Derwent Estuary fishers were more likely to view the bag limit as excessive compared with fishers of the eastern north coast, central east coast and the Mercury Passage. Across all fishing regions, views aligned with regional trends for both stock condition (Fraser et al. 2022) and fisher satisfaction (Section 4.3.2). For example, the four regions where fishers were most likely to view the bag limit as excessive were the Derwent Estuary, D’Entrecasteaux Channel and Fredrick Henry and Norfolk Bays (Figure 46). These regions also contain some of the worst performing flathead stocks which is furthermore reflected in relatively low fisher satisfaction.

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*“My thought is we can all live without flathead for a few years. Close the fishing of flathead for 5 years then 5 per person bag limit, 20 per boat, Min size 35, max size 42. You can't get 20 in a day out now on the east coast so maybe even less for a boat limit.... say a 15 flathead boat limit. Would be heaps for one day!”*

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SURVEY OF RECREATIONAL FISHERS IN TASMANIA WITH A FOCUS ON SAND FLATHEAD

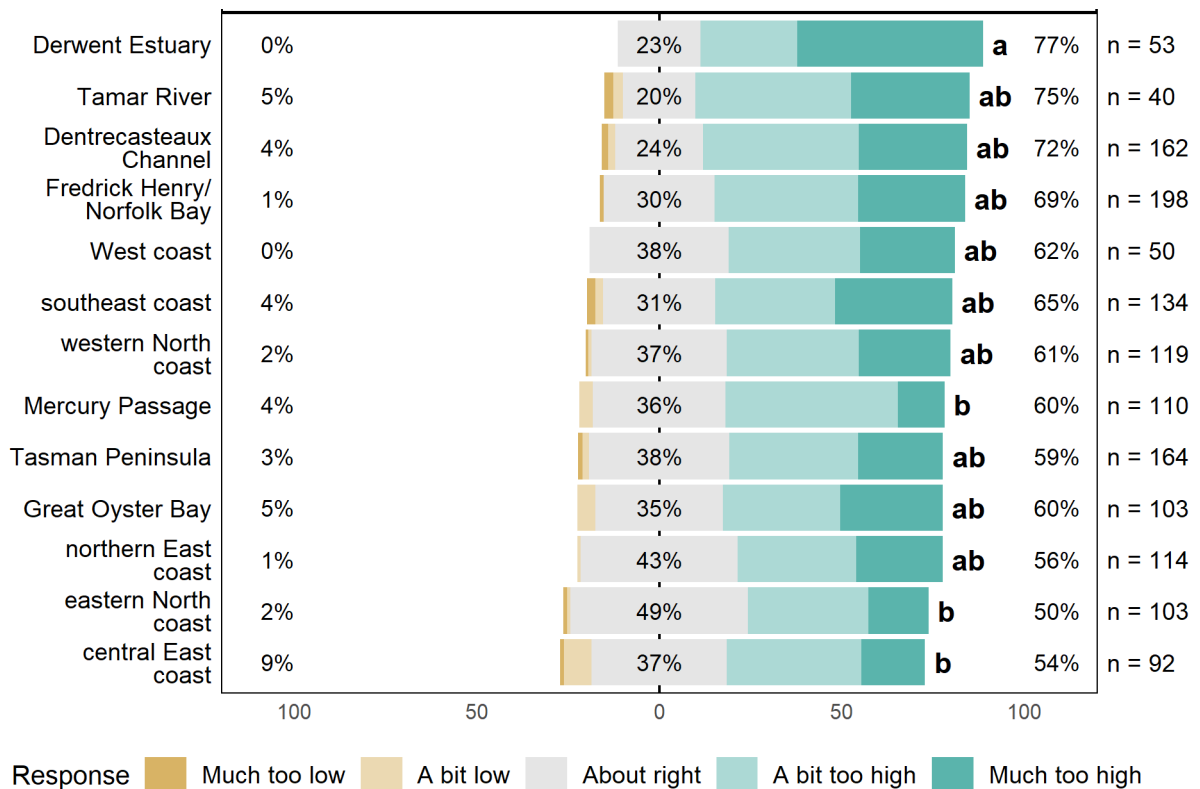


Figure 46. Perceptions on the appropriateness of the Sand Flathead bag limit at the time of the survey based on the region most commonly fished.

4.4.1.2 Perceptions on a minimum legal-size limit of 32 cm

Nearly one in three respondents thought the minimum legal-size limit was too small, with 6% stating it was *much too small*. Around two in three respondents thought it was *about right* and 5% thought it was too big (Figure 47).

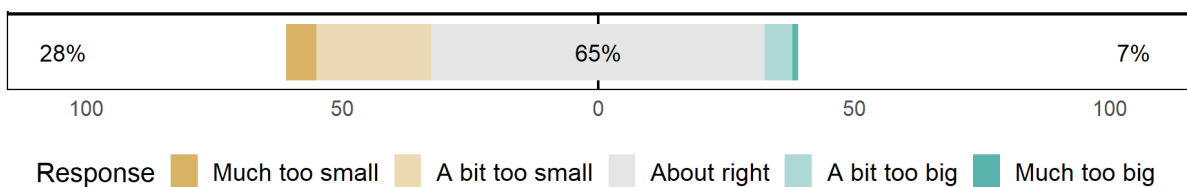


Figure 47. Perceptions on the appropriateness of the minimum size limit of Sand Flathead at the time of the survey which was 32 cm (n=1,447, with a further 24 responding they were 'UNSURE').

Fishers were more likely to view the size limit as too small if they had 5–9 fishing experience years compared with fishers with 20+ years' and if they were highly fishery literate (Appendix 1: Figure 91).

*“I think that the most important thing is to have an upper limit to allow the big flathead to breed.”*

*“32 cm is too small a minimum size. There is so little meat on a fish of this size. We don’t keep fish under about 35 cm.”*

*" I think the recent increases in size are about right. The fish just look so much more mature at 32cm."*

While there were no significant regional differences, there was a general trend in views that size limits were too big in poorly performing regions and too small in better performing regions. Despite the lack of significance, the indicative trend is somewhat intuitive as those fishing in areas with smaller fish will find it more difficult to retain harvestable fish – the high importance placed on eating Sand Flathead (Section 4.7) supports this interpretation. Defying the apparent relationship between views on size limits and regional fisheries health were responses provided from Derwent Estuary fishers - in this poorly performing region, fishers were more supportive of higher size limits than fishers in some better performing regions.

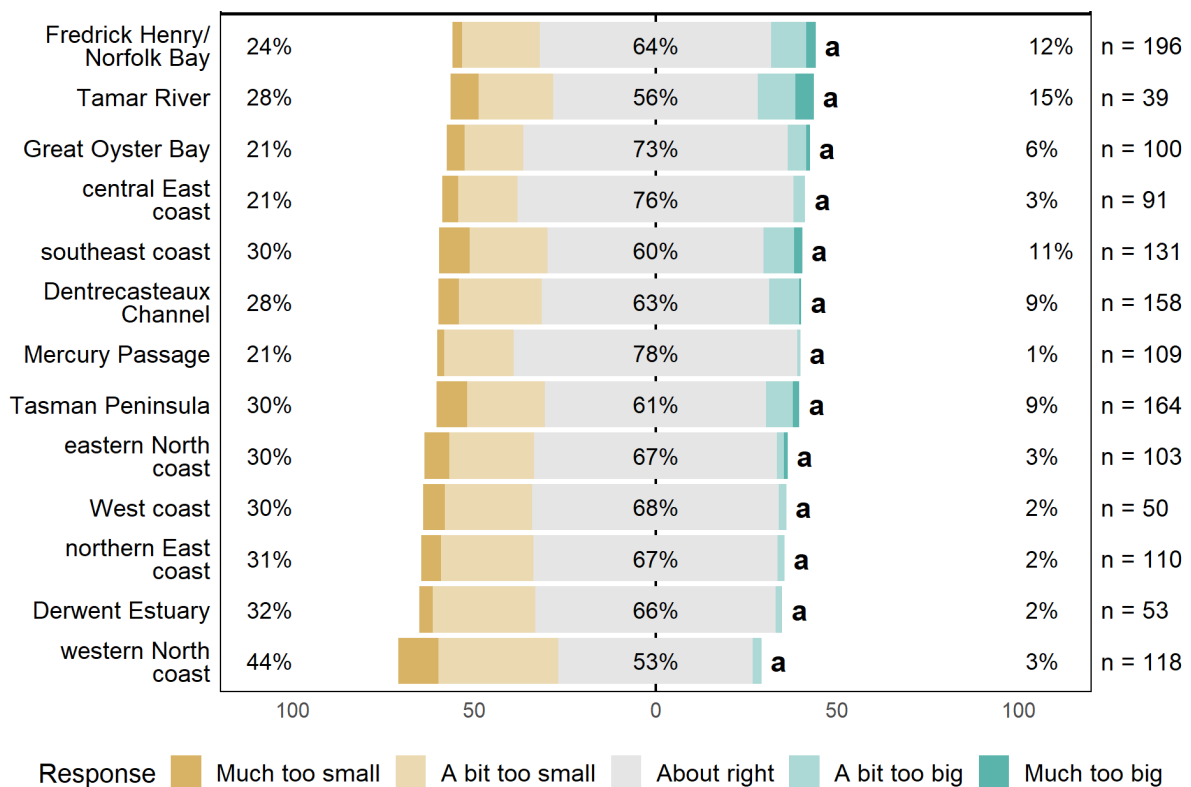


Figure 48. Perceptions on the appropriateness of the size limit of Sand Flathead at the time of the survey based on region most commonly fished.

#### 4.4.2 Perceptions on possible management changes

Respondents were asked to indicate their support for seven hypothetical management packages to rebuild the sand flathead fishery. They were informed that the exact scenarios were not necessarily being considered for implementation. Rather, the exercise was designed to identify preferred management mechanisms and settings to rebuild the sand flathead fishery noting that different combinations may sometimes be used to pursue similar rebuilding outcomes.

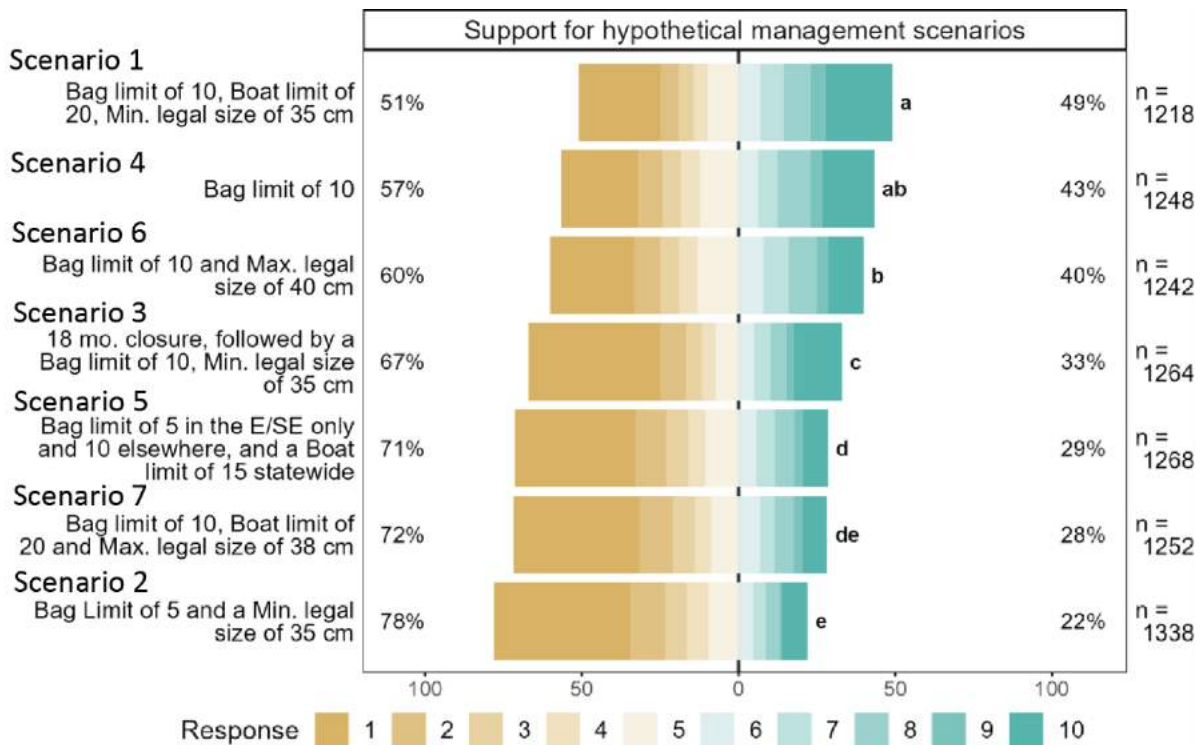


Figure 49. Respondent support scores (from 1 to 10) for seven hypothetical management scenarios. Minimum legal-size limits were 32 cm if not indicated.

When responses were determined as either supportive (6-10) or non-supportive (1-5), none of the seven scenarios received majority (>50%) support. Support ranged from 22% to 49% (Figure 49).

Scenario 1 (Q25) and Scenario 4 (Q28) received the highest (49%) and second highest (43%) level of support respectively. However, support was not significantly different. The relatively high level of support for Scenario 4 is intuitive as it is the least restrictive of the seven scenarios (and most like prevailing settings at the time of the survey). However, the slightly higher (albeit insignificant) level of support for Scenario 1 suggests that many respondents were also motivated by a need to reduce recreational Sand Flathead catch and provide greater protection to breeders.

Lowest support was given to Scenario 2 (Q26) (22%) which proposed the most restrictive catch limit and Scenario 7 (Q31) (28%), which introduced the most restrictive maximum size limit which is a new management tool for Tasmanian marine fisheries.

Interpreting management support through a lens of access constraint is challenging. This is largely due to uncertainties around how respondents navigate conflicting motivations associated with minimising a loss of fishing access and promoting fishery recovery. Many respondents will be motivated by both and therefore expressions of support will represent a conflicted balance. Adding complexity, there are likely to be diverse perceptions about the relative effectiveness of different tools and settings in providing fisher access and in recovering the fishery. Further challenging interpretation is the likelihood that fishers will perceive the effectiveness of different tools and settings differently depending on where and how they fish. For example, fishers seeking to maximise access may be less likely to support high minimum size limits in regions where fish are smaller while shore-based fishers may be more likely to

support boat limits than boat fishers. Conversely, fishers motivated by recovering the fishery may support boat limits and lower bag limits through concerns about excessive catches made by other fishers.

Despite these challenges, some inferences may be drawn from the results. Firstly, at a whole-of-fishery level, there was a lack of general support for all management scenarios. While this highlights the challenge of implementing broadly supported management changes, it also indicates a need to better understand fishers' motivations in supporting or opposing management changes. To this end, other results in this study may be instructive. For example, the large proportion of fishers who think that commercial fishers have a greater impact on the Sand Flathead than recreational fishers (Section 4.3.3) are less likely to support recreational initiatives to constrain catch. In turn, this may highlight a need for more targeted science communication to correct the understanding about which sector impacts the fishery and improve the understanding of the science behind assessments and the need for action to allow stock rebuilding.

Second, there was a general trend of increasing support for less restrictive measures. This was most pronounced for bag limit changes – the three least supported scenarios proposed a bag limit of five while the four most supported scenarios proposed a bag limit of ten. This indicates the importance of being able to retain high numbers of Sand Flathead to eat. Considering that 84% of respondents agreed or strongly agreed with “swift and appropriate management” (Section 4.4) to manage the fishery sustainably, the results may also indicate that while most fishers are supportive in principle of corrective management, many if not most were unaware (or unconvinced) of the depth of changes required to restore the fishery. Further, the strong response that commercial fishing is the major driver of stock depletion among many respondents (Section 4.3.3) may reflect an agreement for swift and appropriate management action, but commercial fisheries management rather than the recreational management scenarios presented.

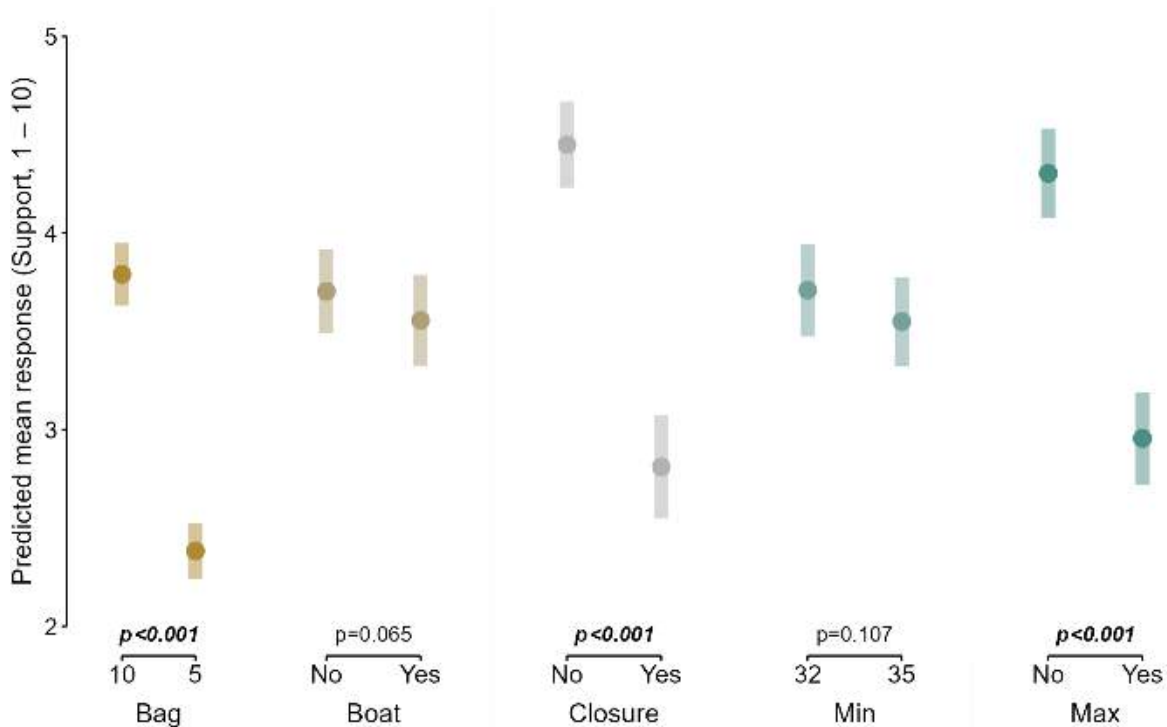


Figure 50. Estimated marginal mean effects of each management measure (x axis) on support for hypothetical management scenarios (with all other measures held constant at their average) generated from a proportional odds model of responses to Q26–Q31. The model was fit with a random effect for individual respondent. Points indicate the mean response across the predicted responses (treating ordinal Support response levels as numeric) and translucent bands indicate confidence intervals. P values indicate significance of the effects of each measure. Model Nagelkerke pseudo- $R^2 = 0.24$ .

Proportional odds modelling of the responses to the hypothetical management scenarios identified three management measures with negative effects on respondent support. These are summarised in terms of change to the predicted mean of support responses if the measure is implemented and all other measures are held constant (Figure 50). For reference, the model predicted that with no management measures implemented (other than the less stringent option for bag limit of 10), mean support would be 5.19 (i.e., on the scale of 1–10).

Reducing the bag limit from 10 to 5 fish resulted in the greatest reduction of support, with a predicted decrease in mean support response of 1.41. This was followed by implementation of an 18-month closure (mean support reduction of 1.09), and implementation of a maximum size limit (mean support reduction of 0.90). The model identified that the implementation of a boat limit and an increase of the minimum size limit both had small, insignificant effects on support ( $p = 0.065$  and  $0.107$ , respectively; Figure 50). No management measures had a positive effect on support.

Prospect Theory (Kahneman and Tversky 1979) is a suite of economic theories that focus on understanding human decision making under risk. Some studies (for example Holland 2008) apply this in a fisheries context, finding that several factors (including uncertainty aversion and loss aversion) are relevant to fishing choices under uncertainty. In the context of this study, fishers appear to be weighing up the imminent loss of a valued component of their fishing activity against an uncertain (in both magnitude and timing) future gain in the quality or quantity of that component. This would then suggest that respondents are more emotionally affected by the immediate certain loss than potential future gain, and hence would likely be biased towards the status-quo. Therefore, the most preferred management scenario (Figure 49) represents a more restrictive setting than the second-most preferred management

scenario (indicating the preference for action on stock rebuilding); but the least preferred management scenarios are the most restrictive (representing ‘a loss aversion’ in terms of current fishing activity).

There are strongly divergent views in the recreational fishing community on managing Sand Flathead which likely relate to a lack of awareness on the state of the stock and the causes for its decline. Also implicated is an apparent distrust in management, evidenced by commonly expressed concerns from fishers about ‘one directional management’ and/or ‘not getting the resource back’ once it improves. This is explored further in the next section, which reports respondents’ views on the best way to rebuild the Sand Flathead fishery (Question 32).

#### 4.4.3 Respondent opinions on required actions by management

The following results are based on free text responses to “*What do you think would be the best way to help rebuild the sand flathead fishery...*”. It is noted that the hypothetical management scenarios reported in Section 4.4.2 were presented beforehand to familiarise respondents with potential management measures that could be implemented.

Analysis of free-text responses was undertaken by thematic coding, a qualitative research technique used to identify patterns or themes within text. This technique assigns codes to segments of text that express meaningful ideas, concepts, or topics across responses.

*Table 2. coding structure used to analyse respondent answers to Q32 of the flathead focus survey (“What do you think would be the best way to help rebuild the sand flathead fishery...”).*

Response Code	Description
Reduce bag limits	Reduce the daily bag limit (e.g., 10 fish, 5 fish).
Increase size limit	Increase the minimum size limit (e.g., 34cm, 35cm).
Maximum size limit	Introduce a maximum size limit (e.g., 38cm, 40cm).
Introduce boat limits	Set a boat limit (e.g., 20, 30, 40).
Close fishery	Fishery closure (e.g., 6-8 months, 12-18 months, 2 years).
Closed season	Impose bans on sand flathead during certain periods.
Trust research/management	Support decisions based on scientific research and management expertise.
Policing and education	Increase enforcement and education to ensure compliance with regulations.
Stop commercial fishing/trawling	Restrict or ban commercial fishing.
Breeding and stocking	Breeding programs to restock young flathead.
Other suggestions	Other suggestions related to monitoring, size limits, closures during spawning seasons, etc.

Free-text responses were coded across eleven suggested rebuilding measures (Table 2). This provides valuable insight into the range and frequency of respondent preferences on rebuilding Sand Flathead stocks.

A reduction in the daily bag limit was the most cited measure followed by a fishery closure, a boat limit, and increasing the minimum size limit (Figure 51). Although, these were closely followed by ‘stopping commercial fishing’. The least cited response measure was restocking.

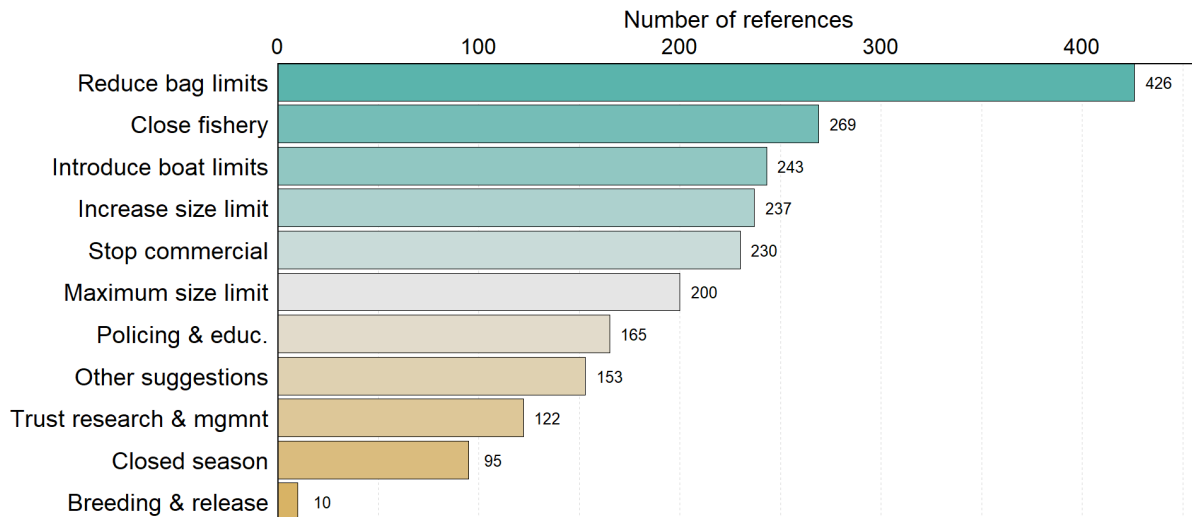


Figure 51. Frequency of respondents' perspectives on the most effective measures for rebuilding flathead stocks (responses to Question 32 "What do you think would be the best way to help rebuild the sand flathead fishery...") based on coding structure presented in Table 2. There were 1,222 responses (excluding "no opinion", "na", etc.) to Question 32.

#### 4.4.4 Summary of perspectives on stock health and management

There was majority agreement that the state of the Sand Flathead stock in Tasmania is in a poor condition and that the condition is worst in the southeast. There was dissatisfaction in both the number of fish caught by respondents and more so in the size of Sand Flathead caught. There was a strong correlation between satisfaction (see Section 4.3.2) and assumed state of the stock both at a statewide and regional level.

Overwhelmingly respondents thought that commercial fishing was having the greatest impact of Sand Flathead stock, with a significantly greater proportion of respondents associating the decline to commercial fishing.

This misperception of the primary driver of depletion will have a significant impact on the perceptions of management required to rebuild the stock. The relative responses to recreational management settings however are likely to be valid but, without acknowledging the magnitude of the role of recreational fishing in stock depletion, support for an appropriate degree of management intervention towards the recreational fishery is likely to be understated.

There were clear trends identified in the perceptions of both stock health and fisheries management based on the range of segmentation factors assessed.

Respondents that were female, under the age of 45 years, fished less than 10 days a year, had less years' experience fishing for Sand Flathead (generally less than 15 years) and a high degree of fishery literacy were all more likely to provide significantly more 'conservative' responses to questions about stock health and management intervention (Figure 52). We define 'conservative' as higher agreement that the stock is in poor condition and more supportive of measures that will improve the stock.

Males, older respondents, those that fished for 20 or more days in a year, had over 20 years' experience and *Poor* or *Low* fishery literacy were significantly more likely to provide a less 'conservative' response (Figure 52).

It is important to note that the sampling method resulted in some bias towards male fishers, older fishers and more avid fishers. Hence, the conservative response profiles are likely under-represented relative to the recreational fishing community in Tasmania.

*Inshore Fishers & Divers*, *Inshore & Freshwater Fishers* and *Inshore Fishers* modality profiles were all more likely to provide more conservative responses than the other segmentation profiles, particularly *Marine Line Fishers*, *Marine Generalists* and to a lesser extent, *Generalists* (Figure 52). This is an interesting response as the inshore fishing segmentation profiles are less likely to have an opportunity to switch to other species based on their fishing preferences relative to the marine and generalist profiles that engage in many more recreational fishing activities.

Respondents that were categorised in the *Leisure anglers* and *Independent anglers* and to a lesser extent the *Casual anglers* motivation groups all provided more conservative responses than the other categories. The *Community anglers* were most likely to provide significantly less conservative responses (Figure 52).

There was general agreement that reduced access to Sand Flathead from depleted stock is an issue for all with very few significant differences based on respondent characteristics. By contrast, however, there were many significant differences of opinion based on reduced access due to management intervention.

The eudemonic clusters were less likely to clearly discriminate significant differences between profiles, although *Influencers* were more likely to provide a less conservative response while *Easy-going* respondents were more likely to provide a conservative view. *Balanced* respondents were significantly more likely to provide either a more or less conservative response depending on the question (Figure 52).

The strongest psychographic determinant in response was Sand Flathead fishing orientation. *Recreation-oriented* Sand Flathead fishers were far more likely to provide a significantly more conservative response than respondents that were identified as *Harvest-oriented* (Figure 52).

An interesting result that counters a discussion point raised by fishers is that those that fish less will be more disadvantaged by a reduction in catch limits as they are not able to take enough fish on a trip to store fillets for later consumption, and hence have less opportunity to harvest protein from the resource. However, the results indicated that those that fish less are more likely to be accepting of more restrictive measures to rebuild stocks. One theory might be that *Generalists*, and *offshore marine fishers* are more financially invested in the fishery, requiring boats, often large if venturing offshore, and more fishing equipment, which becomes expensive particularly when fishing in deeper offshore fisheries or game fishing.

SURVEY OF RECREATIONAL FISHERS IN TASMANIA WITH A FOCUS ON SAND FLATHEAD

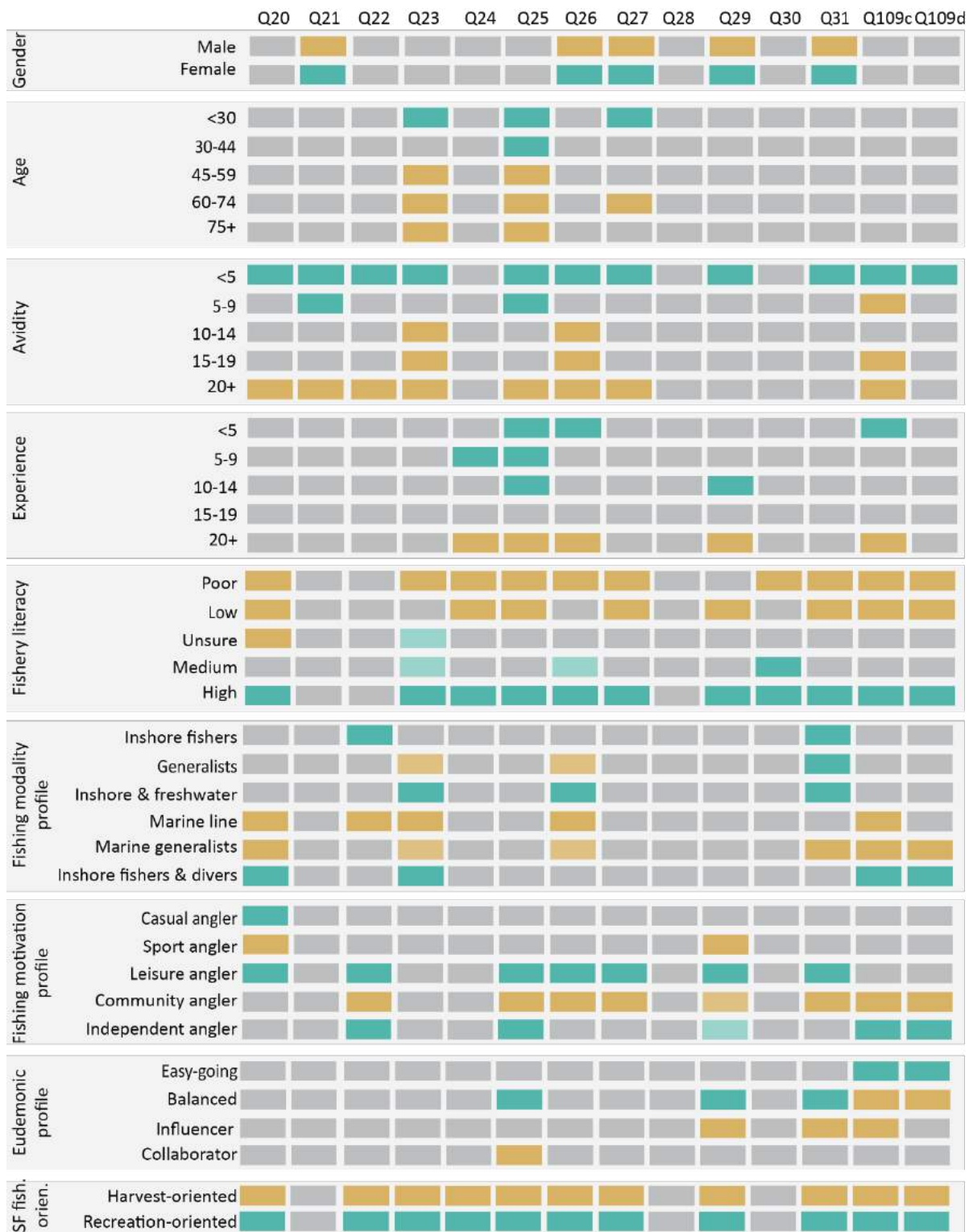


Figure 52. Matrix plot visually significant differences to questions about stock status and management interventions between factors assessed in this study. Green indicates a factor that reported a significantly more 'conservative' response (i.e., the bag limit is too high, the stock is in a poor condition), Yellow indicates a factor that reported a significantly less 'conservative response' (i.e., the stock is in a good condition, lack of support for more restrictive management intervention), while grey indicates no significant difference. SF fish. orien. = Sand Flathead Fisher Orientation.

#### 4.5 Perceptions on compliance and policing

The majority (73%) agreed that increased compliance checks by marine police are needed to enforce recreational fishing rules (Figure 53). There was a significant trend where younger fishers and *Recreation-* relative to *Harvest-oriented* more likely to agree with this statement (Appendix 1: Figure 100).

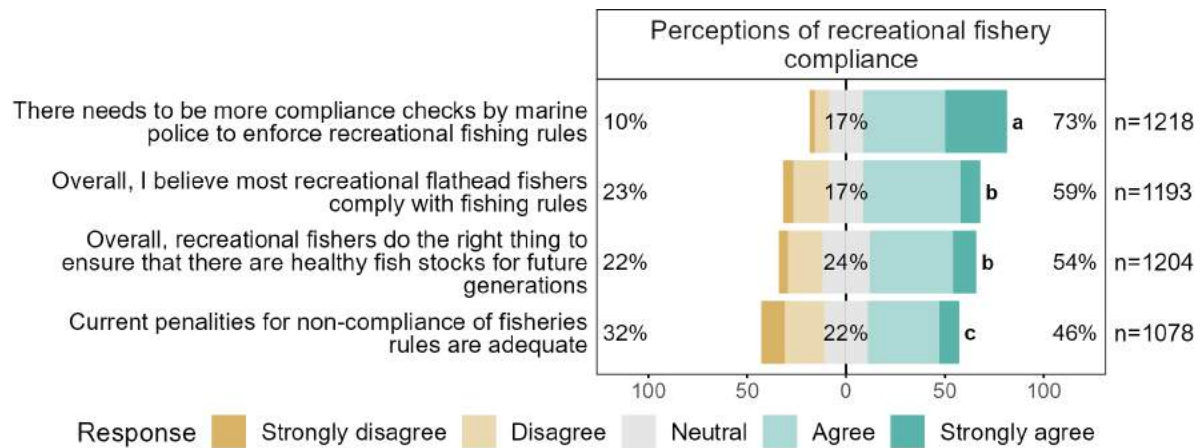


Figure 53. Respondent perception on compliance of the recreational fishery in Tasmania.

There was also majority agreement from the majority that most recreational fishers comply with fishing regulations, although nearly one in four stated that they disagreed with this (Figure 53). While a minority, it is significant that such a high proportion believe that not all recreational fishers do the right thing. A lower degree of fishery literacy and Sand Flathead fishers that were *harvest-* relative to *recreation-oriented* were more likely to agree more strongly with this statement (Appendix 1: Figure 99).

A similar proportion of respondents agreed that, overall, recreational fishers do the right thing to ensure that there are healthy fish stocks for future generations, but again 22% disagreed with this statement (Figure 53). Respondents that were younger, had higher fishery literacy and higher education as well as Sand Flathead fishers that were *Recreation-* relative to *Harvest-oriented* were all more likely to disagree with this statement (Appendix 1: Figure 102).

Forty-six percent of respondents agreed that current penalties for non-compliance are adequate, but 32% disagreed with this statement (Figure 53). *Recreation-* relative to *Harvest-oriented* Sand Flathead fishers were more likely to disagree with this statement (Appendix: Figure 101).

*“Wharf fishing needs to be regulated and checked on more.”*

*“Just better policing of the waterway and what people are catching.”*

*“I don’t think there is sufficient policing of our waterways. I think I have seen a boat only once this year in Coles Bay, needs to be a visible presence.”*

*“I believe the lack of law enforcement is a massive contributor to depletion of sand flathead stocks. So often I’ve heard of and seen people take*

*undersized fish and therefore take more than they should to get a feed. It's not just isolated incidents it's the norm. Not once have I heard this mentioned in the media about sandy depletion. There is simply no point in changing these rules without law enforcement or dedicated sea fisheries officers. Tasmania Police cannot do this as there are too many other issues/crimes they have to deal with. Whoever reviews my comments will see I feel very strongly about this and would be happy to talk further about what I've seen and what could be done to rectify the issue. Things would start changing very quickly if 15 people were fined for breaking limits and it was in the media."*

#### 4.5.1 Perceptions on data collection for fisheries management

Over two out of three respondents agreed or strongly agreed that data collected for managing recreational fisheries should be collected by the Government, or affiliated agencies (Figure 54). Respondents that fished less and those with the highest degree of fishery literacy were more likely to agree with this (Appendix 1: Figure 103).

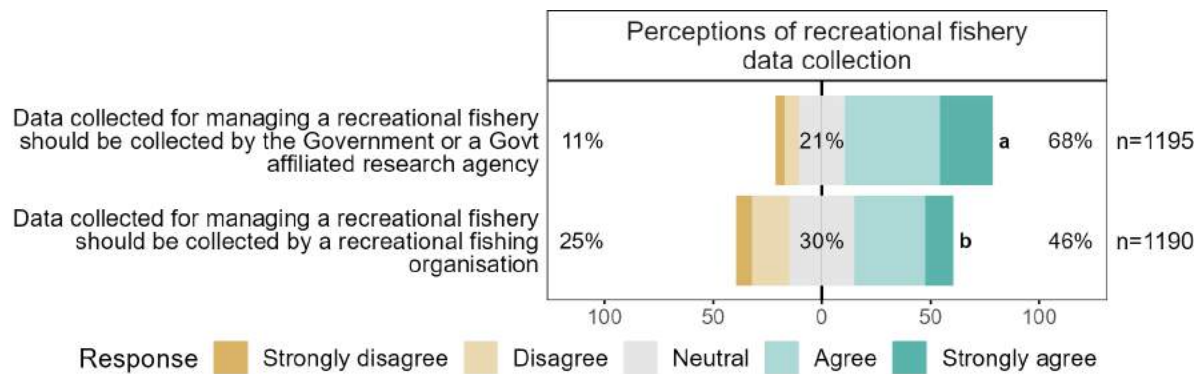


Figure 54. Respondent perception on data collection for sustainable management of the recreational fishery in Tasmania.

There was, however, also support (46% agreeing), that data collected for managing recreational fisheries should be collected by a recreational fishing organisation, with 30% indicating a neutral response and 25% disagreeing (Figure 54). The most avid fishers were more likely to agree than the lowest avidity group as were those with a lower level of schooling and those with all but the highest level of fishery literacy. It is not clear whether this response was considered in combination with Government data collection (i.e., citizen science initiatives) or as alternative data for management collected solely by the sector, however there was a slight negative correlation between agreement with collection by the recreational sector and agreement with collection by the government (Spearman's  $\rho = -0.18, p < 0.001$ ).

#### 4.6 Perceptions on stewardship, voluntary actions, and good fishing practices

Understanding what drives behaviour can inform the development of effective normative strategies to bolster engagement and generate long-term behaviour change, as an alternative to costly, and often ineffective enforcement in recreational fisheries (Cooke et al. 2013, Martin et al. 2017, Mackay et al. 2018).

Fifty-three percent of respondents thought encouraging recreational fishers to voluntarily reduce catches could make a big difference in the recovery of Sand Flathead stocks. Thirty six percent thought it wouldn't make a difference and 11% were unsure (Figure 55). *Recreation-*

relative to *Harvest-oriented* Sand Flathead fishers were more likely to agree with this statement (Appendix 1: Figure 105).

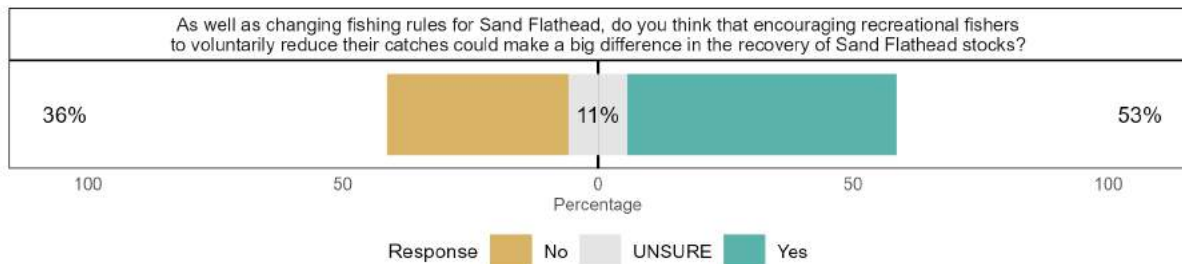


Figure 55. Responses to a question asking survey participants their thoughts on the following: ‘As well as changing fishing rules for Sand Flathead, do you think that encouraging recreational fishers to voluntarily reduce their catches could make a big difference in the recovery of Sand Flathead stocks?’ (n = 1,390, 159 respondents provided a response of ‘unsure’).

Over 90% of respondents provided a score of five or greater (out of ten) when asked whether they would be likely to remind or educate friends, family, or others about recreational fishing rules. This indicates widespread willingness among flathead fishers to social sanction peers when required (Figure 56). The most avid relative to those who fish less than 10 days a year, *Marine Generalists* relative to all but *Inshore & Freshwater fishers*, *Sports and Community anglers* as well as *Influencers and Collaborators* were more likely to provide higher agreement to this statement (Appendix 1: Figure 106).

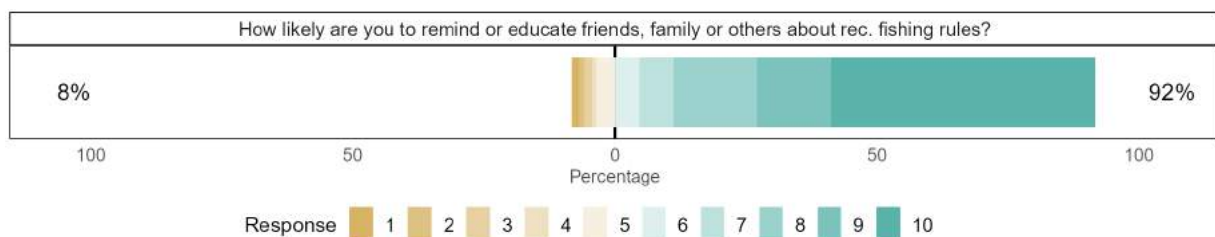


Figure 56. The response profile to a question asking respondents to indicate how likely they were to remind or educate friends, family, or others about recreational fishing rules, where 1 indicates they are highly unlikely and 10 indicates they are highly likely (n = 1,219).

#### 4.6.1 Gear to minimise damage and fish handling practices while flathead fishing

##### 4.6.1.1 De-hookers

De-hookers minimise handling which is known to increase the chance of a fish surviving when released (Brownscombe et al. 2017). Nearly three out of four respondents indicated using a de-hooker either most or all the time (Figure 57). Twenty-three respondents (< 2%) indicated that they did not know what a de-hooker was.

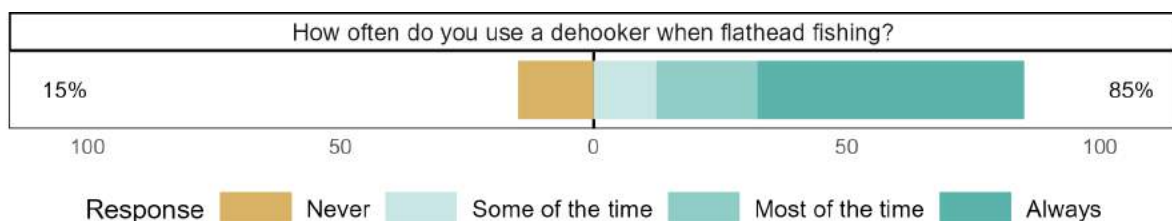


Figure 57. How regularly respondents use a de-hooker when flathead fishing (n = 1,390).

Sand Flathead fishers that are *Harvest-* relative to *Recreation-oriented* are more likely to use a de-hooker (Appendix 1: Figure 107). However, respondents who mainly fished the east and north coasts were more likely to use a de-hooker than those that mainly fished in the southeast

or the Tamar River, in some cases this difference was significantly different between regions (Figure 58).

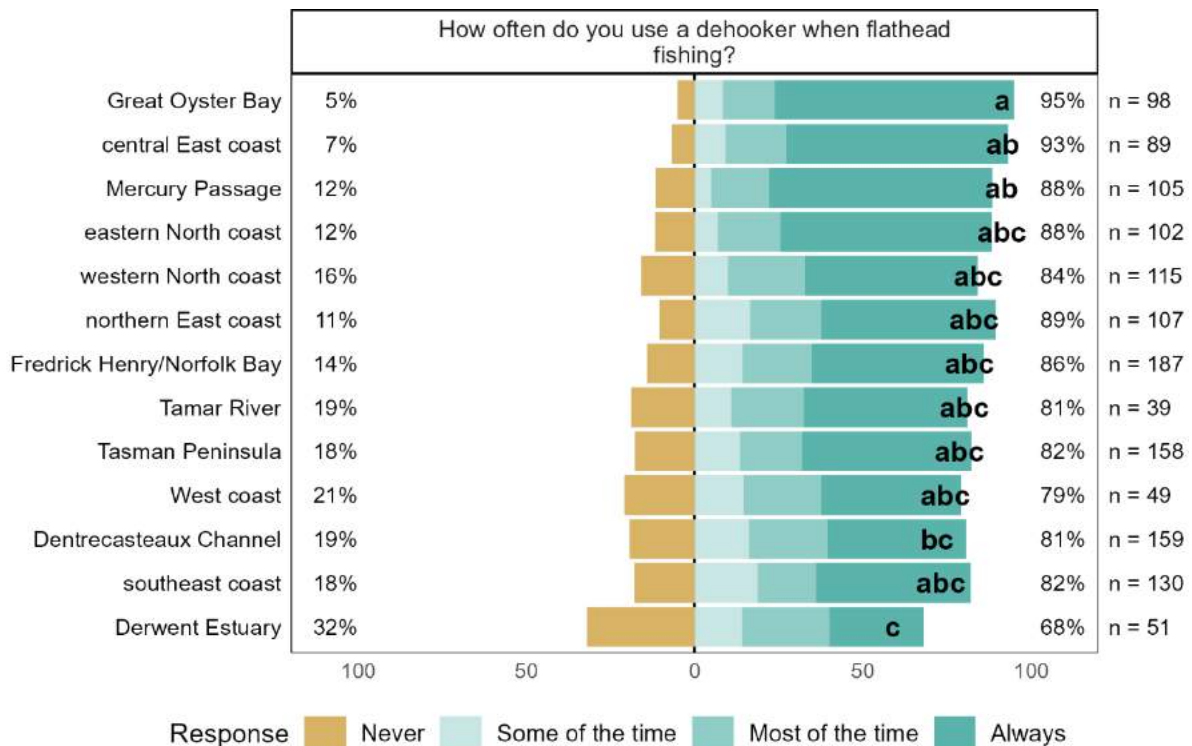


Figure 58. How common it is for respondents to use a de-hooker by the main region they fish for Sand Flathead.

#### 4.6.1.2 Circle hooks

Circle hooks are known to minimise deep hooking of Sand Flathead which is one of the major causes of post-release mortality due to damaging vital organs (Lyle et al. 2007). When circle hooks are used, post-release survival rates for Sand Flathead are greater than 99% (Lyle et al. 2007). Just under half of the respondents reported that they use circle hooks when fishing for flathead using baited lines either *Most of the time* or *Always* (Figure 59). Seven percent of respondents reported they did not know what a circle hook was. There was no significant response difference based on any of the factors tested (Appendix 1: Figure 108), including region most fished.

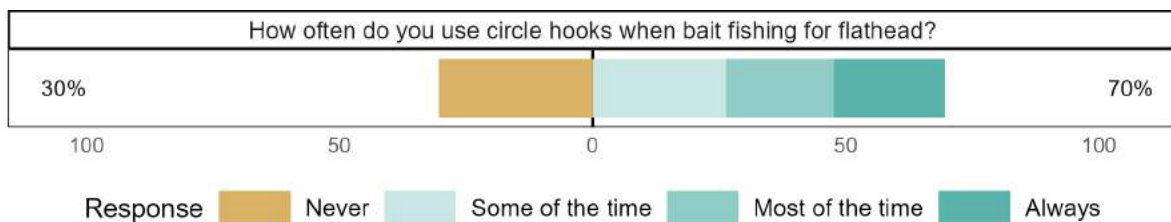


Figure 59. How regularly respondents use circle hooks when bait fishing for flathead (n = 1,390).

#### 4.6.1.3 Using Sand Flathead as bait

Using undersize fish for bait is illegal and contributes to fishing mortality. Over nine out of 10 respondents indicated that they either *Never* or only sometimes use Sand Flathead as bait (Figure 60). *Harvest-oriented* fishers were significantly more likely to report using Sand Flathead for bait than *Recreation-oriented* Sand Flathead fishers. There were also some significant differences based on the main region fished with a trend of those in the east and southeast more likely to use Sand Flathead as bait (Figure 61). While the results are

encouraging, it is not clear from the question whether respondents indicating using flathead for bait were referring to the use of fish frames or offal from harvested fish, which has no detrimental impacts on the fishery.

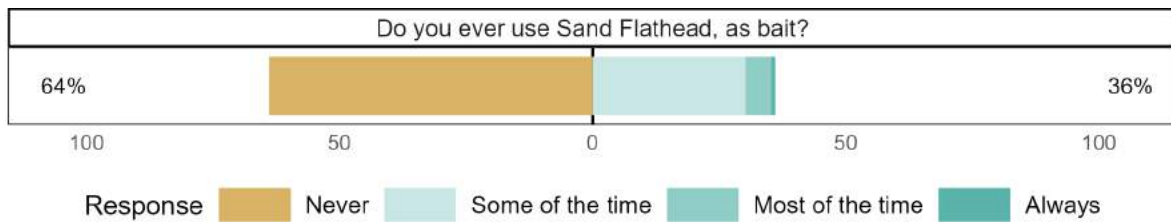


Figure 60. How regularly respondents use Sand Flathead for bait (n = 1,390).

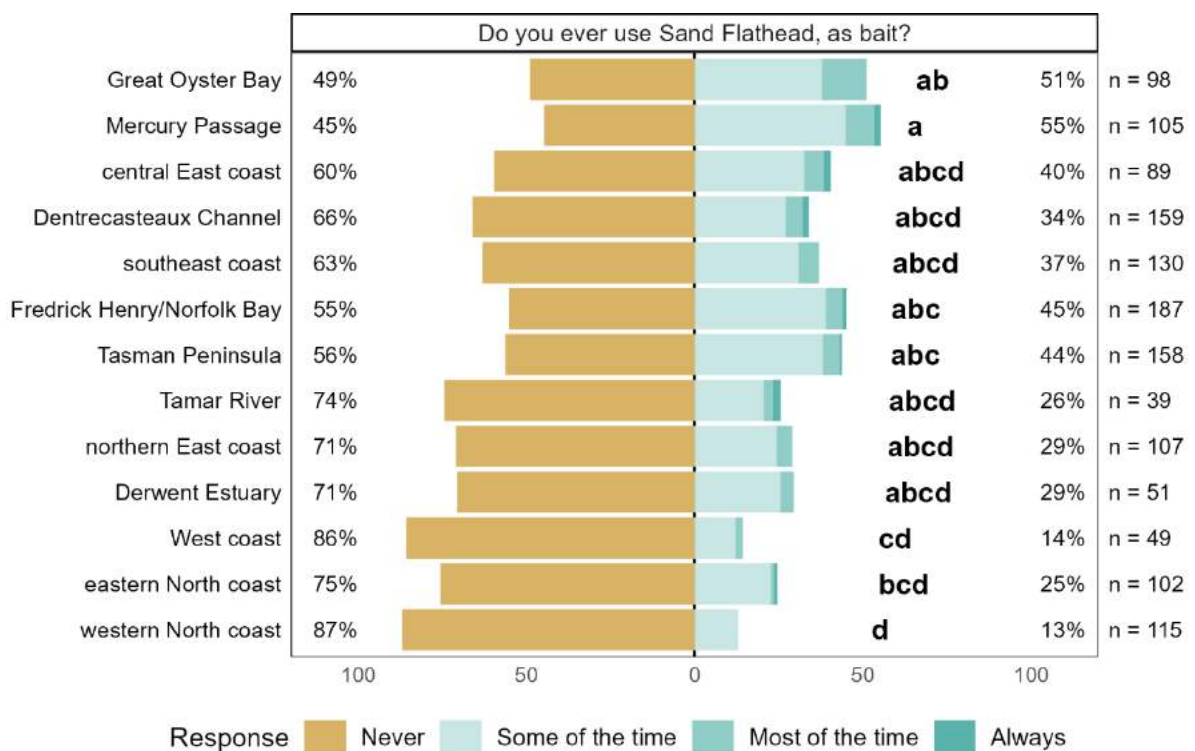


Figure 61. How often respondents use Sand Flathead as bait by the main region they fish for Sand Flathead.

Given the number of undersized Sand Flathead caught, minimising damage and post-release mortality for released fish is important to assist with the rebuilding of stocks. The results indicate some scope to encourage the use of de-hookers, but considerably more scope to encourage the use circle hooks. Increasing these behaviours should be a focus of education and stewardship initiatives.

#### 4.7 Species preferences and substitution potential

Understanding species preferences of survey respondents can be a useful tool to assess substitution potential of catch and effort from Sand Flathead while catch is restricted to allow stocks to rebuild. While there was some indication that recreational fishers may fish less if they are unable to access Sand Flathead the high value placed by respondents on recreational fishing as a dimension of their lifestyle (Q71; Figure 12) suggests a likely outcome may be a redirection of effort to other species. It has been explored in other jurisdictions whether the promotion of species substitution is an effective complement to fishing regulations in reducing fishing mortality (Ditton and Sutton 2004, Gentner and Sutton 2008, Scheufele and Pascoe 2022).

In this study we asked respondents to rank between 0 – 10 several common fish species found in Tasmania by their enjoyment of the experience of catching the fish and secondly their enjoyment of consuming the fish. A result of '0' reflected that they did not either catch or consume the species depending on the question, then a score of '1' reflected very low enjoyment and '10' the highest enjoyment. By then using a 'bump' plot to visualise the data it was possible to identify species that were commonly caught or eat but ranked low for the experience or consumption or species that were less commonly caught but ranked higher for the experience or consumption. The former indicate species that may be a substitute but would require some education on how to increase the value by using appropriate tackle or preparation, preservation and cooking techniques to improve the eating qualities. The latter reflects species that are potentially currently underutilised but are likely to be popular as substitutes.

Ninety-nine percent of all respondents reported both catching and eating Sand Flathead (Figure 62; Figure 63). The next highest caught and eaten fish among the 15 key recreational scalefish species presented to respondents were Southern Calamari (91%) and Tiger Flathead (85%).

When asked to rate the importance of the same 15 species for both the fishing experience provided and their eating qualities, Sand Flathead was valued highest on both measures followed by Southern Calamari, Tiger Flathead and Striped Trumpeter. For both, the differences in importance between Sand Flathead and other species were also statistically significant. On the 10-point scale of importance, 81% and 91% of respondents assigned the experience and consumption values greater than five, respectively (Figure 62).

While these results underscore the importance of the Sand Flathead recreational fishery, it needs to be acknowledged that an overwhelming expression of importance was not unexpected given the focus of the survey. Also noteworthy is the possibility of a strategic response bias where some respondents may have exaggerated the importance of Sand Flathead to affect management outcomes. Nonetheless, the fishery is clearly of great importance to the recreational sector, as reported in Statewide surveys over a 20-year period (Henry and Lyle 2003, Lyle et al. 2009, Lyle et al. 2014, Lyle et al. 2019, Tracey et al. In prep).

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*"Sand flathead is delicious."*

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SURVEY OF RECREATIONAL FISHERS IN TASMANIA WITH A FOCUS ON SAND FLATHEAD

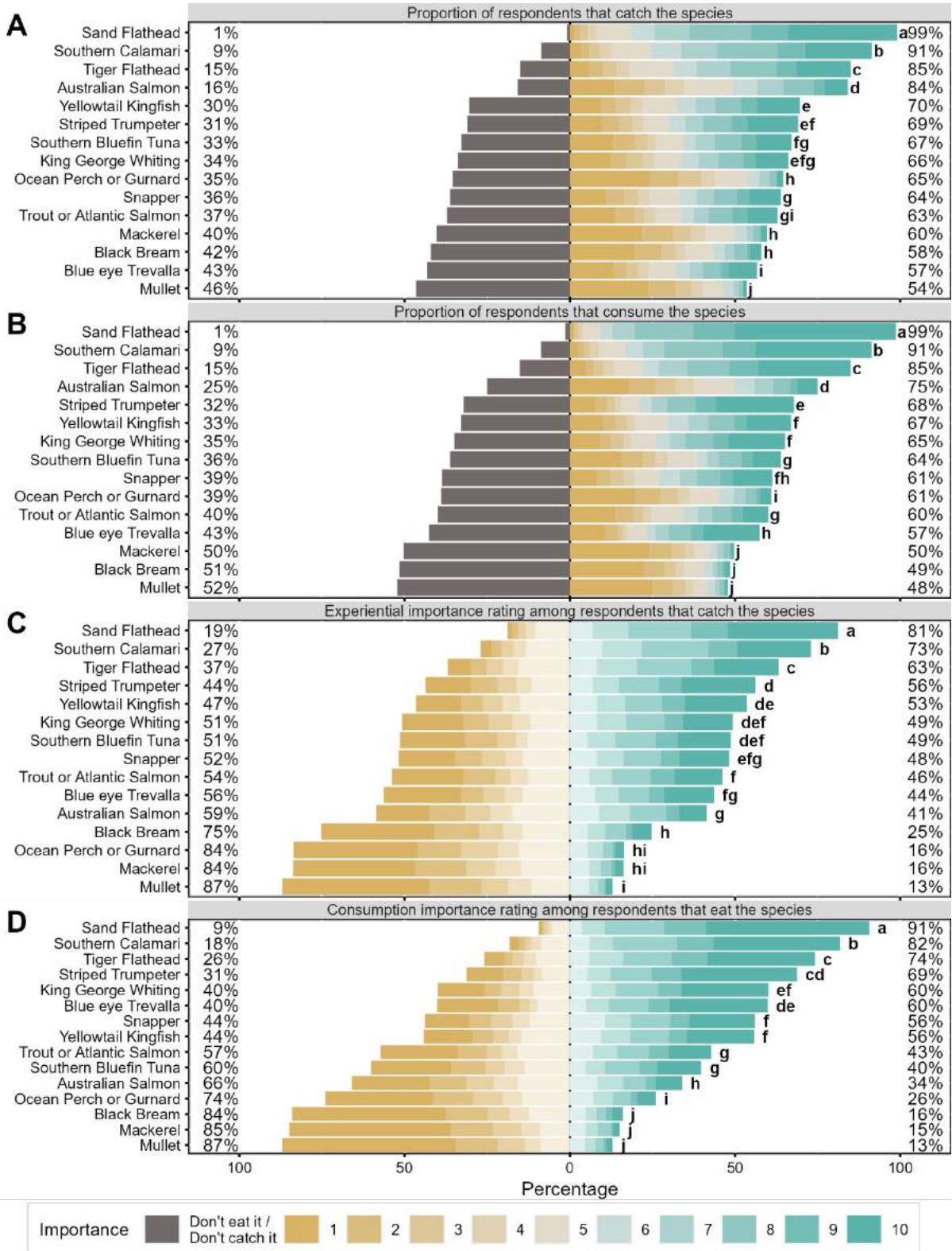


Figure 62. (A) Respondent scores rating how important each of the listed species is to their fishing experience from 1 to 10, where 1 is their least favourite fish and 10 is their most favourite fish to catch. (B) Respondent scores rating how important each of the listed species is for them to catch and eat, from 1 to 10, where 1 is you don't enjoy eating at all to 10 is it would be your favourite fish to eat. (C) Respondent scores rating how important each of the listed species is to their fishing experience, from 1 to 10, where 1 is you don't enjoy the experience of catching them at all to 10 where it is one of their favourite fish to catch. Respondent scores rating how important each of the listed species is for them to catch and eat, from 1 to 10, where 1 is you don't enjoy eating at all to 10 is it would be your favourite fish to eat.

#### 4.7.1 Southern Calamari

The popularity of Southern Calamari *Sepioteuthis australis* to the recreational sector has increased dramatically over the last 20-years (Lyle et al. 2019). The Tasmanian stock is currently classified as 'depleting' (Fraser et al. 2022). A shift of fishing effort to this species is likely to be detrimental as recreational catches already contribute between a quarter and a half of the total statewide catch according to the last three statewide surveys – 2007/08, 2013/14, 2017/18 (Lyle et al. 2019, Fraser et al. 2022).

#### 4.7.2 Tiger Flathead

Tiger Flathead *Neoplatycephalus richardsoni* are currently assessed as sustainable, and the recreational sector takes a very small proportion of the overall harvest (SAFS 2020<sup>1</sup>). They are a good substitute target to Sand Flathead, rated third according to the importance of the fishing experience provided and their eating qualities (Figure 62, Figure 63). However, its preference for deeper water compared with Sand Flathead (Edgar 2008) would limit access to fishers willing and able to access deeper waters (generally >50 m). While their catchability is seasonal, they are available during the summer and autumn months when recreational fishing effort for flathead is highest (Lyle et al. 2019).

#### 4.7.3 Eastern Australian Salmon

Eastern Australian Salmon *Arripis trutta* offers excellent substitution potential due to its ubiquitous distribution around Tasmania (Fraser et al. 2022), accessibility from both boat and shore (Lyle et al. 2019) and its sustainable stock status (SAFS 2020<sup>2</sup>). They were ranked the fourth most caught and eaten species. However, its reported poorly rated catching and eating qualities, ranked 11<sup>th</sup> for both the importance of the fishing experience and eating qualities, would require a change in mindset from recreational fishers. It is not clear if Australian Salmon have become less popular over time, but recreational catch has declined since 2000/01 (Lyle et al. 2019). They are a powerful fighting fish and using appropriate tackle can provide a rewarding fishing experience. Smaller fish are reportedly better to eat than adult fish (Yearsley et al. 1999) and careful post-capture preparation including bleeding, rapid chilling and smoking can improve eating qualities<sup>3,4</sup>.

#### 4.7.4 Yellowtail Kingfish

While Yellowtail Kingfish *Seriola lalandi* have reportedly been caught in Tasmania for decades, they have increased their distribution in Tasmania waters in recent years (Stuart-Smith et al. 2018, Graba-Landry et al. 2023). They are a popular recreational species on the mainland where they grow to 1,900 mm (Stewart and Hughes 2008, Green et al. 2020). In Tasmania, most fish caught are smaller and sexually immature, particularly off the east coast; however some larger (and possibly mature) fish are caught on the north coast (Graba-Landry et al. 2022).

With ocean warming in southern Australia, the distribution of Yellowtail Kingfish is predicted to increase, particularly southward (Champion et al. 2018, Champion et al. 2019, Gervais et al. 2021, Graba-Landry et al. 2022, Graba-Landry et al. 2023). With increasing availability in

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<sup>1</sup> Status of Australian Fish Stocks [Tiger Flathead 2020 \(fish.gov.au\)](https://fish.gov.au) accessed on 1 Sept 2023.

<sup>2</sup> Status of Australian Fish Stocks [Eastern Australian Salmon 2020 \(fish.gov.au\)](https://fish.gov.au) accessed on 1 Sept 2023.

<sup>3</sup> [Cooking Australian Salmon | Recipes for Kahawai \(sea-ex.com\)](https://sea-ex.com)

<sup>4</sup> [Fishing Monthly Magazines: Cleaning and Preparing Australian Salmon](#)

eastern and southern Tasmania, this species has great potential value as a substitute target species for Tasmanian recreational fishers. While the multi-jurisdictional stock of this migratory species is currently assessed as ‘sustainable’ (SAFS 2020<sup>5</sup>). At current catch levels from the Tasmanian recreational sector, concerns about the broader stock are likely to be minimal.

The results indicate potential to promote the experiential and eating qualities of this species as a substitute target for Sand Flathead. They are renowned as a tough fighting fish and often inhabit inshore waters, making them accessible to both boat-based and shore-based fishers. They are also highly attracted to structures, including fish aggregating devices (FADs). The Tasmanian Government has recently installed 14 FADs in Tasmanian waters giving Tasmanian fishers more opportunities to target this species. They are considered to be excellent eating, often used for sashimi and have good oil qualities suitable for smoking (Yearsley et al. 1999). Regarding the lower rating given for its eating qualities, this could be improved by promoting greater awareness on dispatching, processing, preparing and preservation techniques.

#### 4.7.5 Striped trumpeter

The proportion of recreational Striped Trumpeter *Latris lineata* catches to total statewide catches has increased from 40% to 69% in 2017/18 (Lyle et al. 2019, Fraser et al. 2022). While they were historically caught on inshore reefs (particularly juvenile fish), prolonged fishing pressure has contracted their core range to deeper offshore waters (Tracey and Lyle 2005). High inter-annual recruitment variability has affected stock viability and minimum legal size limits below size at maturity have likely exposed juvenile fish to fishing mortality (Tracey et al. 2007, Tracey et al. 2011). While recent changes to management settings aim to recover the stock, promoting additional fishing pressure on this species is not recommended.

#### 4.7.6 Southern Bluefin Tuna

In line with a significant global recovery trend over the last decade (CCSBT 2019, Hobsbawn et al. 2019), the abundance and seasonal and geographic availability of Southern Bluefin Tuna *Thunnus maccoyii* in Tasmanian waters appears to have increased in recent years. Previously limited to the east and south coasts in autumn and winter, they are now caught all around the state in almost all months and often close to shore. While this has made Southern Bluefin Tuna (SBT) more accessible, they are still restricted to fishers with access to a vessel of suitable size and quality plus relatively sophisticated and expensive fishing gear (Tracey et al. 2023). Another limitation in the potential for this fishery to receive transferred effort is the nature of the fishing itself where large fish are targeted offshore in exposed conditions. This would likely deter many fishers irrespective of boat and gear access.

Despite this, there may be more scope for additional effort, particularly considering the growing capacity of the Tasmanian recreational fleet and the increasing abundance, distribution, and seasonality of the fishery. While most fishers are likely aware that SBT provide premium sashimi, anecdotal evidence suggests that SBT prepared in other ways is unpopular and likely reflected in the low rating (10<sup>th</sup>) given to their eating qualities. This is due to a large volume of blood in the muscle tissue requiring careful dispatchment, processing and storage to enhance their consumption value. Providing information to fishers on how to do this – such

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<sup>5</sup> Status of Australian Fish Stocks [Yellowtail Kingfish 2020](#) accessed on 1 Sept 2023.

as promoted by the ‘Tuna Champions’ stewardship program (Tracey et al. 2023) – could be an important focus of potential efforts to promote the fishery.

#### 4.7.7 King George Whiting

In South Australia and Victoria, King George Whiting *Sillaginodes punctatus* are one of the most popular and commonly caught species caught by recreational fishers and are highly prized for their fighting and eating qualities (Yearsley et al. 1999). In Tasmania, the distribution of King George Whiting (KGW) has increased significantly over the last decade (Graba-Landry et al. 2022, Graba-Landry et al. 2023). While the species has been reported along the north coast for decades, populations have extended southwards with increasing water temperatures and are now commonly caught at numerous locations along the east coast. In these areas, KGW provide excellent fishing opportunities. Throughout their distribution they are currently assessed as sustainable (SAFS 2020<sup>6</sup>), although they appear genetically different from each other, including the population in Tasmania (Jenkins et al. 2016). As they are caught in shallow inshore waters, are accessible from boat and shore and require relatively simple fishing equipment, they are an excellent substitute species for Sand Flathead. Statewide recreational catches have increased considerably over the last 20 years (Lyle et al. 2019). They were ranked down the list based on the number of people who fish for them, likely due to their spatial distribution, but those that did catch them rated them highly for both experience and consumption.

Anecdotal accounts of captures as far as Adventure Bay and Southport have been reported suggesting that the species has the potential to establish viable populations in south-east Tasmania – the region most affected by management changes to the Sand Flathead fishery. While this is likely to provide recreational fishing opportunities in coming years, it would be prudent to carefully assess the stock potential and cross-sectoral catch restrictions to ensure added fishing pressure from an effort shift can be accommodated. If managed carefully, KGW should be on an increasing biomass trajectory as more suitable habitat becomes available for the species in Tasmania (Twiname et al. 2020, Gervais et al. 2021, Graba-Landry et al. 2022, Graba-Landry et al. 2023).

#### 4.7.8 Scorpaeniformes

Ocean Perch *Helicolenus percoides* and Gurnard *Neosebastes scorpaenoides* were grouped as they are both from the Order *Scorpaeniformes* and are often confused with each other. They are generally a bycatch species, with Ocean Perch typically caught when fishing over reefs for species such as Striped Trumpeter while Gurnard are often caught while fishing over sand for species such as flathead. They were ranked low for experience and eating qualities but were relatively commonly reported caught among respondents.

Both species have venomous spines which contributes to their reputation as a pest species by many and their ascribed low experience value reported in this study. While both species have excellent quality white flesh, anecdotal reports indicate that many fishers prefer to release the fish to avoid being spiked. Therefore, promotional efforts could focus on education on how to handle the fish safely. They are likely a good substitute species for Sand Flathead, particularly to harvest a fish of good eating quality (Yearsley et al. 1999).

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<sup>6</sup> Status of Australian Fish Stocks [King George Whiting 2020 \(fish.gov.au\)](https://www.fish.gov.au) accessed on 1 Sept 2023.

#### 4.7.9 Snapper

Like the King George Whiting, Snapper *Chrysophrys auratus* are a very popular recreational target species on mainland Australia (West et al. 2015, Ryan et al. 2019, Conron et al. 2020, Graba-Landry et al. 2022, Beckmann et al. 2023) and have been caught in low numbers in Tasmanian waters for many years, mainly on the north coast. In recent decades, the availability of Snapper appears to have increased along the north coast and extended southwards with warming waters. They are now regularly caught off the east and southeast coasts though the size of the fish is generally smaller than fish caught off northern Tasmania.

Snapper are keenly targeted by a growing number of recreational fishers as they become more established in Tasmanian waters. Like KGW, they can be caught in shallow inshore waters, by both boat and shore fishers and require relatively simple fishing equipment. As such, they could be considered an excellent substitute species for Sand Flathead particularly given predictions of a biomass increase over the coming decades (Graba-Landry et al. 2023), including in south-eastern waters where recreational fishing effort is most highly concentrated. Although not ranked particularly high for either experience or eating by respondents, this will likely increase with education and increased abundance of larger fish especially given their popularity on the mainland.

However, they have life history characteristics making them vulnerable to overfishing and multiple Snapper stocks across Australia are currently assessed as 'depleted' (SAFS 2020<sup>7</sup>). As such, they need to be carefully managed, particularly if fishing effort is likely to increase and suppress the potential of their continued emergence in Tasmania (Link et al. 2011, Twiname et al. 2020).

#### 4.7.10 Freshwater species

Trout and Atlantic Salmon *Salmo salar* were grouped in this assessment as freshwater species. However, gillnetting and line fishing of Atlantic Salmon escapees from aquaculture farms and sea run trout in marine waters occurs. In this study we have considered both species based on freshwater angling as the Tasmanian Government is phasing out recreational gillnetting. This may, however, not have been clear to respondents so there may be a confounding effect on the response profile to this question.

Despite a substantial proportion of flathead fishers who indicated fishing for Atlantic salmon and/or trout, segmentation profiling in Section 4.1.3 indicates potential challenges associated with promoting trout and salmon fishing to some identified flathead fishing clusters. If promotion were considered, understanding drivers that create a delineation between marine and freshwater fishing participation may provide important insights.

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<sup>7</sup> Status of Australian Fish Stocks [SAFS Report - Prod \(fish.gov.au\)](https://fish.gov.au) accessed on 1 Sept 2023.

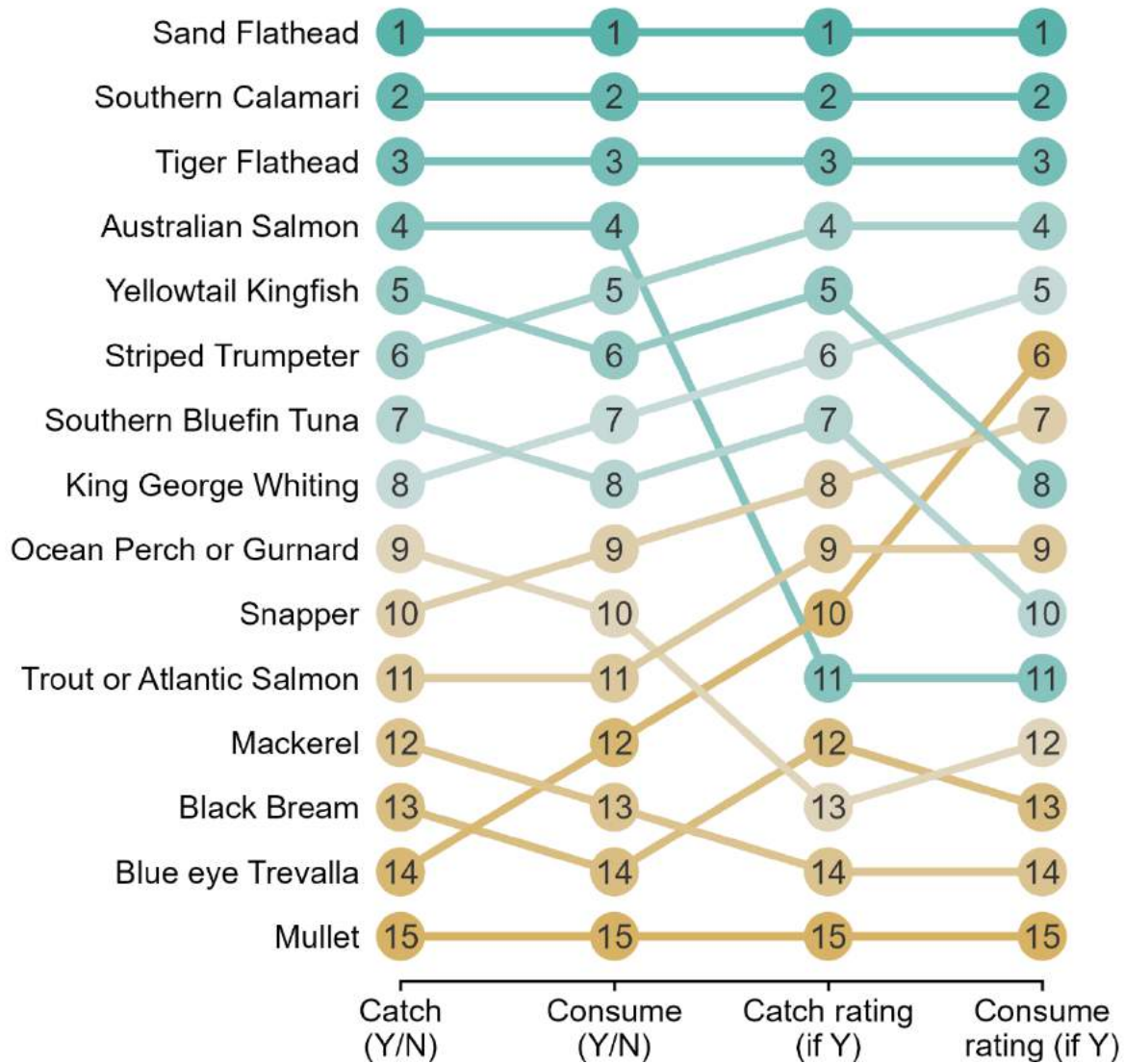


Figure 63. Bump plot showing the ranking (and change of ranking) based on whether respondents experience catching the species, consume the species, the importance to the fishing experience and the importance of consuming the species.

#### 4.7.11 Mackerel

Several mackerel species are common in Tasmanian coastal waters during the warmer months and can be caught from boat and shore. They are often used as bait for other species and can provide a good fishing experience on light fishing gear. However, they are generally considered poor eating as reflected in the low rating received in this study. Given the popularity of smoked and cured mackerel among people from northern Europe and South America, promotional efforts could focus on non-traditional ways of fish preparation.

#### 4.7.12 Black Bream

Black Bream *Agropanthus butcherii* are caught by shore and boat-based fishers in estuaries, including the lower Derwent River. They fight hard on light gear, can be challenging to catch and attract a following of dedicated anglers. As such, the low experiential rating among survey respondents who had caught the species was somewhat unexpected. Despite this, there may be scope to promote Black Bream fishing for experiential values particularly among shore-based fishers close to metropolitan areas.

Black Bream are predominantly considered a sports fish with many fishers choosing to release them (Lyle et al. 2019). They are not highly regarded for eating and there appears to be a heightened awareness among fishers of their vulnerability to fishing (particularly their long lives and high age at reproduction) as well as elevated levels of Mercury in some estuaries, including the Derwent River (Verdouw et al. 2011). As such, promoting Black Bream fishing for consumption is neither advisable nor likely to be successful.

#### 4.7.13 Blue Eye Trevalla

Blue Eye Trevalla *Hyperoglyphe antarctica* were the 14<sup>th</sup> and 12<sup>th</sup> most caught and eaten fish, respectively. Among respondents who had caught them, they were rated 10<sup>th</sup> and 6<sup>th</sup> for the importance of the fishing experience provided and their eating qualities, respectively.

Blue Eye Trevalla is a deep-water species, and a boat of sufficient size and seaworthiness is required to access the fishery. Successful fishing also requires sophisticated electronics to identify habitat and mark spots. These factors exclude the species as a target for many recreational fishers. For boat-based fishers, however, with suitable gear and vessel they were rated highly, particularly for their eating qualities.

#### 4.7.14 Mullet

Yelloweye Mullet *Aldrichetta forsteri* was the lowest ranked species across all rankings (Figure 49, Figure 50). Regardless, this underutilised fishery has numerous qualities that suggest potential for displaced Sand Flathead fishing effort given considerable promotional efforts. These include widespread availability in coastal and estuarine waters for shore and boat-based fishers, good fighting abilities, responsiveness to berley, and being easy to catch. As an oily fish, its eating qualities are reputedly enhanced through smoking and curing. Further, they are currently assessed as a 'sustainable' species in Tasmania (SAFS 2020<sup>8</sup>).

#### 4.7.15 Other species

A large range of additional species were nominated, spanning a diverse range of taxa (e.g., teleosts, elasmobranchs, and cephalopods), preferred habitats and fishing modalities (e.g., inshore line fishing, deepwater line fishing, spear and game fishing).

Gummy Shark *Mustelus antarcticus* was easily the most mentioned species, both for experiential (20% of responses) and consumptive values (23%) followed by Jackass Morwong *Nemadactylus macropterus*, Greenback Flounder *Rhombosolea tapirina* and Albacore Tuna *Thunnus alalunga*, each accounting for 6-9% of responses to both measures (Figure 64). The remaining species each accounted for 5% or less of all responses.

Gummy Shark are a good fighting fish with excellent eating qualities and can often be caught in the same habitat as Sand Flathead. They are classified as sustainable (SAFS 2020<sup>9</sup>); however, like most elasmobranch species they are sensitive to overfishing (Dulvy et al. 2021). As such, sharks are not allowed to be retained in a large proportion of Tasmania's inshore bays in estuaries that account to the majority of the statewide Sand Flathead catch. In other waters, catch should be carefully controlled and monitored if effort is to increase.

<sup>8</sup> Status of Australian Fish Stocks [Yelloweye Mullet 2020 \(fish.gov.au\)](https://www.fish.gov.au) accessed on 1 Sept 2023.

<sup>9</sup> Status of Australian Fish Stocks [Gummy Shark 2020 \(fish.gov.au\)](https://www.fish.gov.au) accessed on 1 Sept 2023.

The other species of importance are also limited in their potential to receive additional displaced fishing effort. Jackass Morwong have recently been classified as depleted (Fraser et al. 2022), Greenback Flounder are generally not caught on angling gear and Albacore Tuna require boats and gear with offshore capacity and are only available for a short period of time. Of the species shown in Figure 64, the ones least limited by fishery sustainability, activity specialisation and regional and seasonal availability are likely to be wrasse and leatherjackets. However, their relatively low popularity among survey respondents suggests that efforts to promote these fisheries are unlikely to result in large changes in statewide fishing effort.

In summary, while some species may provide a reprieve for a recreational fishing experience and a white flesh fish to substitute for consumption, few coastal species are going to be considered the quality of the iconic Sand Flathead, highlighting the need to recover the species for the benefit of the Tasmanian community for current and future generations.

*“We now target other species because flathead stocks are low. People need to be educated to catch and eat other species.”*

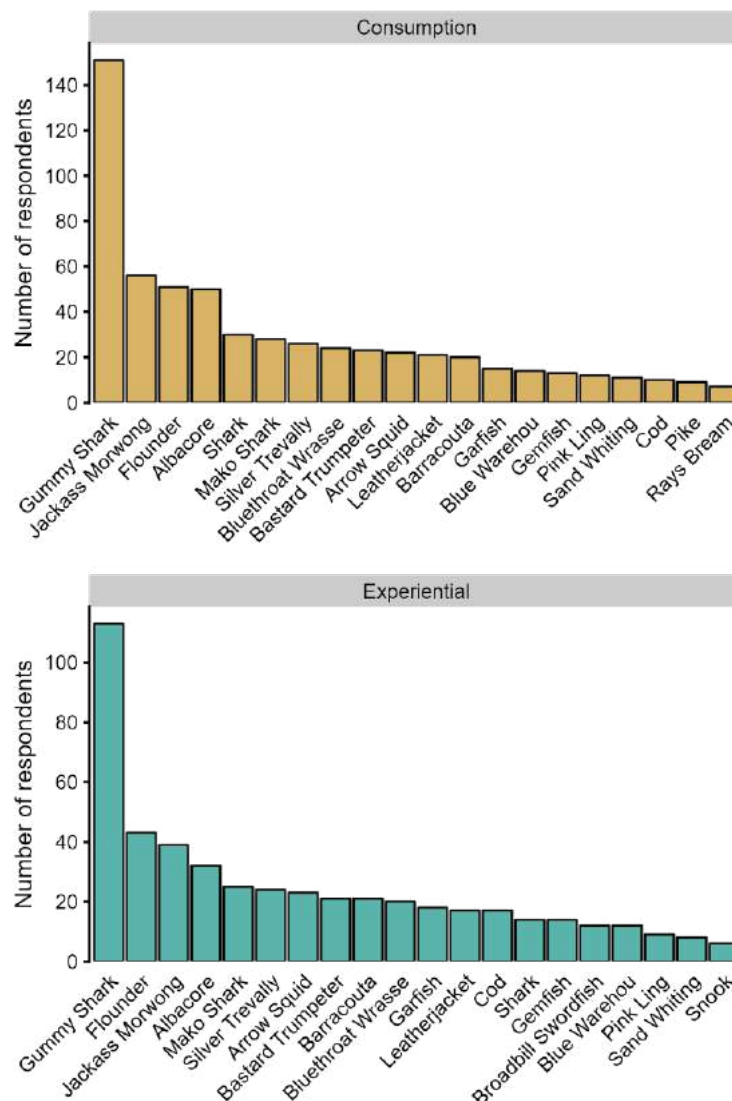


Figure 64. Frequency of species other than those listed in Q39-53 and Q55-69 mentioned by respondents relating to fish and cephalopods that they rate as either for consumptive (n = 593) or experiential values (n = 488). The top 20 species from each value are shown, the remainder accounted for less than 1% of mentions.

#### 4.8 Social media use

Just over one-thousand respondents indicated they used social media ( $n = 1,033$ ), of which 35% stated they used it to share their fishing experiences (Figure 65A). Facebook, followed by Instagram were by far the most cited platforms to share fishing experiences (Figure 65B).

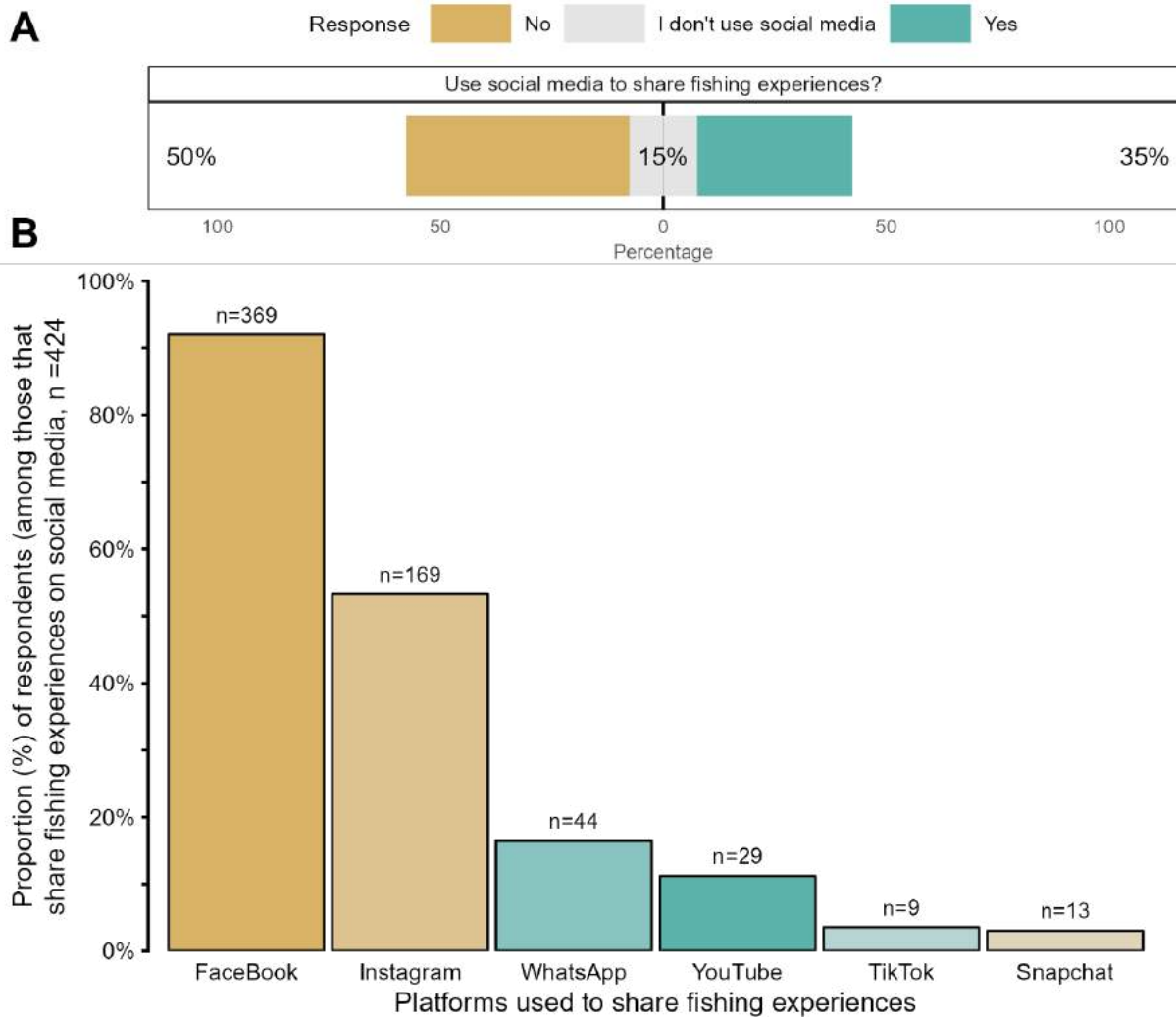


Figure 65. Use of social media including platform preferences of respondents.

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## Appendix 1 – Survey question factor analysis plots

On the following pages are plots of responses to a range of questions from the Flathead focused survey, stratified by demographic and fishing factors. The letters next to each bar indicate the results of pairwise Kolmogorov-Smirnov tests for differences in the distribution of responses among subgroups of each stratifying factor, such that the distribution of responses for subgroups that do not share a letter are significantly different from one another ( $p < 0.05$ , after Holm correction for multiple comparisons).

SURVEY OF RECREATIONAL FISHERS IN TASMANIA WITH A FOCUS ON SAND FLATHEAD

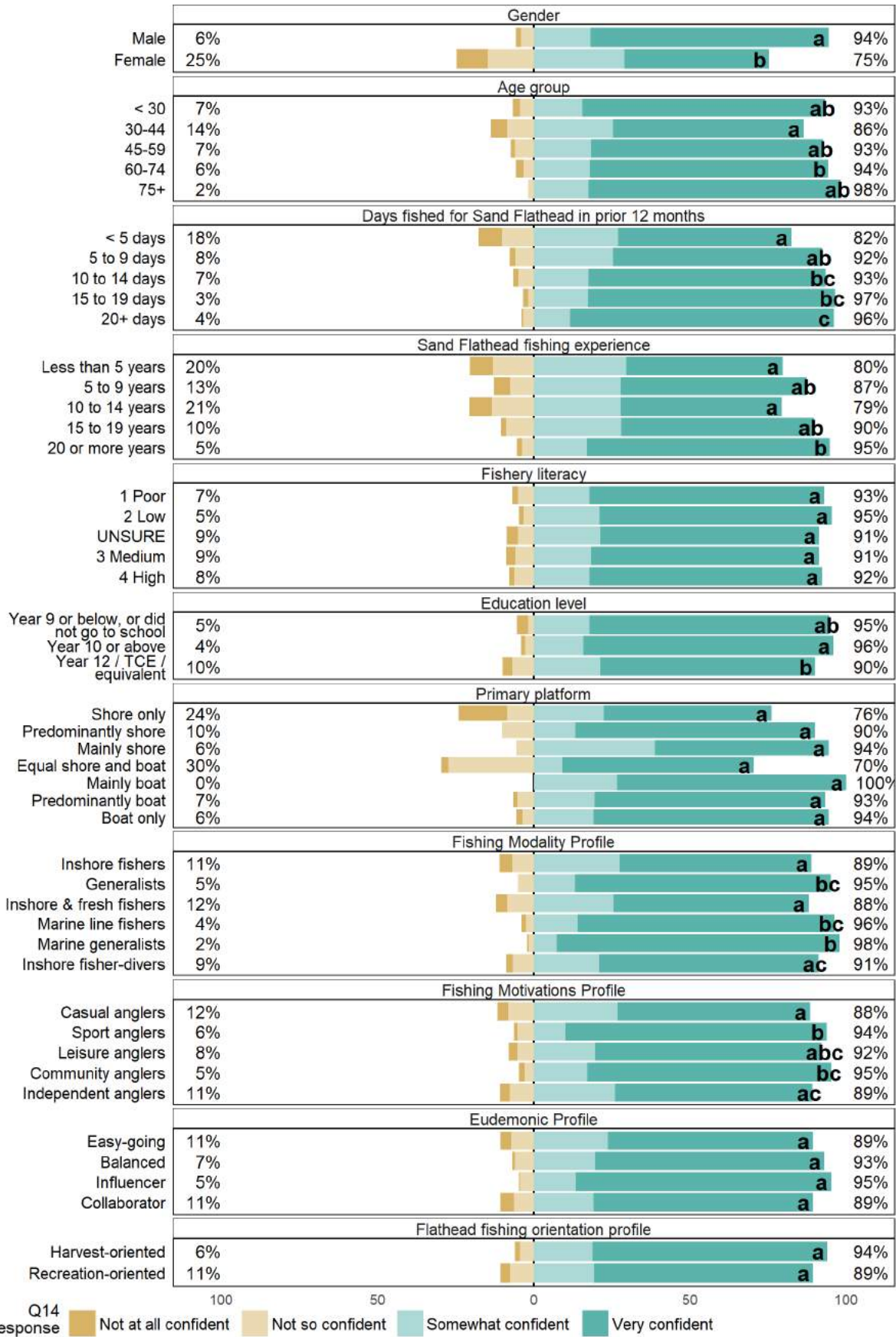


Figure 66. Responses to Q14 "The two main species of flathead caught in Tasmania are sand flathead and tiger flathead. How confident are you in your ability to tell the difference between them?"

SURVEY OF RECREATIONAL FISHERS IN TASMANIA WITH A FOCUS ON SAND FLATHEAD

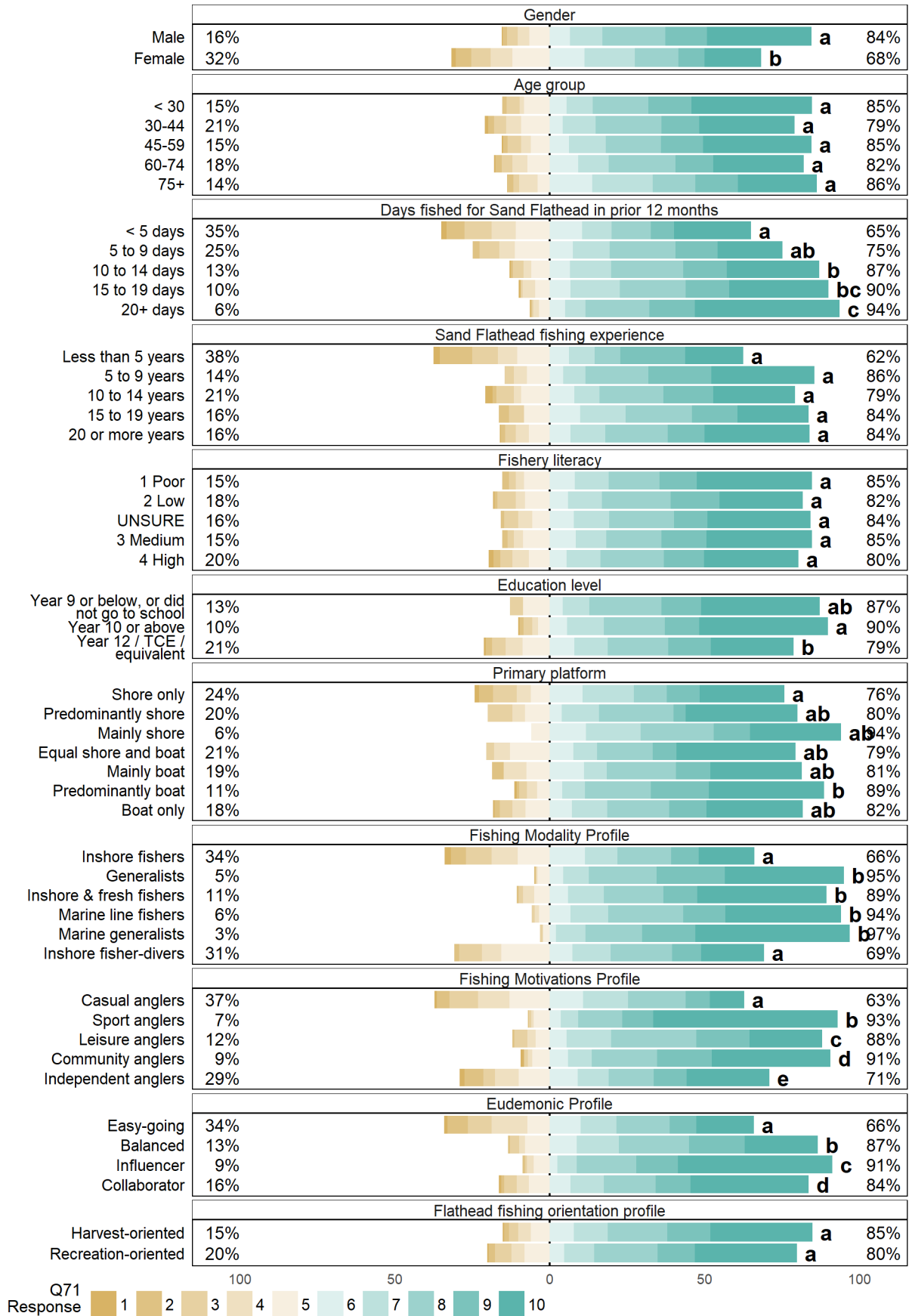


Figure 67. Responses to Q71 "How important is fishing to you compared to other hobbies, activities or sports?"

SURVEY OF RECREATIONAL FISHERS IN TASMANIA WITH A FOCUS ON SAND FLATHEAD

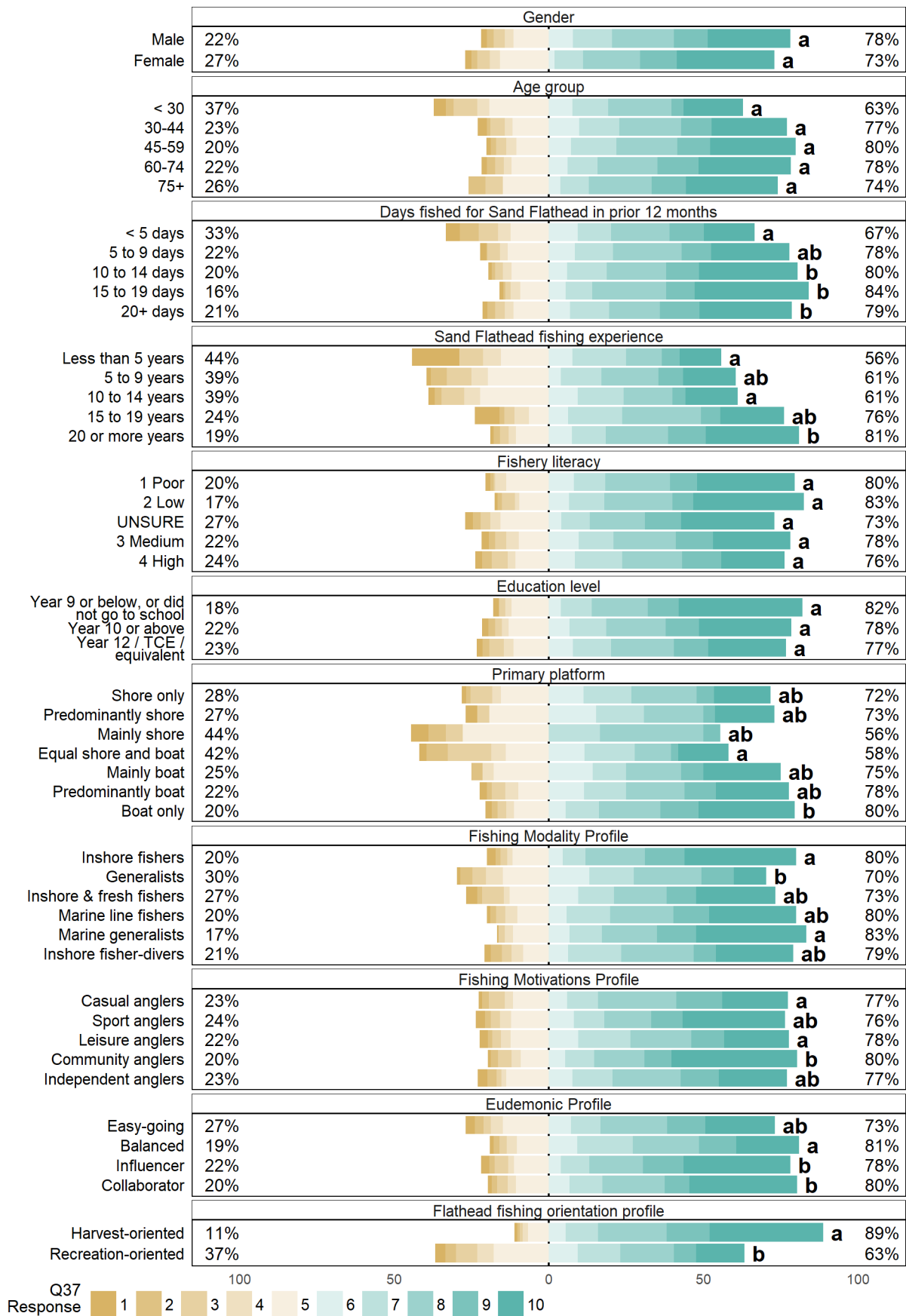


Figure 68. Responses to Q37 "How important is fishing for sand flathead to you compared to fishing for other species?"

SURVEY OF RECREATIONAL FISHERS IN TASMANIA WITH A FOCUS ON SAND FLATHEAD

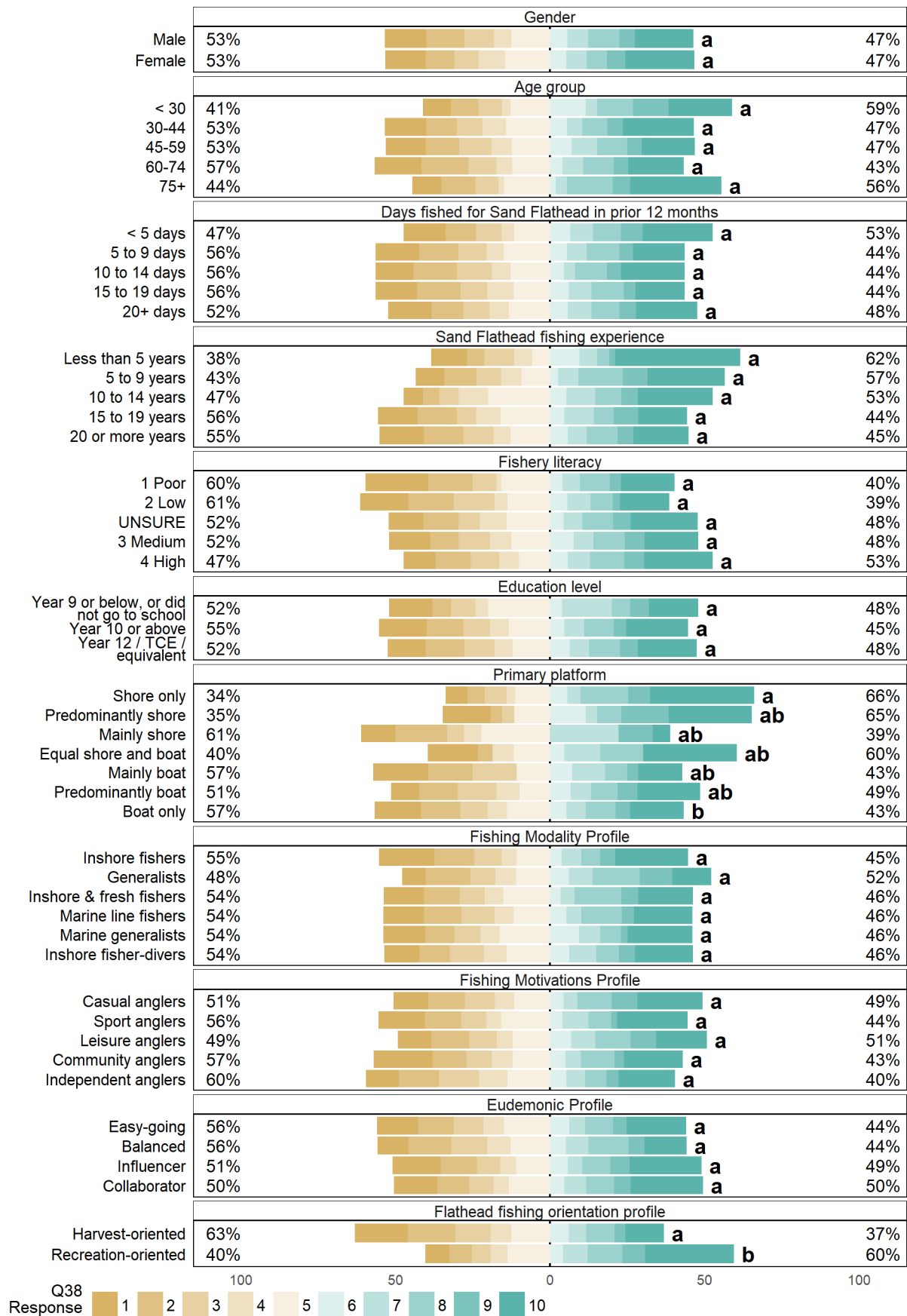


Figure 69. Responses to Q38. "How strongly do you agree with the statement, "if I couldn't catch Sand Flathead I would go fishing less?"; with 1 being "I basically wouldn't go fishing" and 10 being "it would not change my behaviour".

SURVEY OF RECREATIONAL FISHERS IN TASMANIA WITH A FOCUS ON SAND FLATHEAD

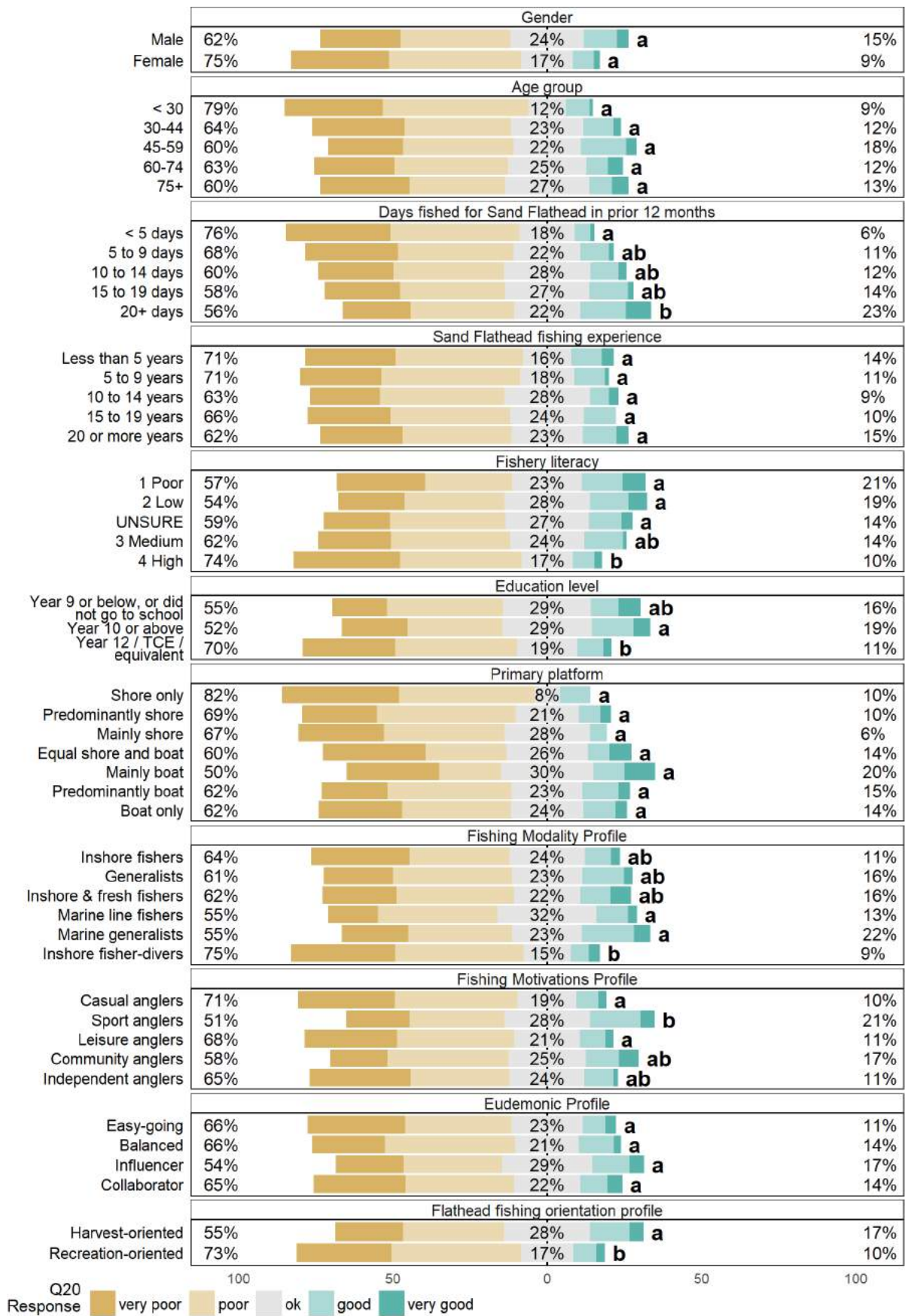


Figure 70. Responses to Q20. "In your opinion, how do you think the sand flathead stock is currently doing in Tasmania?"

SURVEY OF RECREATIONAL FISHERS IN TASMANIA WITH A FOCUS ON SAND FLATHEAD

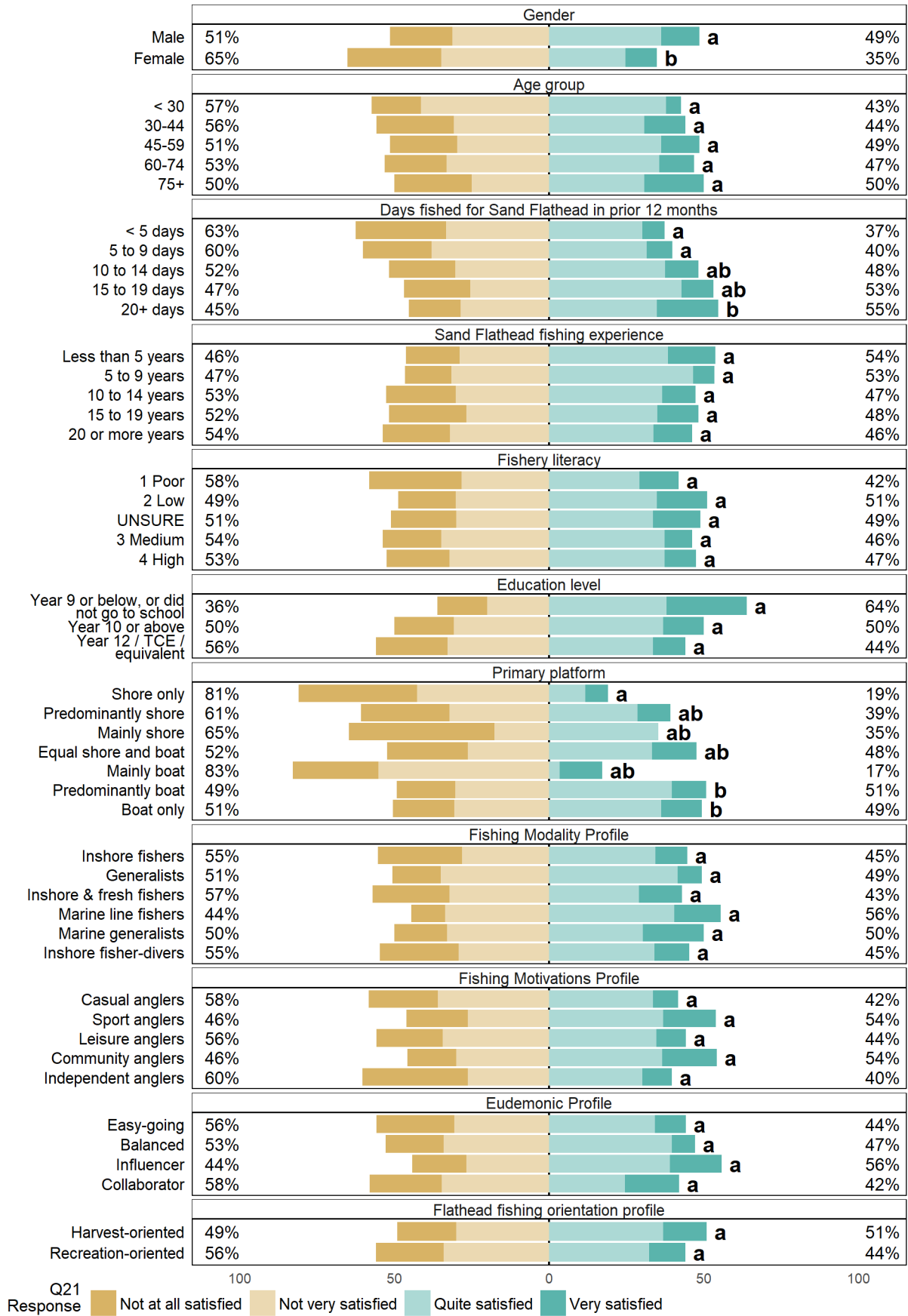


Figure 71. Responses to Q21. "In the last 12 months, how satisfied have you been with the number of Sand Flathead you caught on your fishing trip(s)?"

SURVEY OF RECREATIONAL FISHERS IN TASMANIA WITH A FOCUS ON SAND FLATHEAD

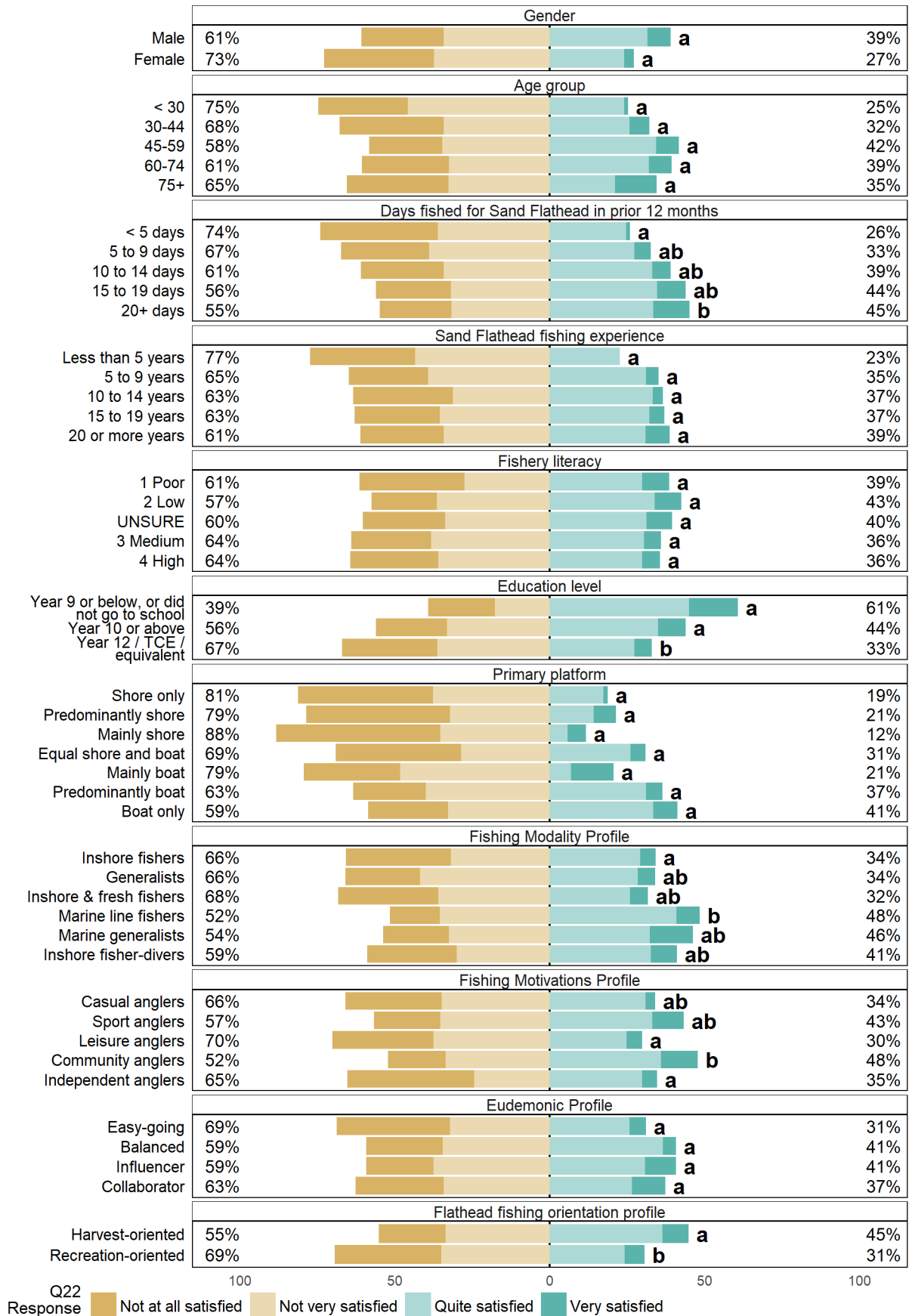


Figure 72. Responses to Q22. "In the last 12 months, how satisfied have you been with the size of Sand Flathead you caught on you fishing trip(s)?"

SURVEY OF RECREATIONAL FISHERS IN TASMANIA WITH A FOCUS ON SAND FLATHEAD

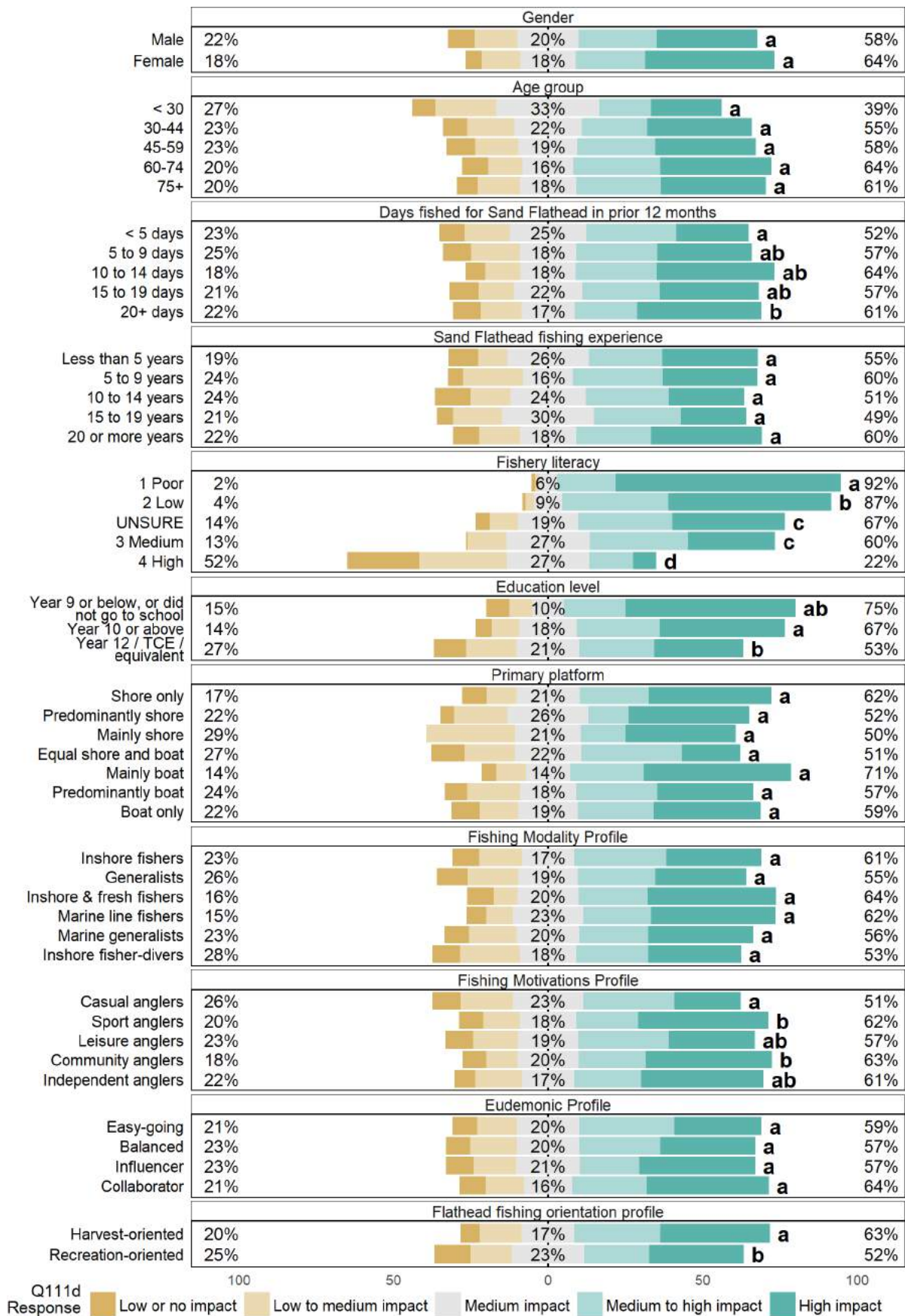


Figure 73. Responses to Q111d. The perceived impact of Commercial fishing on the depletion of the Sand Flathead population in Tasmania.

SURVEY OF RECREATIONAL FISHERS IN TASMANIA WITH A FOCUS ON SAND FLATHEAD

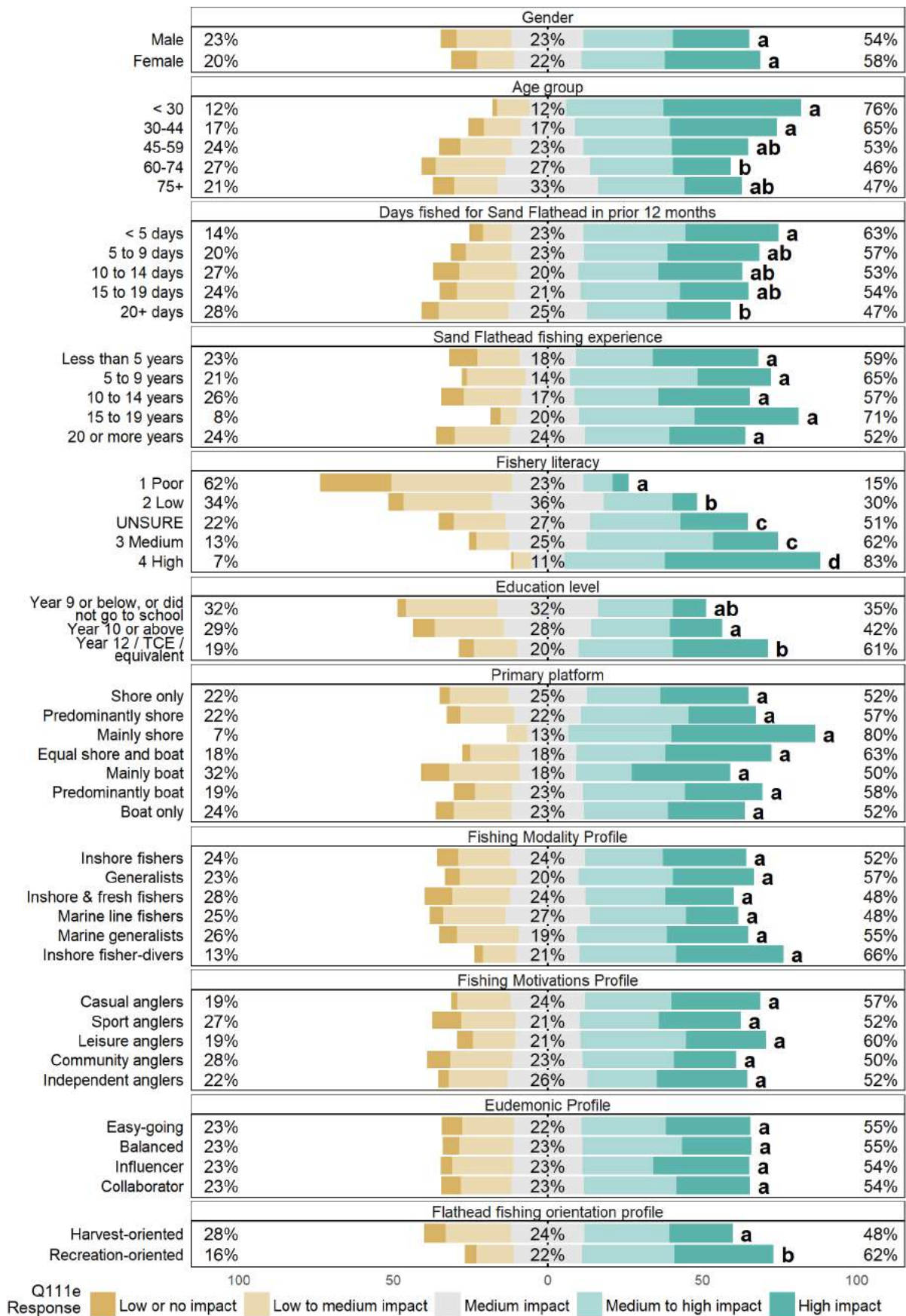


Figure 74. Responses to Q111e. The perceived impact of Recreational fishing on the depletion of the Sand Flathead population in Tasmania.

SURVEY OF RECREATIONAL FISHERS IN TASMANIA WITH A FOCUS ON SAND FLATHEAD

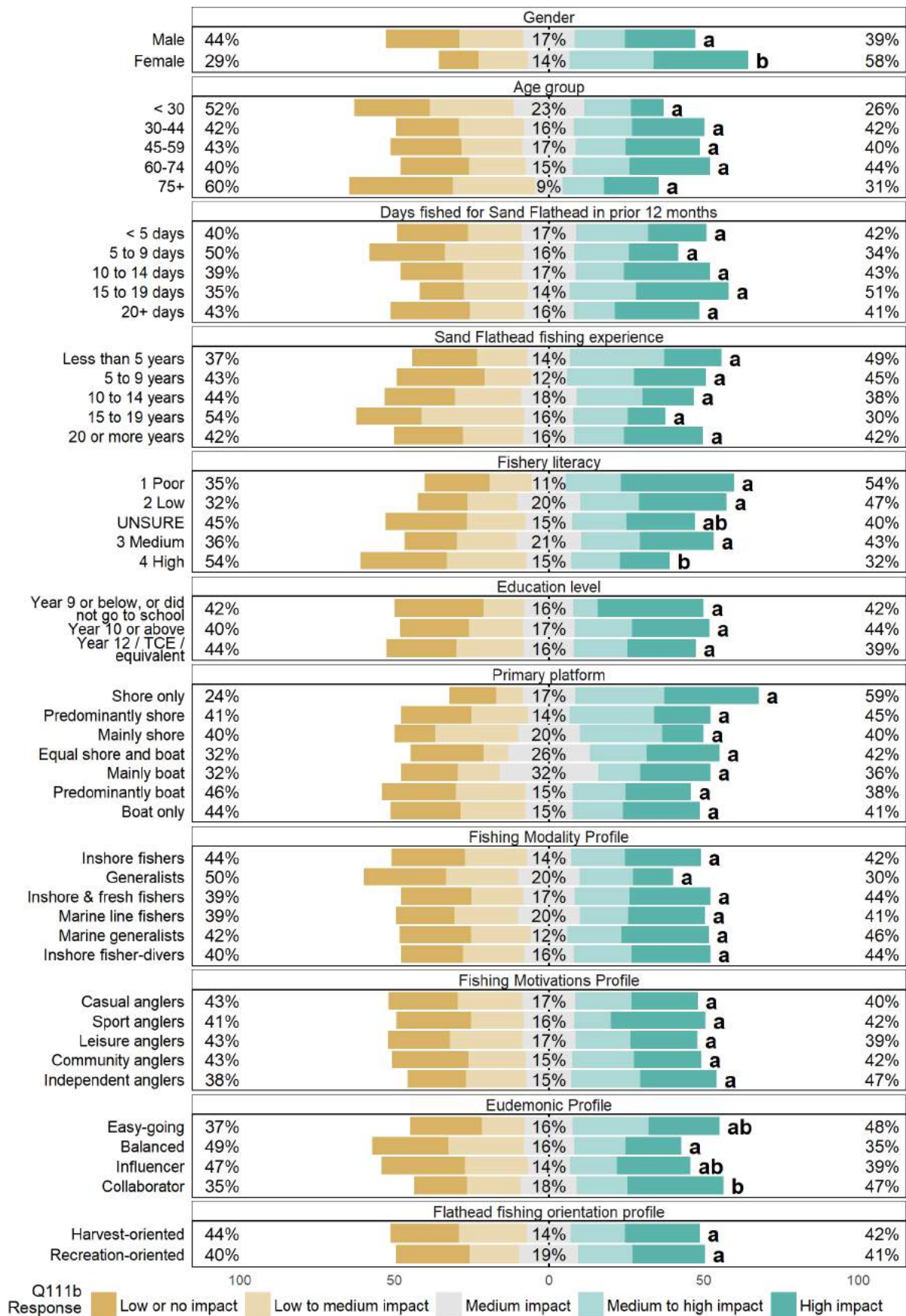


Figure 75. Responses to Q111b. The perceived impact of marine farming on the depletion of the Sand Flathead population in Tasmania.

SURVEY OF RECREATIONAL FISHERS IN TASMANIA WITH A FOCUS ON SAND FLATHEAD

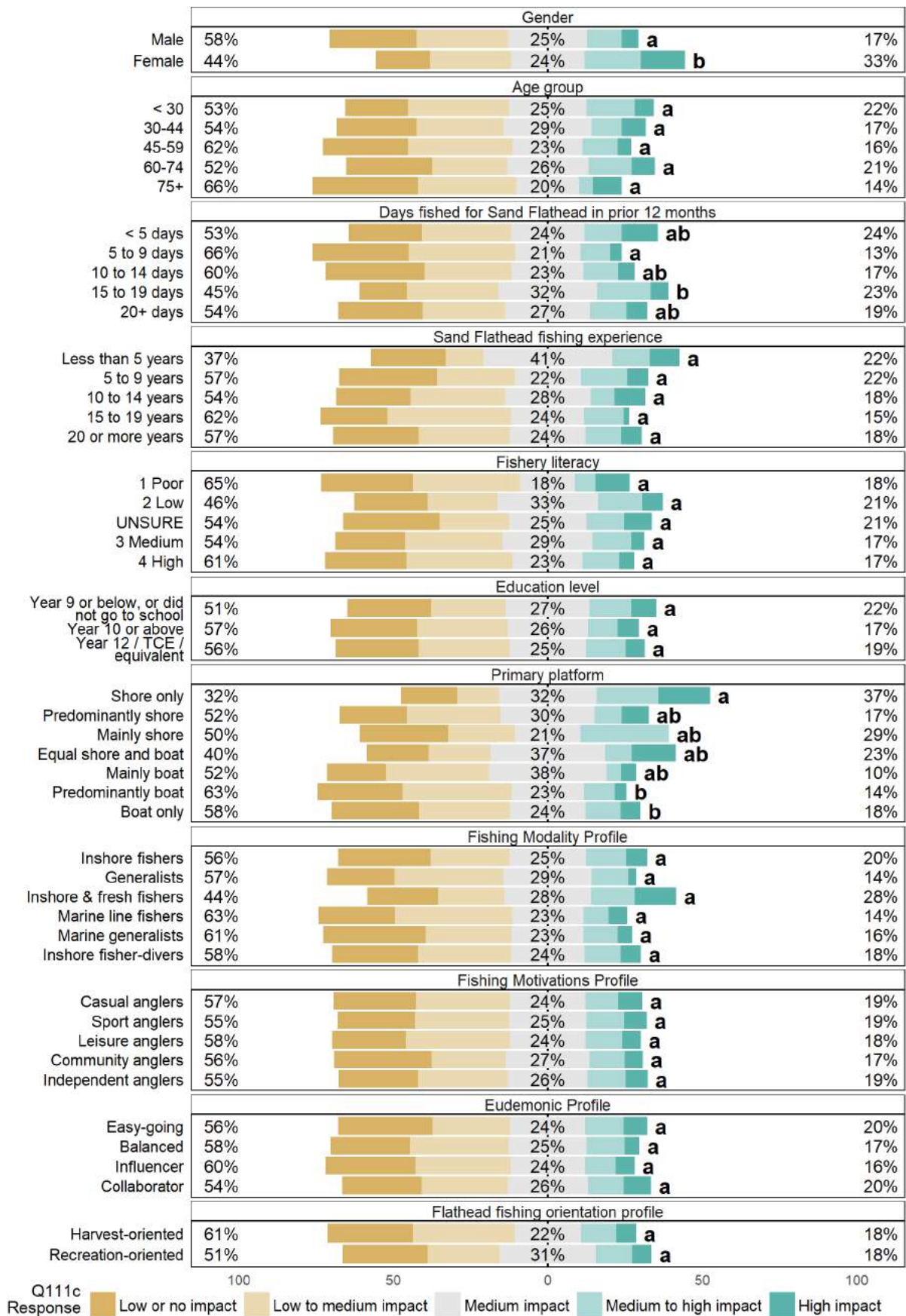


Figure 76. Responses to Q111c. The perceived impact of environmental factors other than climate change or those from marine farming on the depletion of the Sand Flathead population in Tasmania.

SURVEY OF RECREATIONAL FISHERS IN TASMANIA WITH A FOCUS ON SAND FLATHEAD

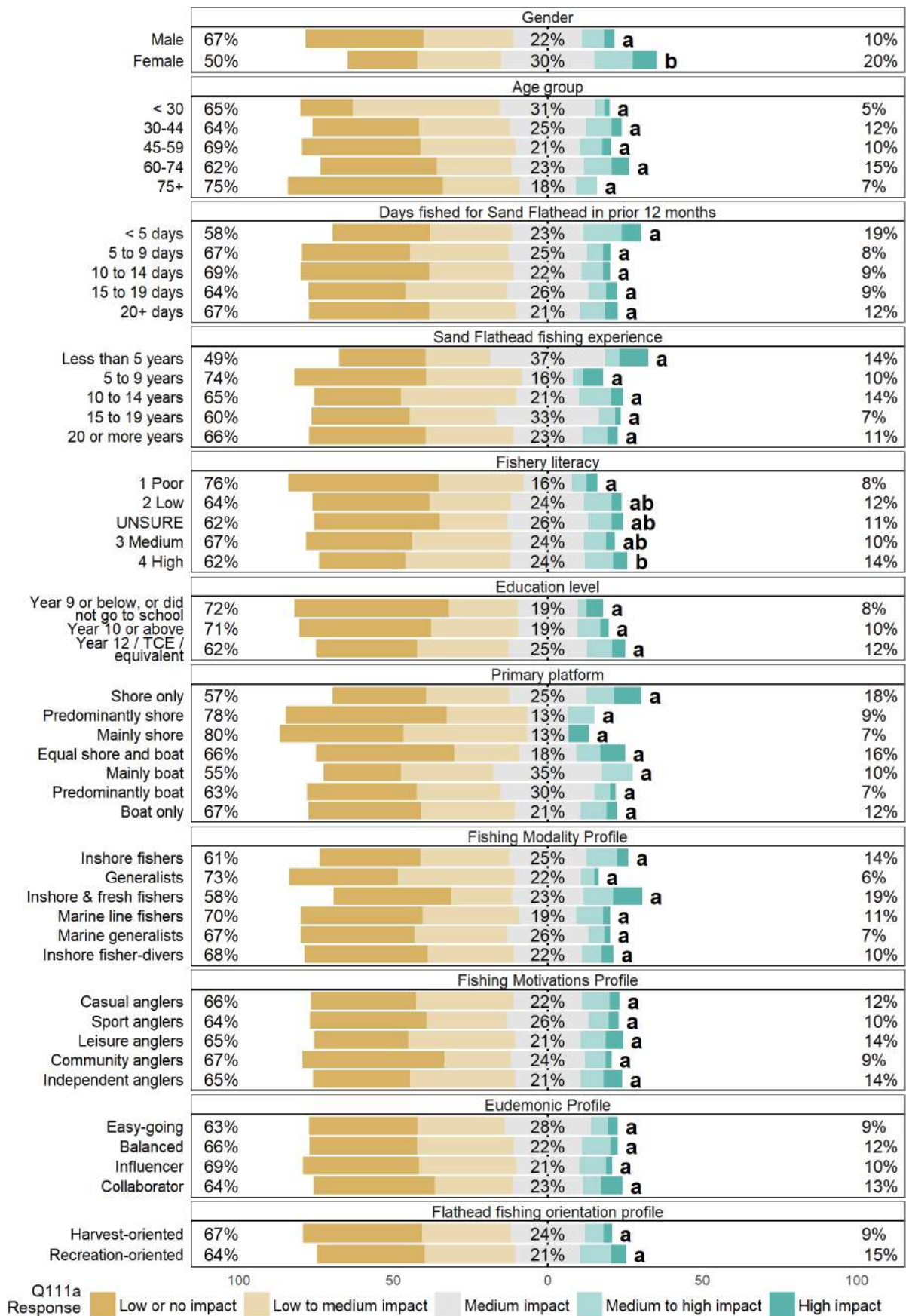


Figure 77. Responses to Q111a. The perceived impact of climate change on the depletion of the Sand Flathead population in Tasmania.

SURVEY OF RECREATIONAL FISHERS IN TASMANIA WITH A FOCUS ON SAND FLATHEAD

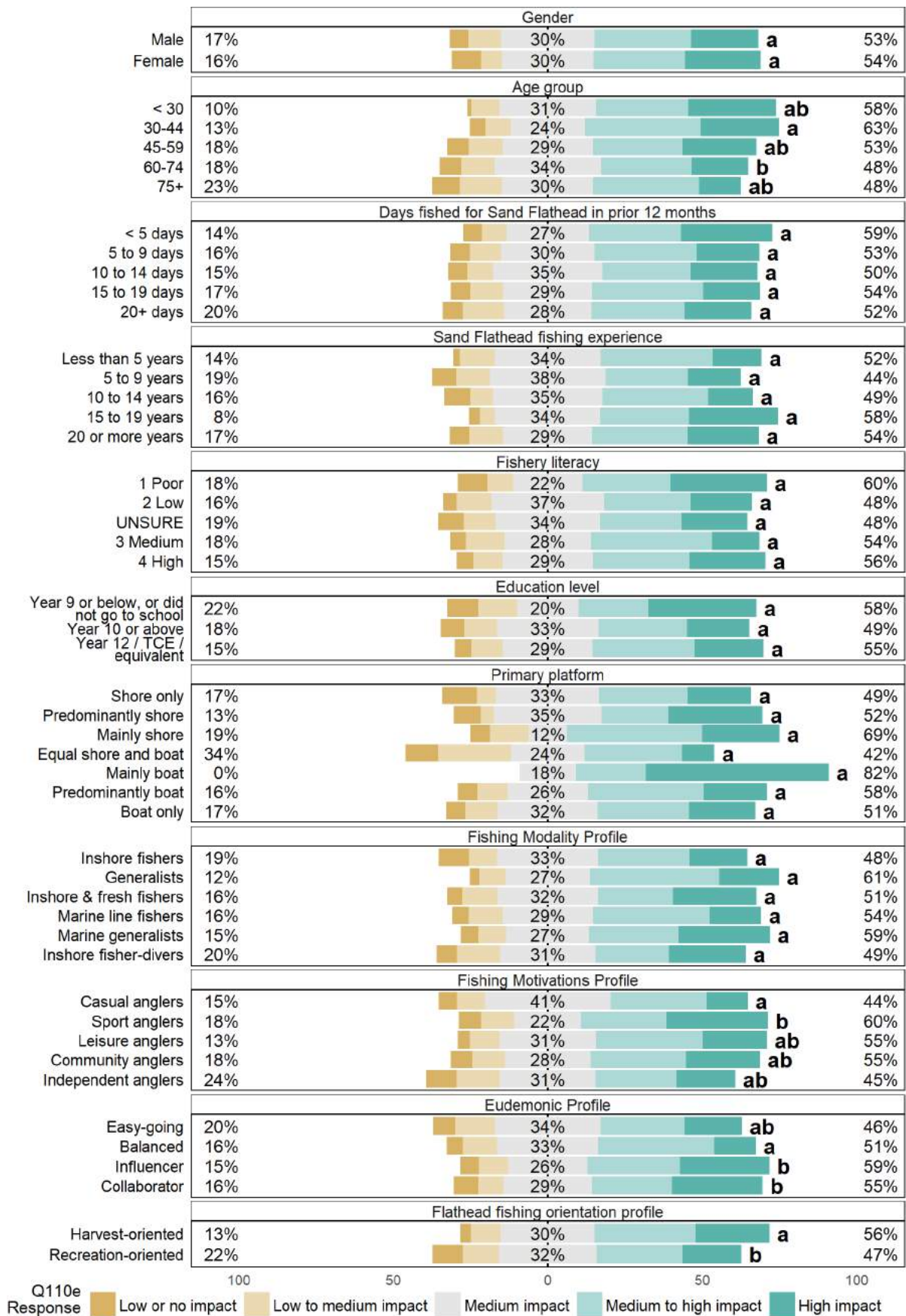


Figure 78. Responses to Q110e. Perceptions on the impacts of a further depleted stock of Sand Flathead based to the overall fishing experience for all Tasmanians [altruistic domain].

SURVEY OF RECREATIONAL FISHERS IN TASMANIA WITH A FOCUS ON SAND FLATHEAD

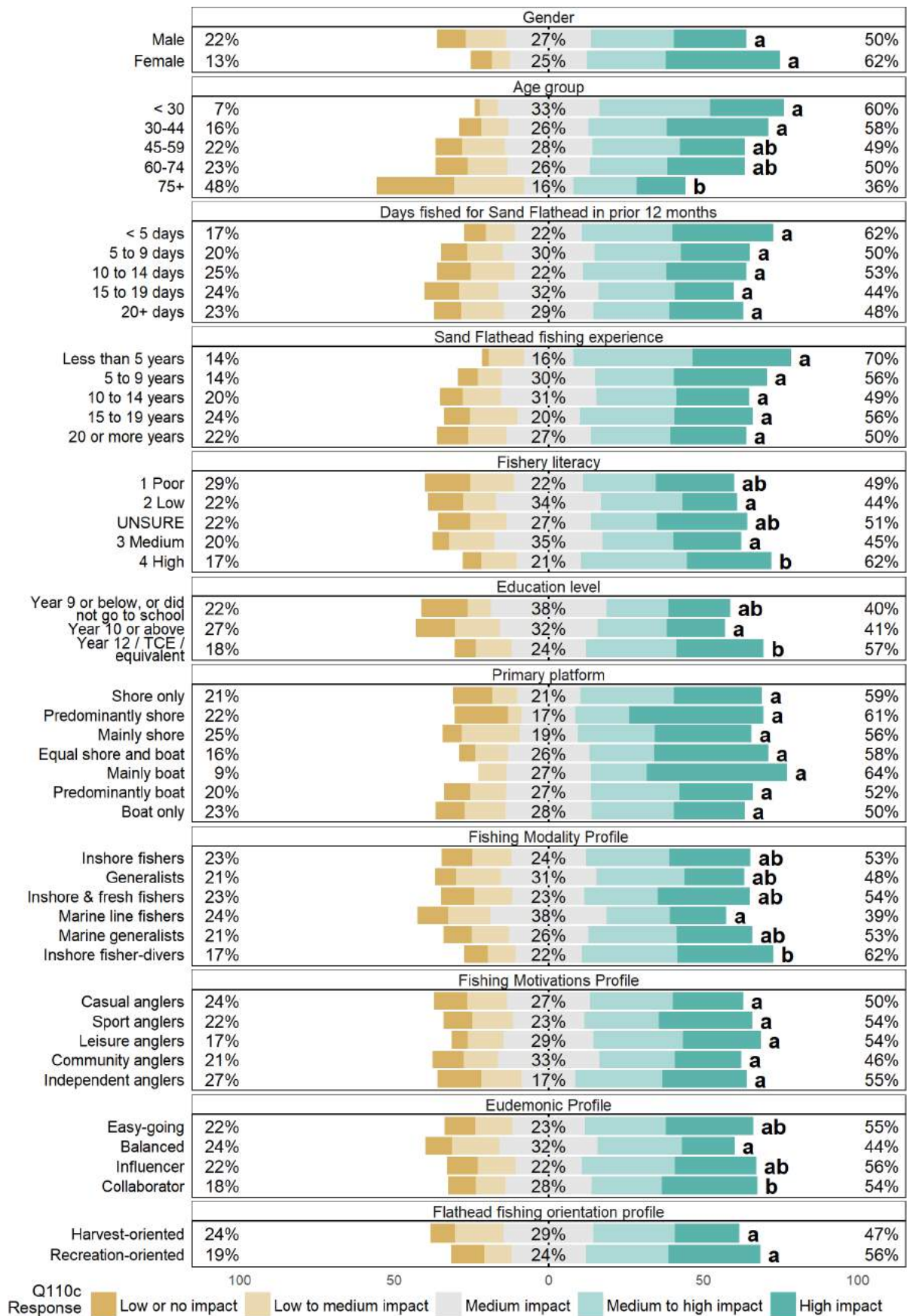


Figure 79. Responses to Q110c. Perceptions on the impacts of a further depleted stock of Sand Flathead.

SURVEY OF RECREATIONAL FISHERS IN TASMANIA WITH A FOCUS ON SAND FLATHEAD

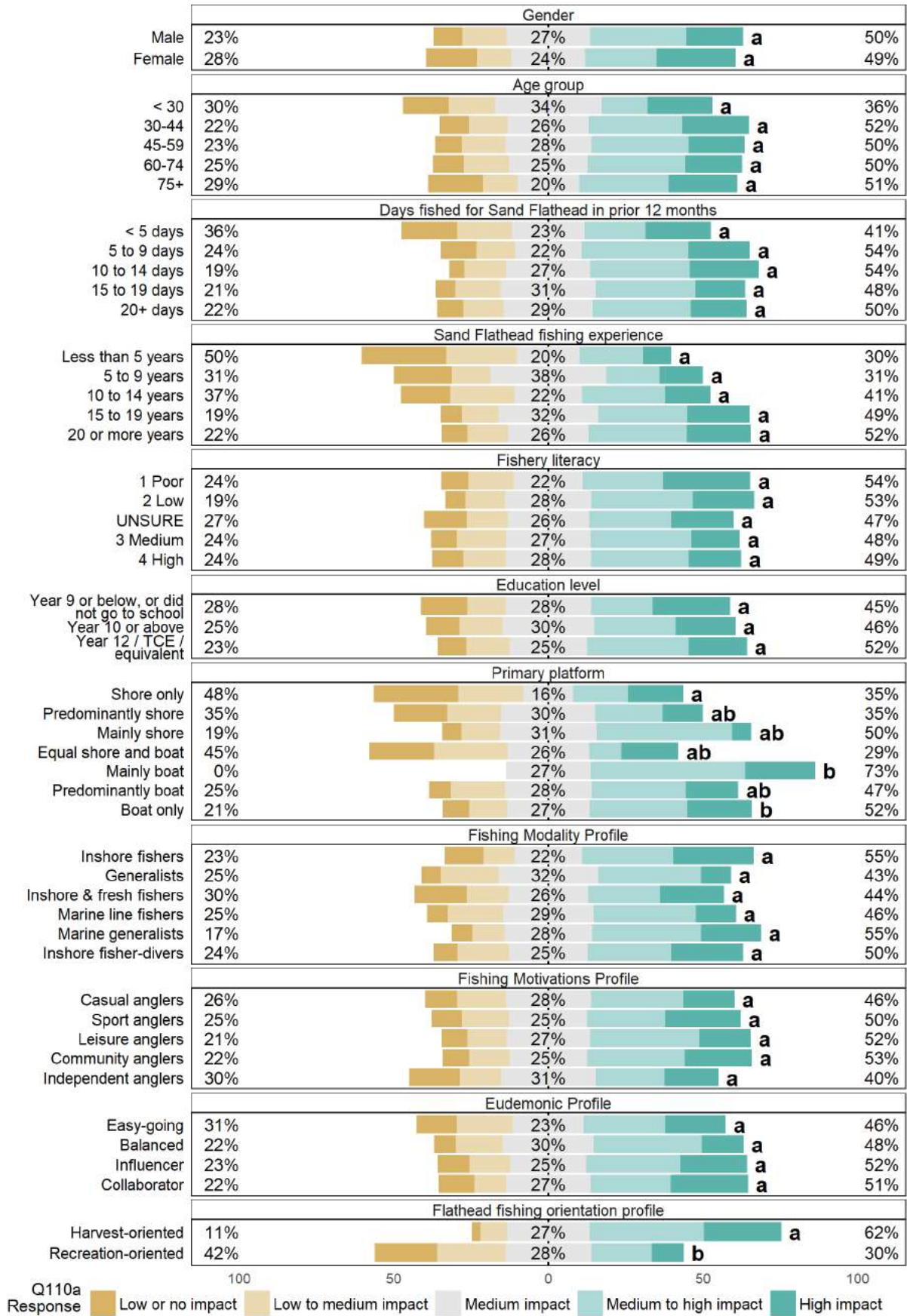


Figure 80. Responses to Q110a. Perceptions on the impacts of a further depleted stock of Sand Flathead on the respondents personal fishing experience [egoistic domain].

SURVEY OF RECREATIONAL FISHERS IN TASMANIA WITH A FOCUS ON SAND FLATHEAD

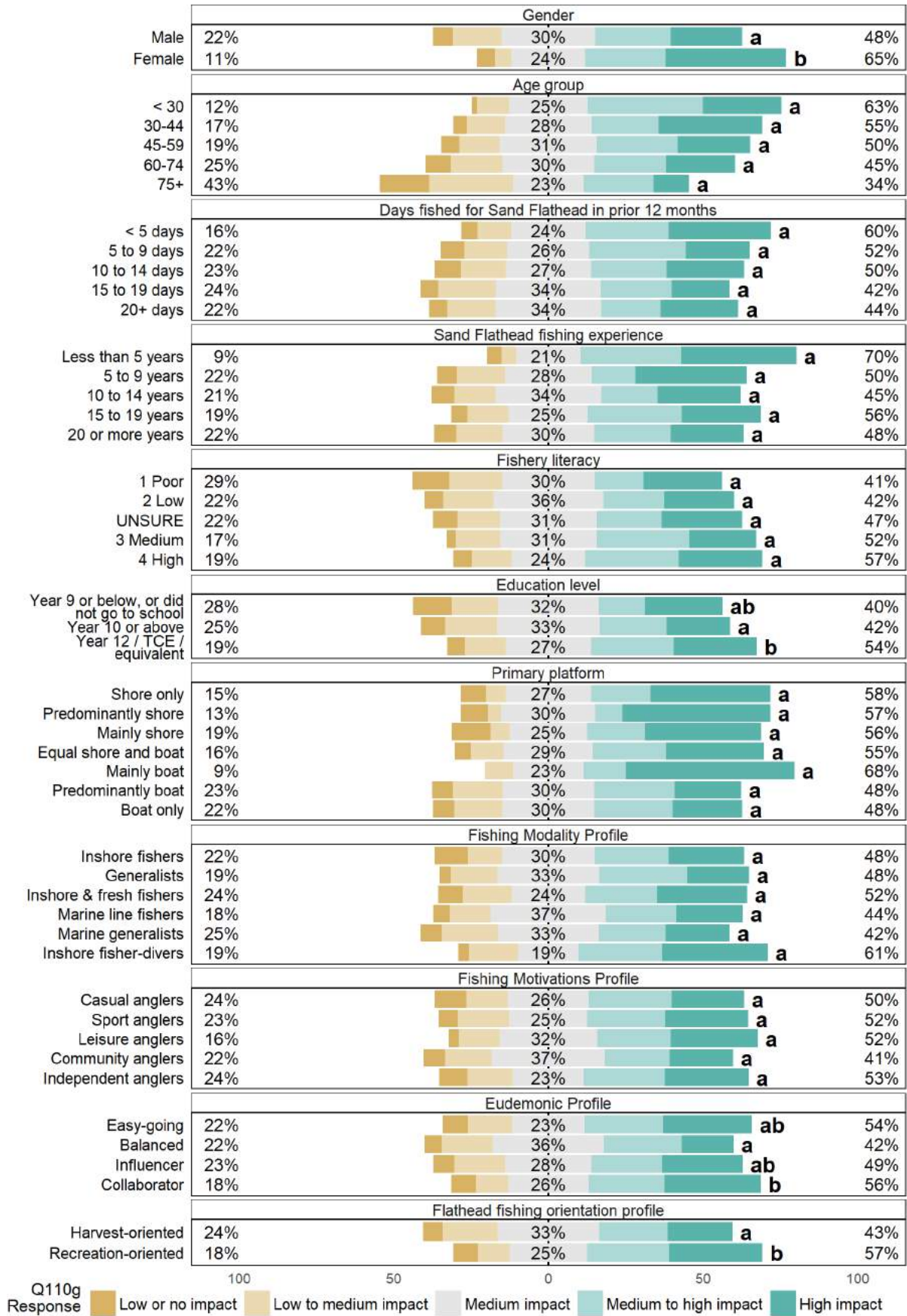


Figure 81. Responses to Q110g. Perceptions on the impacts of a further depleted stock of Sand Flathead on the overall ecosystems and environment in Tasmania [Biospheric/altruistic domain].

SURVEY OF RECREATIONAL FISHERS IN TASMANIA WITH A FOCUS ON SAND FLATHEAD

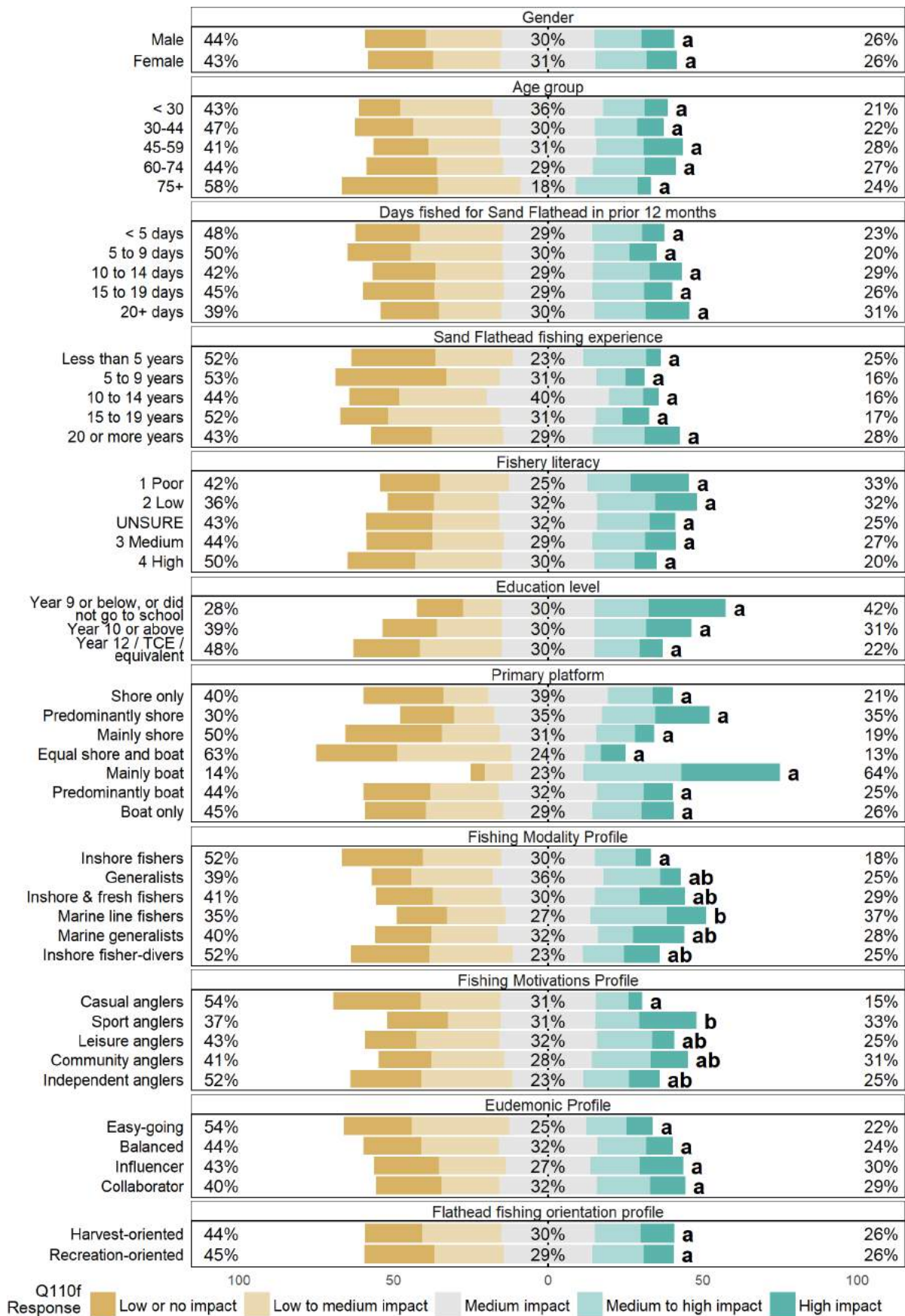


Figure 82. Responses to Q110f. Perceptions on the impacts of a further depleted stock of Sand Flathead on the overall Tasmanian economy [altruistic domain].

SURVEY OF RECREATIONAL FISHERS IN TASMANIA WITH A FOCUS ON SAND FLATHEAD

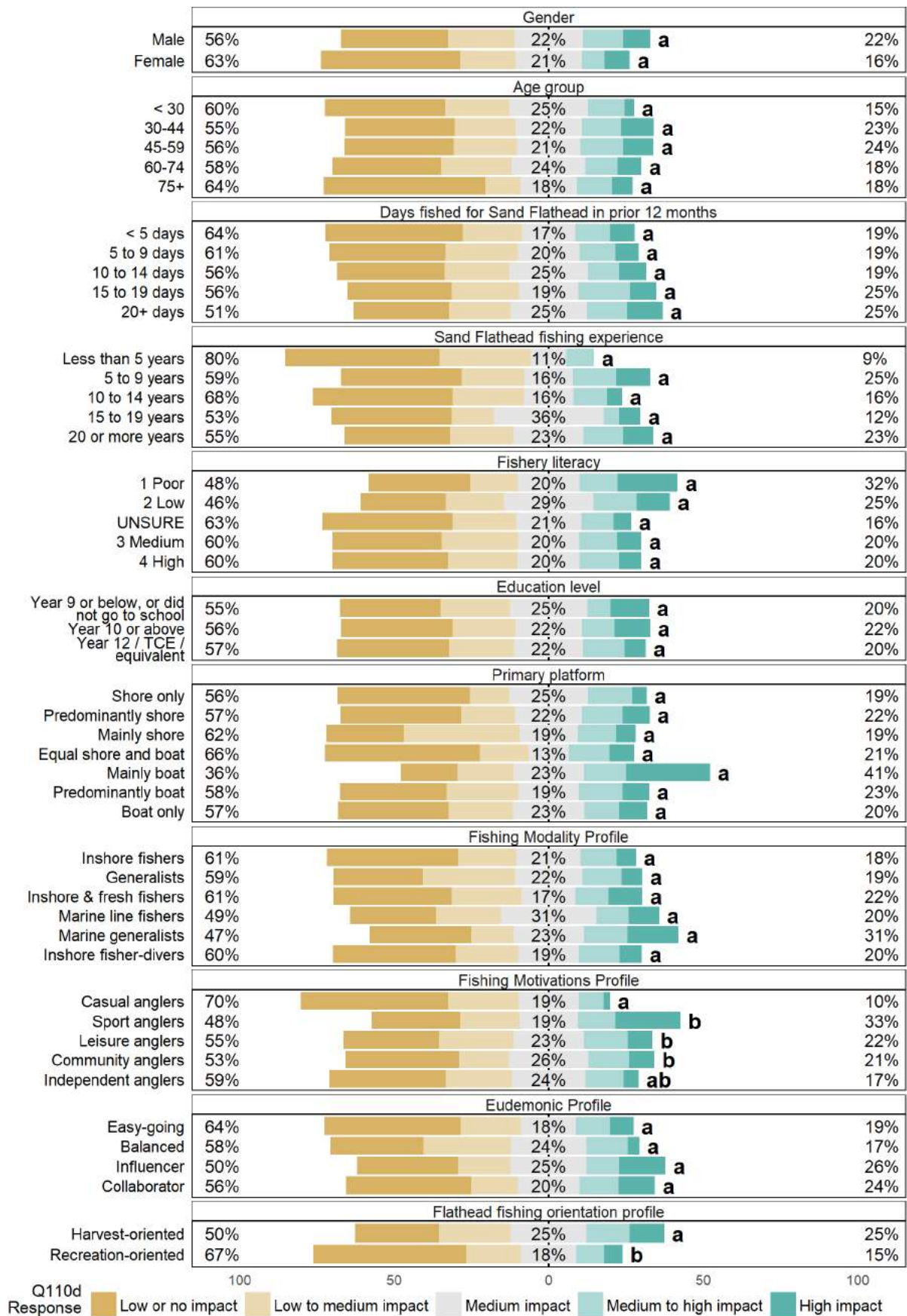


Figure 83. Responses to Q110d. Perceptions on the impacts of a further depleted stock of Sand Flathead on respondents' personal mental health [egoistic domain].

SURVEY OF RECREATIONAL FISHERS IN TASMANIA WITH A FOCUS ON SAND FLATHEAD

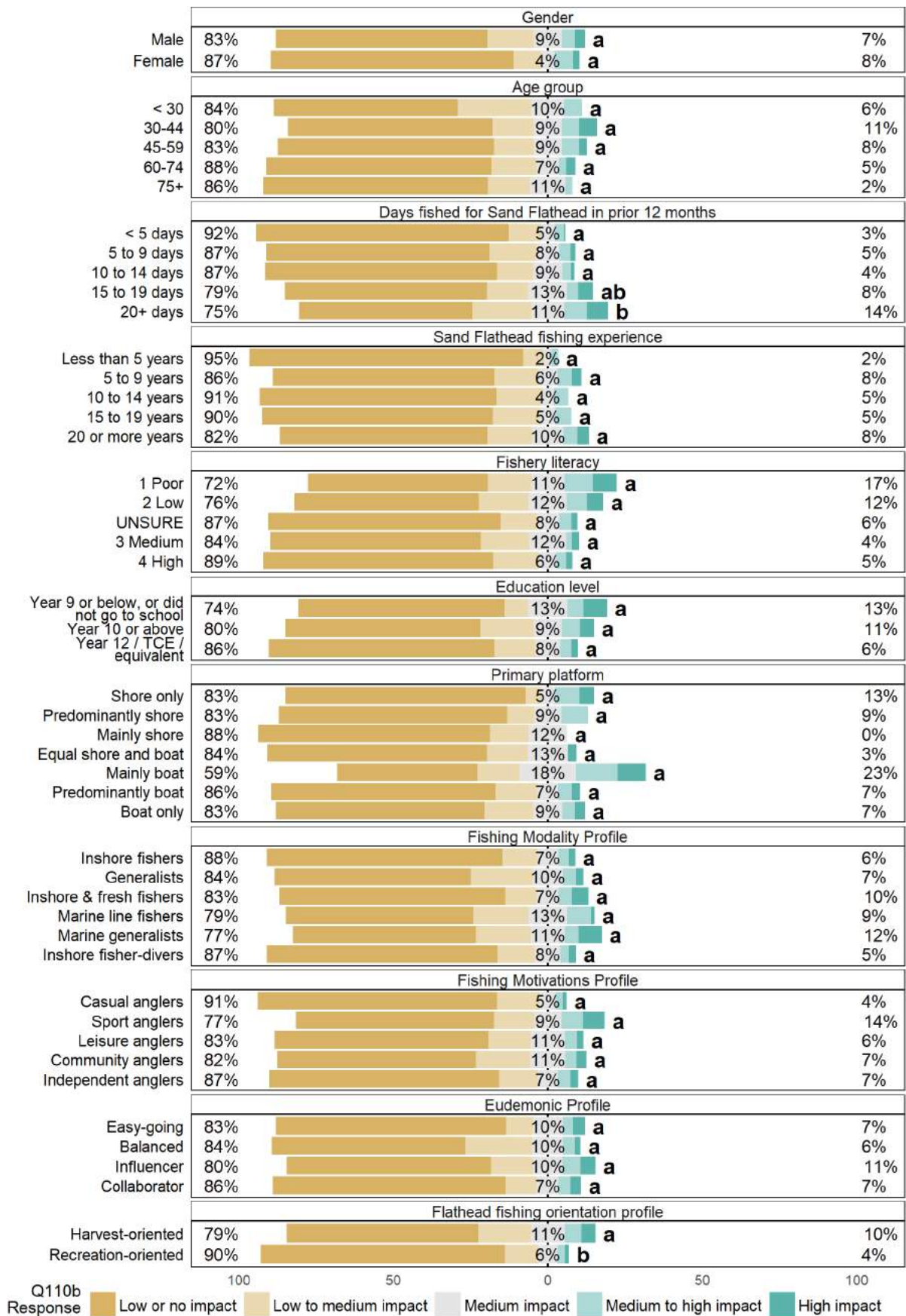


Figure 84. Responses to Q110b. Perceptions on the impacts of a further depleted stock of Sand Flathead on respondents' personal financial wellbeing [egoistic domain].

SURVEY OF RECREATIONAL FISHERS IN TASMANIA WITH A FOCUS ON SAND FLATHEAD

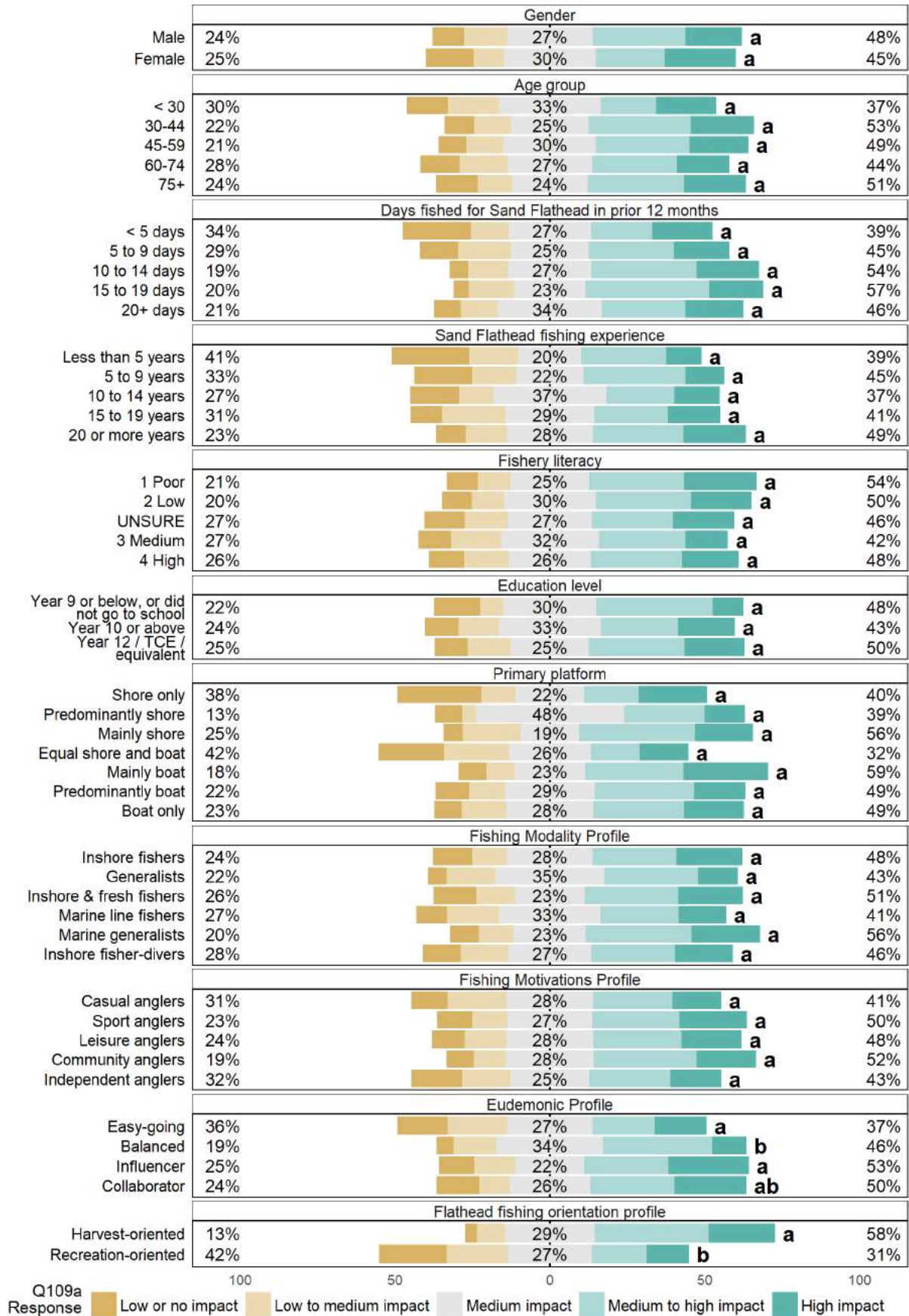


Figure 85. Responses to Q109a. Perception of the potential impacts to respondents' overall fishing experience due to reduced access to numbers of Sand Flathead due to depletion of the stock.

SURVEY OF RECREATIONAL FISHERS IN TASMANIA WITH A FOCUS ON SAND FLATHEAD

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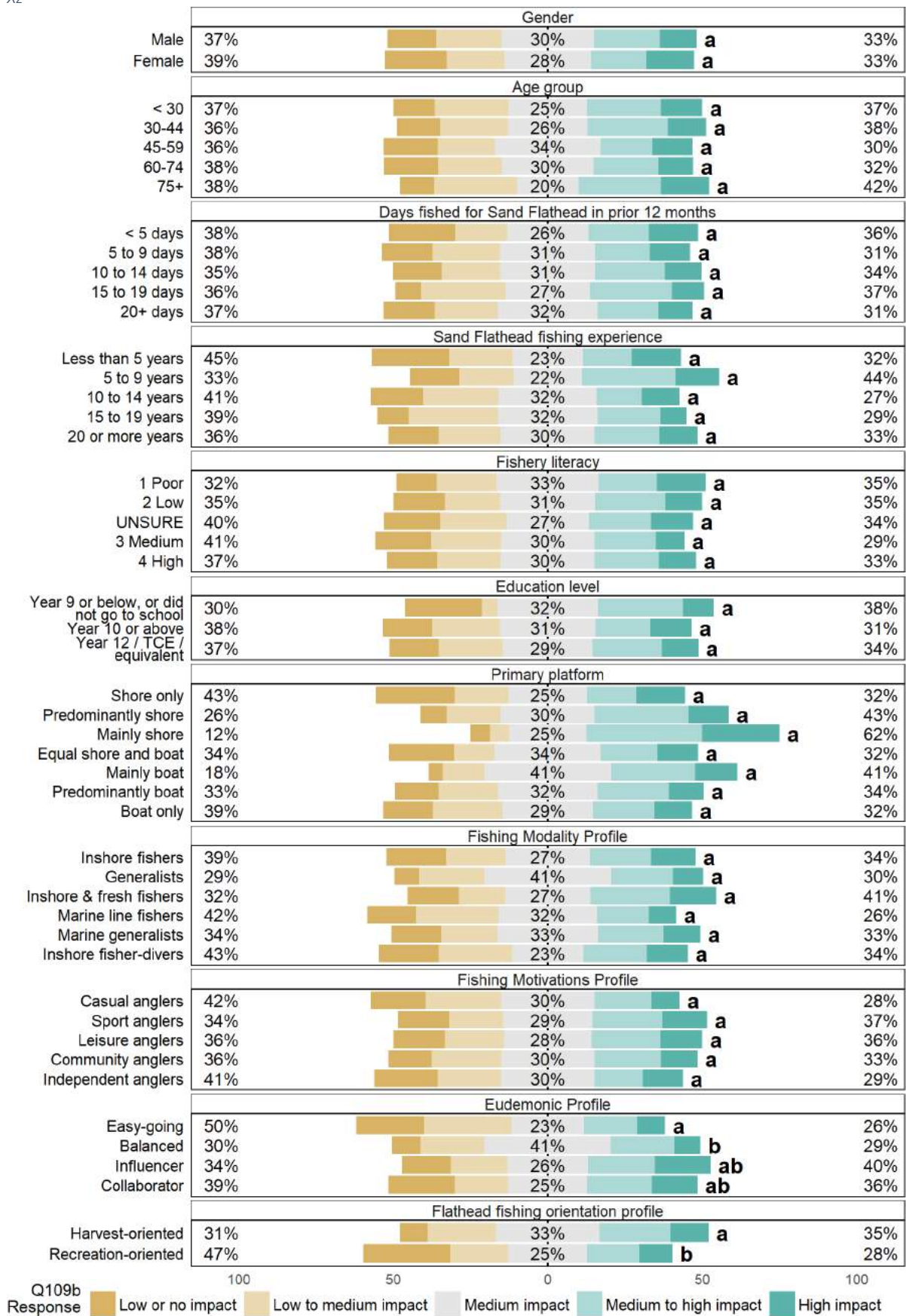


Figure 86. Responses to Q109b. Perception of the potential impacts to respondents' overall fishing experience due to reduced access to larger fish due to their depletion within the stock.

SURVEY OF RECREATIONAL FISHERS IN TASMANIA WITH A FOCUS ON SAND FLATHEAD

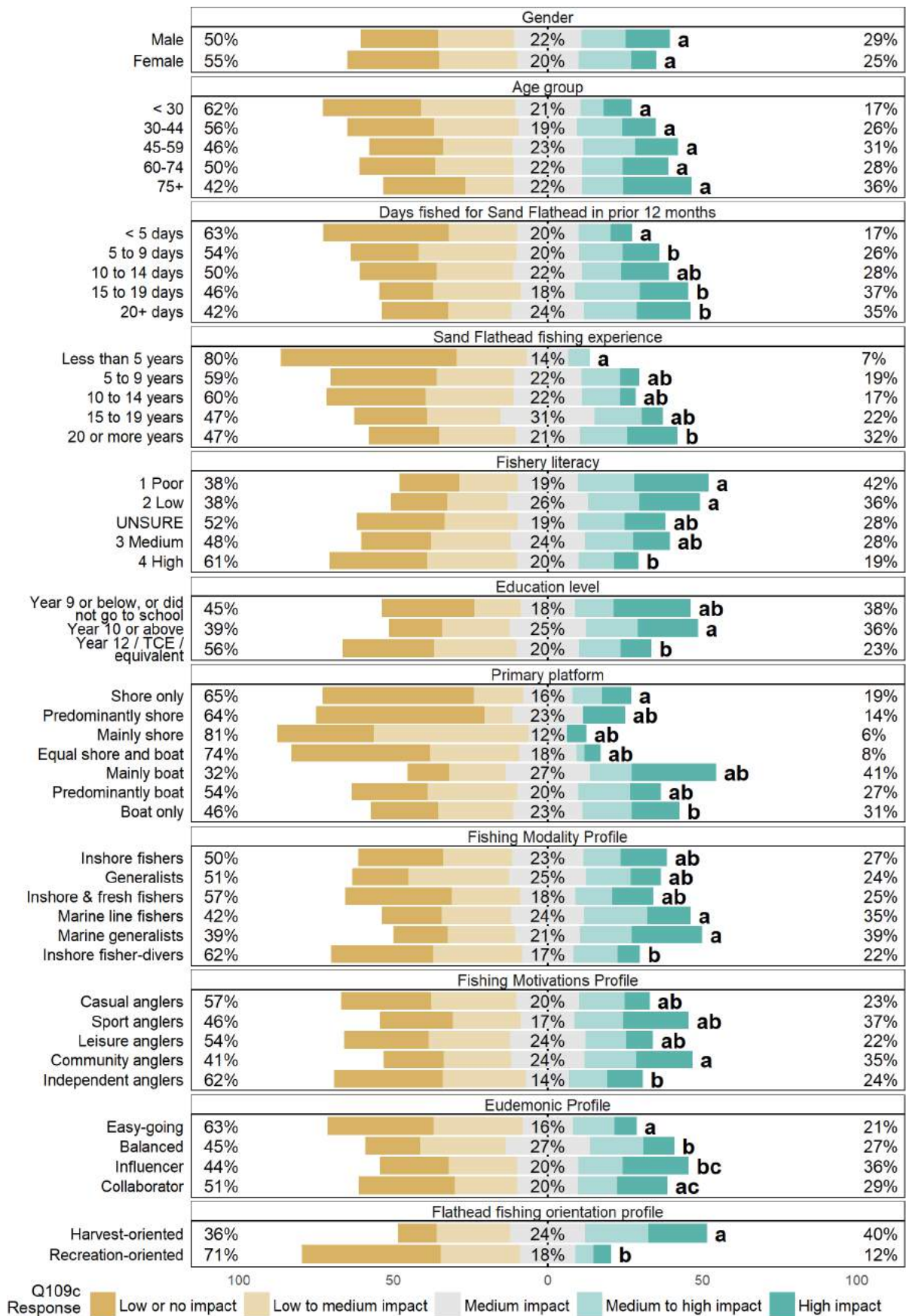


Figure 87. Responses to Q109c. perceptions on the impacts to respondents on not being able to keep as many Sand Flathead due to reduced catch limits imposed to recover the stock.

SURVEY OF RECREATIONAL FISHERS IN TASMANIA WITH A FOCUS ON SAND FLATHEAD

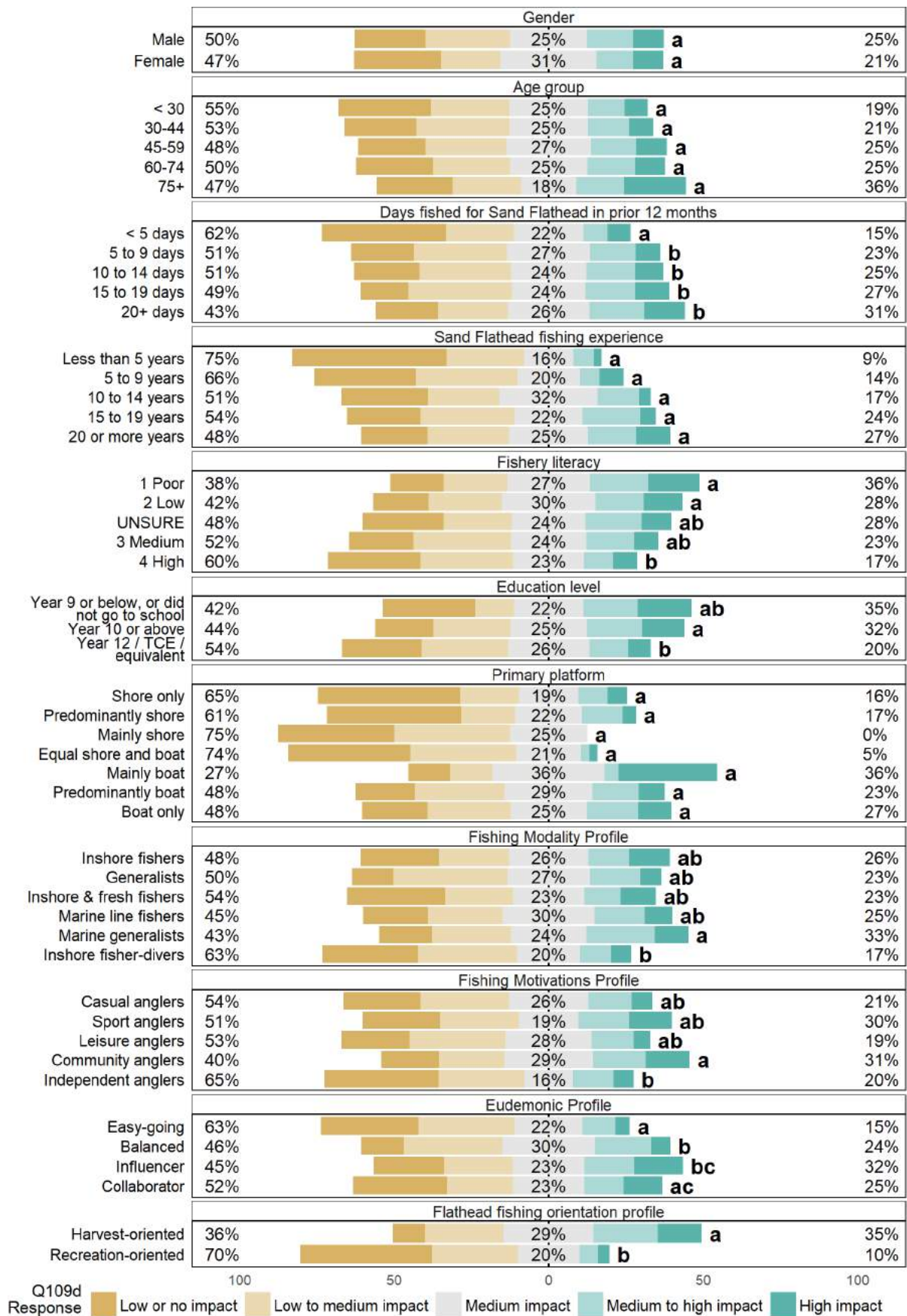


Figure 88. Responses to Q109d, perceptions on the impacts to respondents on not being able to keep as many Sand Flathead due to increased size limits imposed to recover the stock based on a range of demographic and fishing factors. Letters show significant differences ( $\alpha = 0.05$ ) based on Kolmogorov-Smirnov tests with a Holm multiple comparison correction.

SURVEY OF RECREATIONAL FISHERS IN TASMANIA WITH A FOCUS ON SAND FLATHEAD

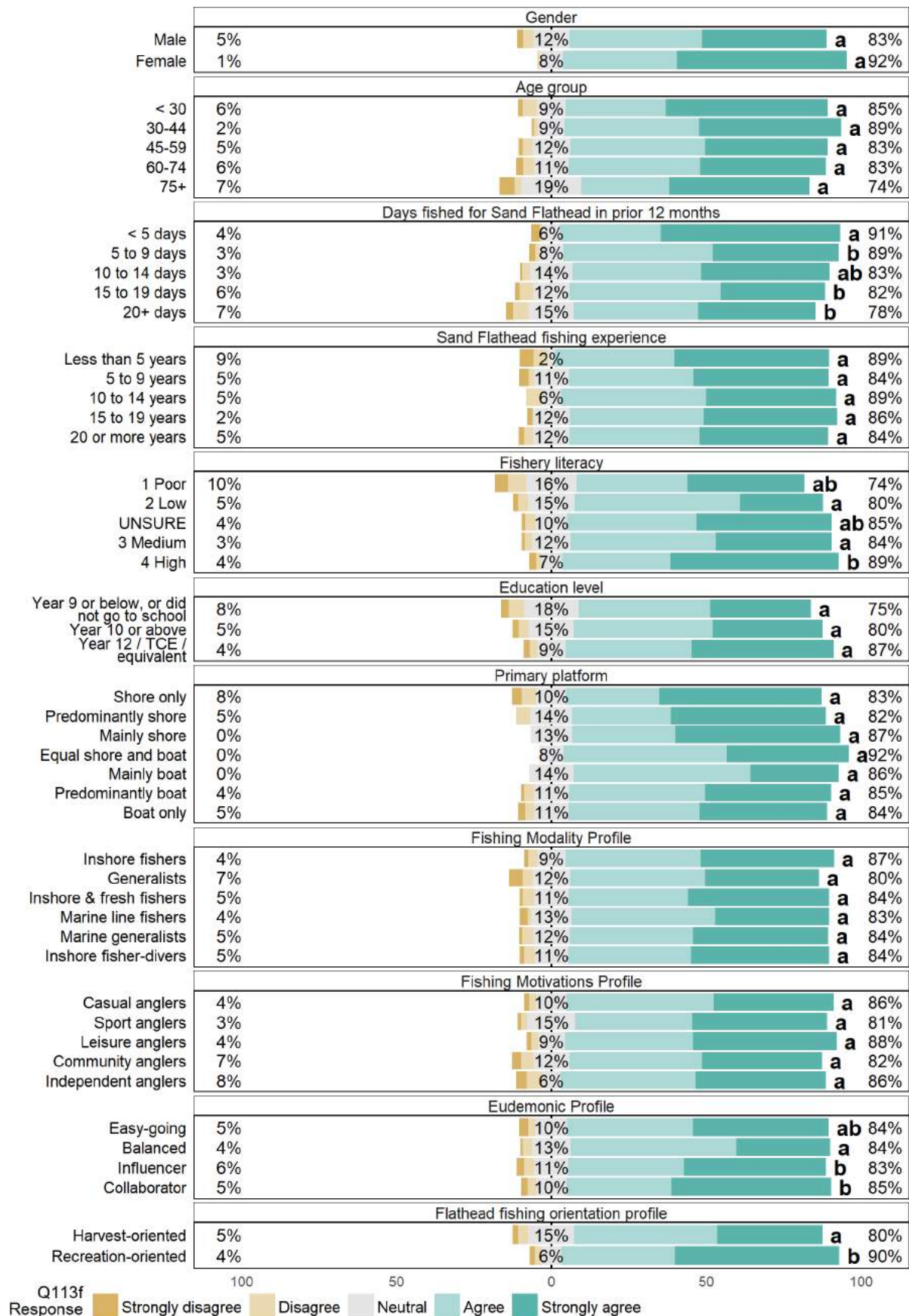


Figure 89. Responses to Q113f. Agreement profile to the question "Swift and appropriate management measures to ensure a fishery is managed sustainably is important for recreational fishers", based on a range of demographic and fishing factors. Letters show significant differences ( $\alpha = 0.05$ ) based on Kolmogorov-Smirnov tests with a Holm multiple comparison correction.

SURVEY OF RECREATIONAL FISHERS IN TASMANIA WITH A FOCUS ON SAND FLATHEAD

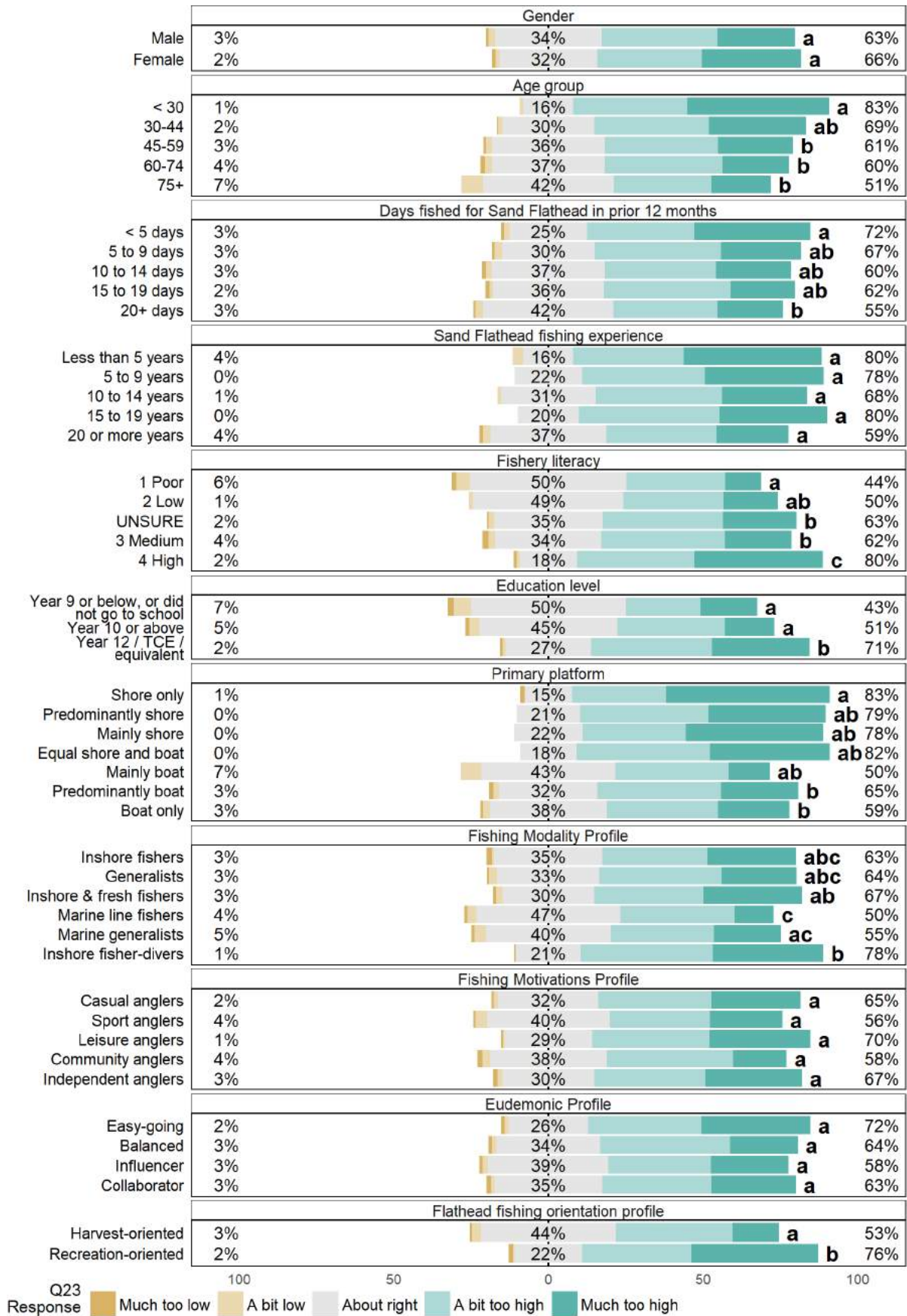


Figure 90. Responses to Q23. "Do you think the current bag limit for Sand Flathead, which is 20 per person per day, is...much too low, a bit low, about right, a bit too high or much too high?"

SURVEY OF RECREATIONAL FISHERS IN TASMANIA WITH A FOCUS ON SAND FLATHEAD

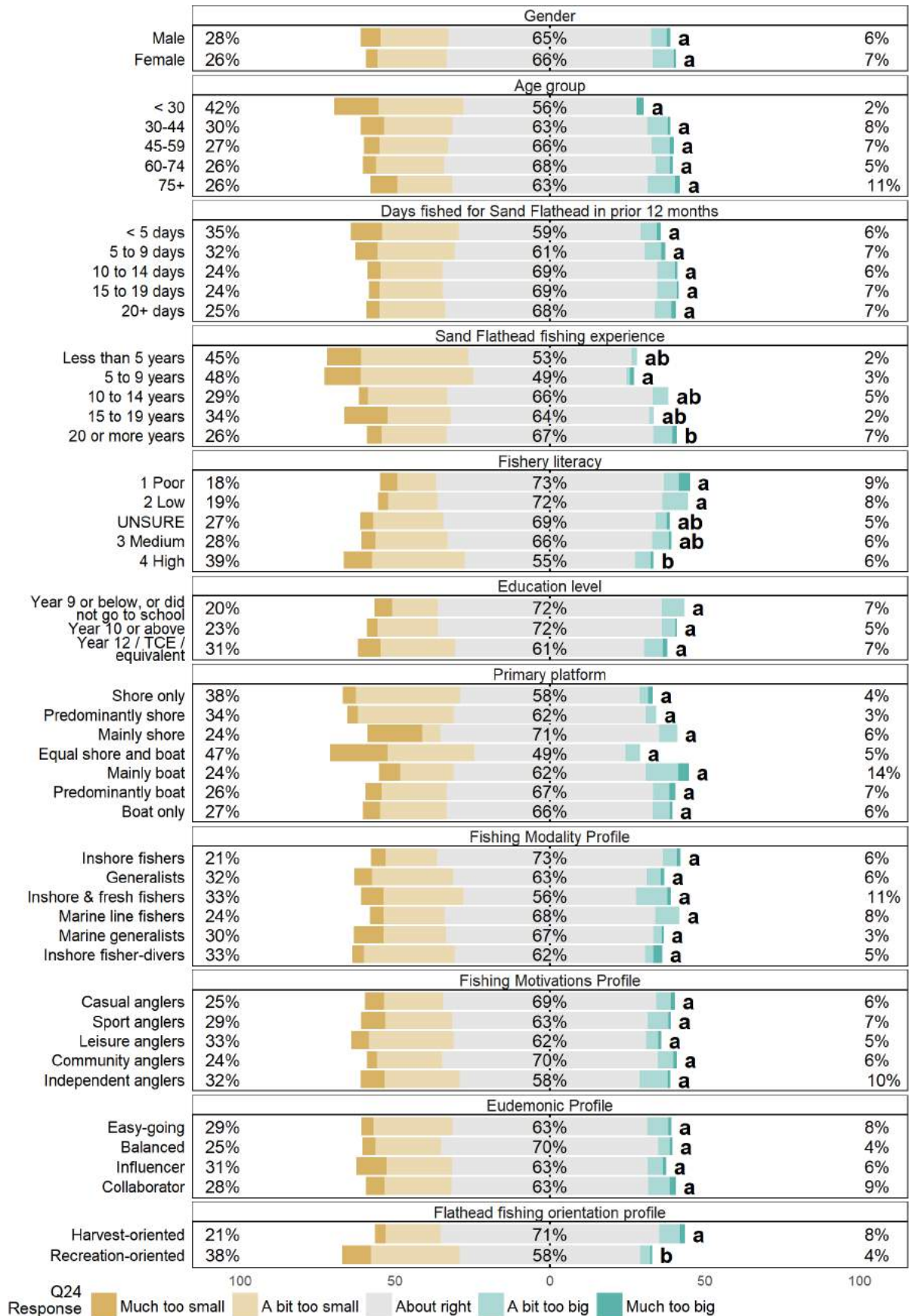


Figure 91. Responses to Q24. "Do you think the current size limit for Sand Flathead, which is 32 cm, is...much too big, a bit too big, about right, a bit too small or much too small?"

SURVEY OF RECREATIONAL FISHERS IN TASMANIA WITH A FOCUS ON SAND FLATHEAD

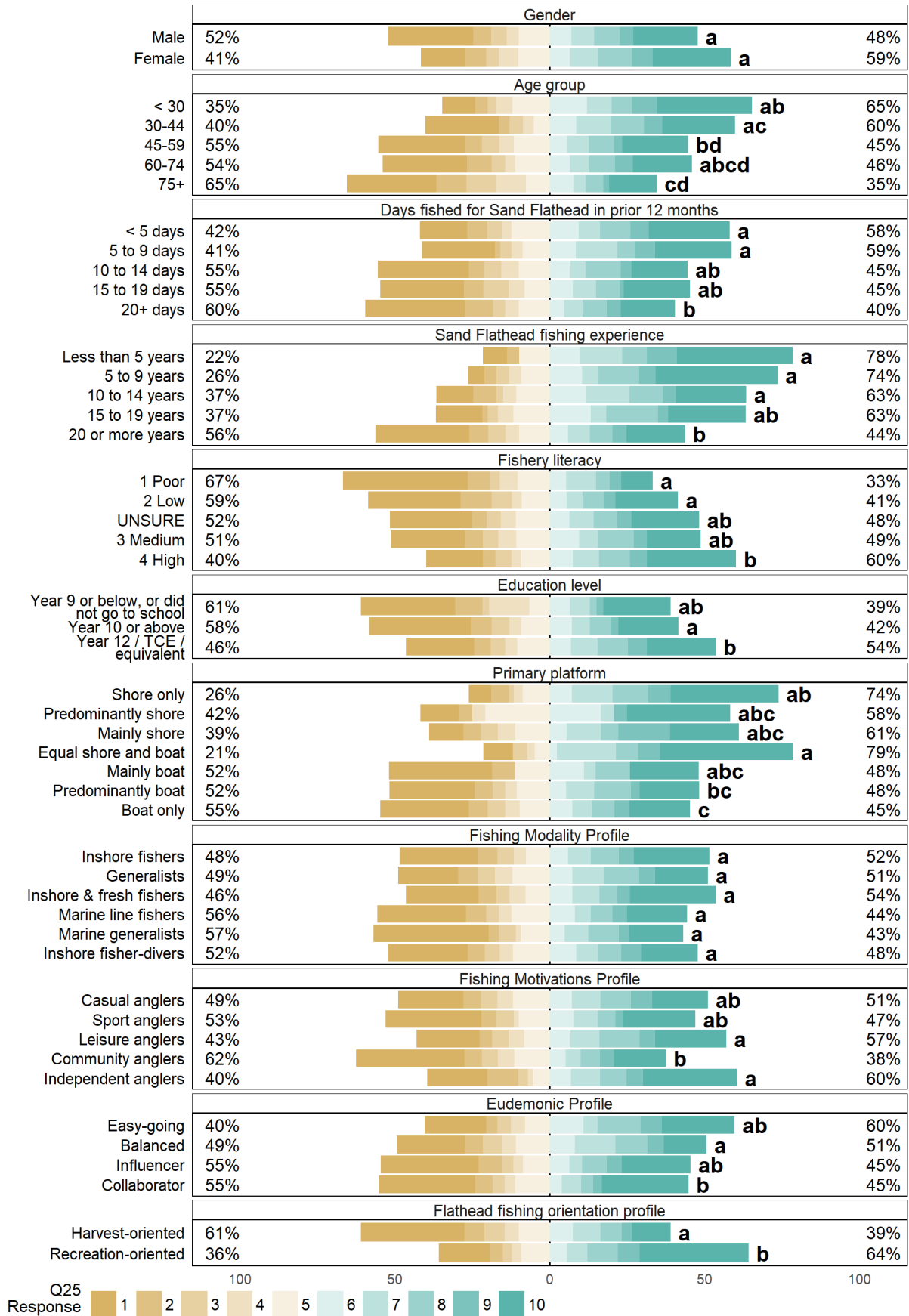


Figure 92. Responses to Q25. Support profile for hypothetical scenario “Halve the bag limit to 10 fish, introduce a boat limit of 20 fish and increase the minimum size limit to 35 cm”, based on a range of demographic and fishing factors. Letters show significant differences ( $\alpha = 0.05$ ) based on Kolmogorov-Smirnov tests with a Holm multiple comparison correction.

SURVEY OF RECREATIONAL FISHERS IN TASMANIA WITH A FOCUS ON SAND FLATHEAD

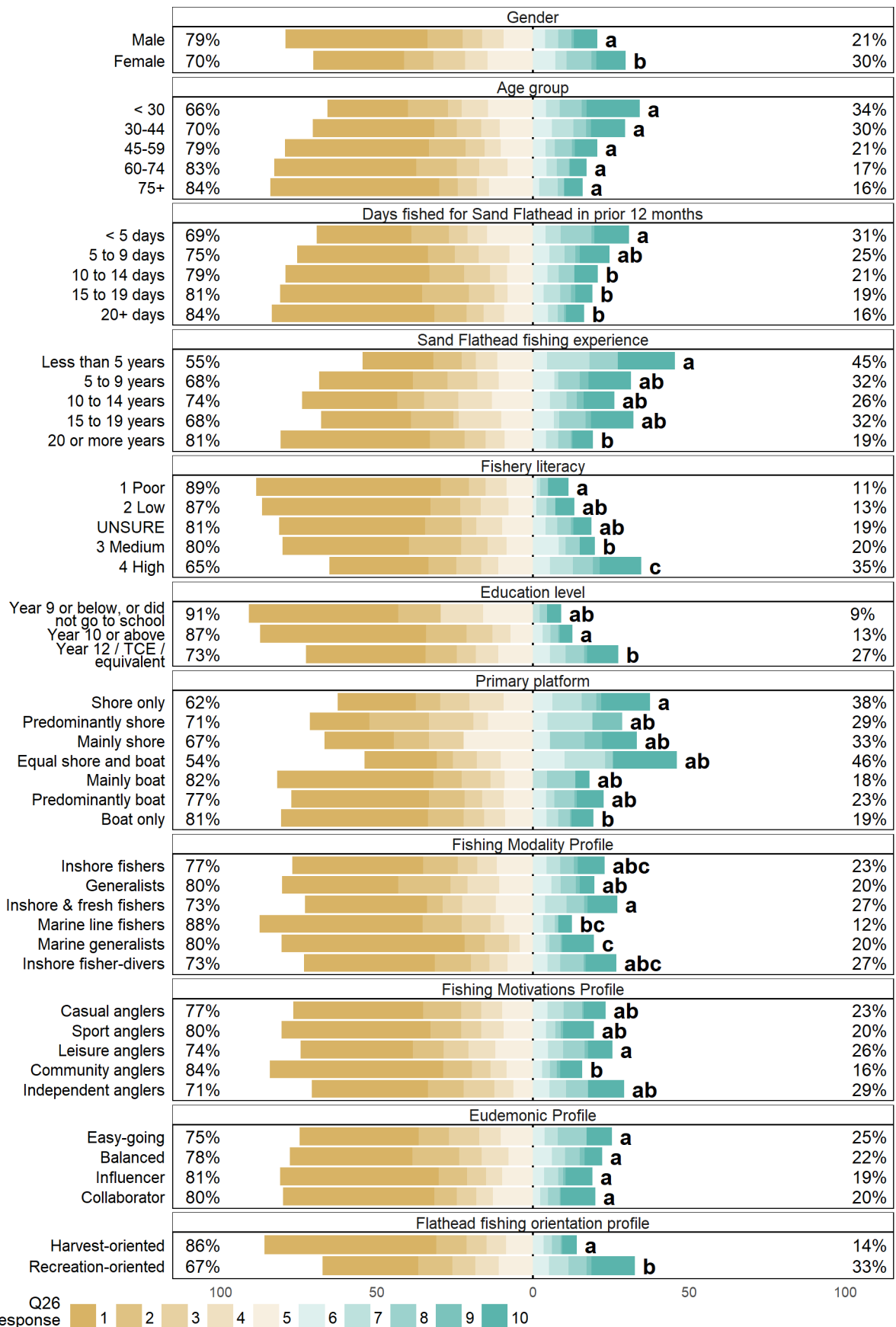


Figure 93. Responses to Q26. Support profile for hypothetical scenario "Reduce the bag limit to 5 fish, keep no boat limit, and increase the minimum size limit to 35 cm", based on a range of demographic and fishing factors. Letters show significant differences ( $\alpha = 0.05$ ) based on Kolmogorov-Smirnov tests with a Holm multiple comparison correction.

SURVEY OF RECREATIONAL FISHERS IN TASMANIA WITH A FOCUS ON SAND FLATHEAD

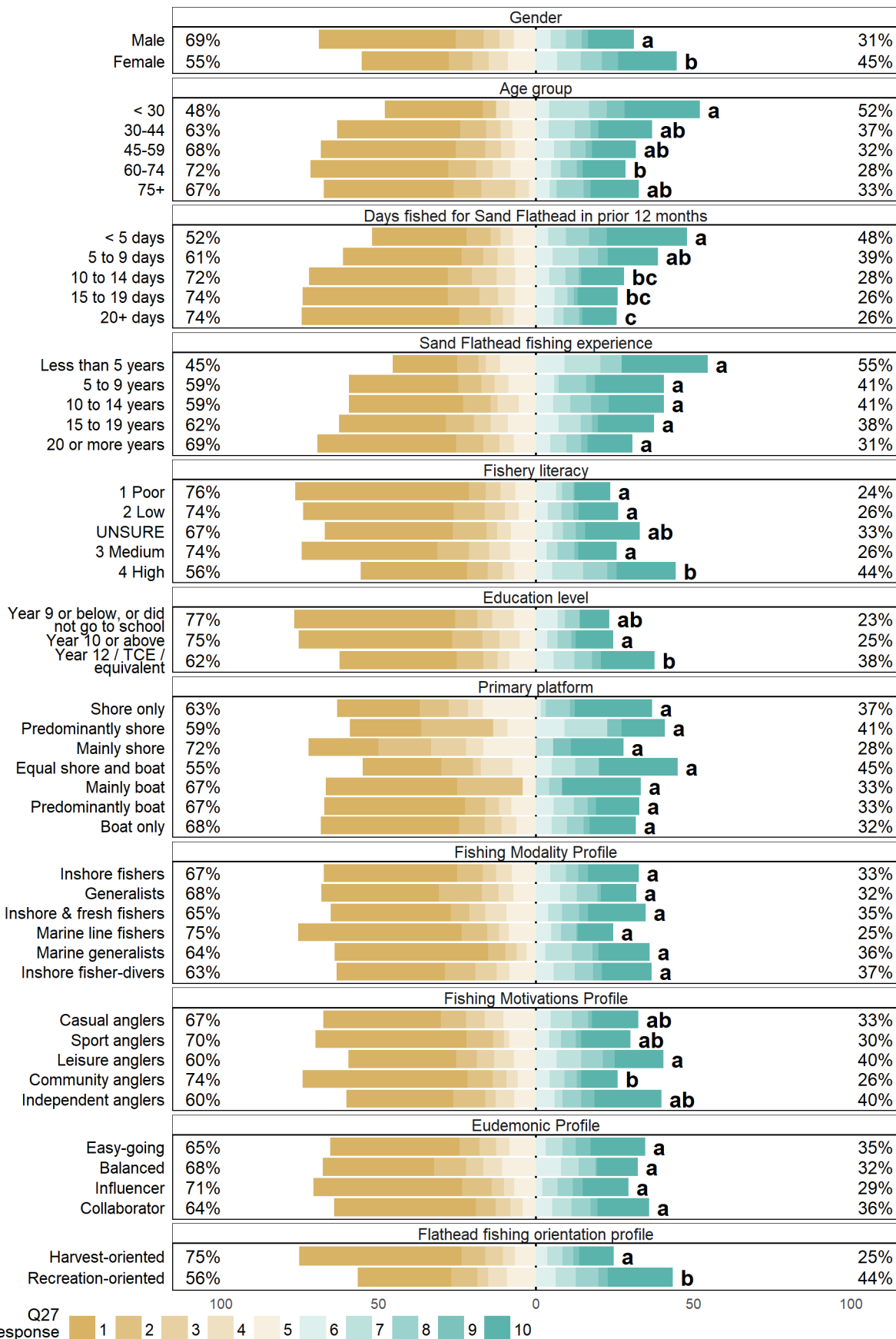


Figure 94. Responses to Q27. Support profile for hypothetical scenario “an 18-month closure of the Sand Flathead fishery, then a bag limit of 10 fish, no boat limit and a minimum size limit of 35 cm”, based on a range of demographic and fishing factors. Letters show significant differences ( $\alpha = 0.05$ ) based on Kolmogorov-Smirnov tests with a Holm multiple comparison correction.

SURVEY OF RECREATIONAL FISHERS IN TASMANIA WITH A FOCUS ON SAND FLATHEAD

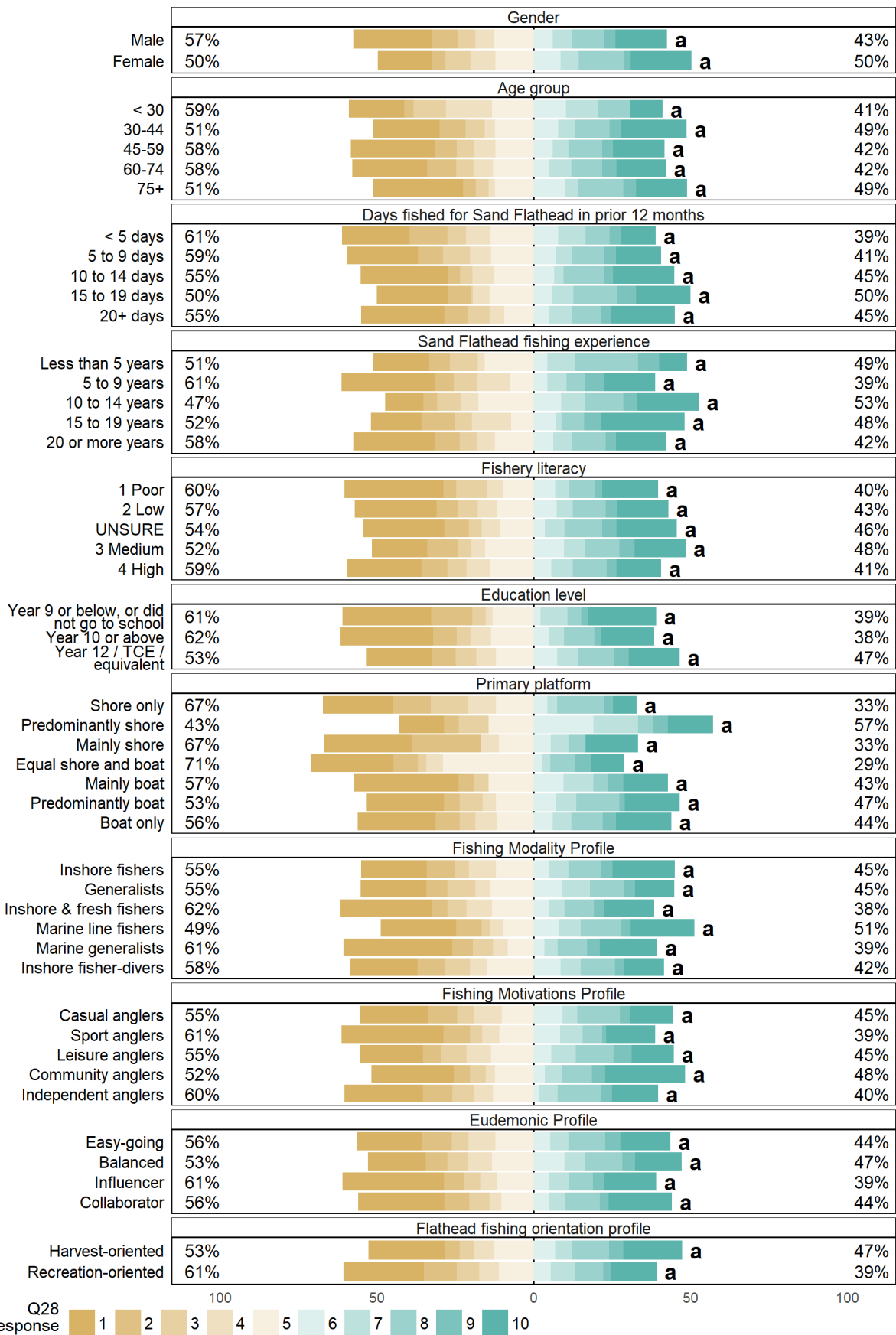


Figure 95. Responses to Q28. Support profile for hypothetical scenario "Halve the bag limit to 10 fish, keep no boat limit, and keep the size limit of 32 cm", based on a range of demographic and fishing factors. Letters show significant differences ( $\alpha = 0.05$ ) based on Kolmogorov-Smirnov tests with a Holm multiple comparison correction.

SURVEY OF RECREATIONAL FISHERS IN TASMANIA WITH A FOCUS ON SAND FLATHEAD

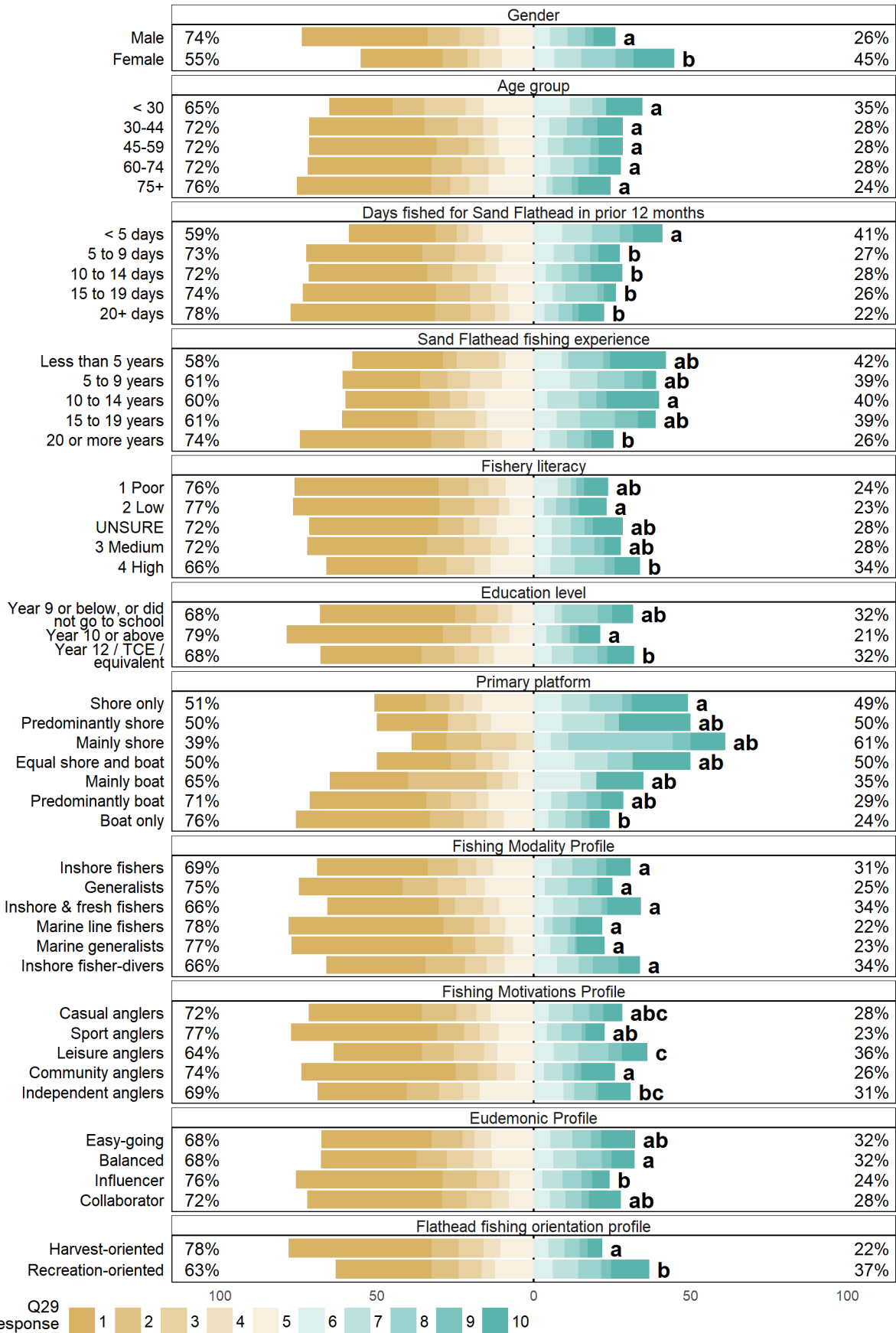


Figure 96. Responses to Q29. Support profile for hypothetical scenario "Reduce the bag limit to 5 fish on the southeast and mid-east coast and 10 fish everywhere else, introduce a boat limit of 15 fish statewide and maintain the minimum size limit of 32 cm", based on a range of demographic and fishing factors. Letters show significant differences ( $\alpha = 0.05$ ) based on Kolmogorov-Smirnov tests with a Holm multiple comparison correction.

SURVEY OF RECREATIONAL FISHERS IN TASMANIA WITH A FOCUS ON SAND FLATHEAD

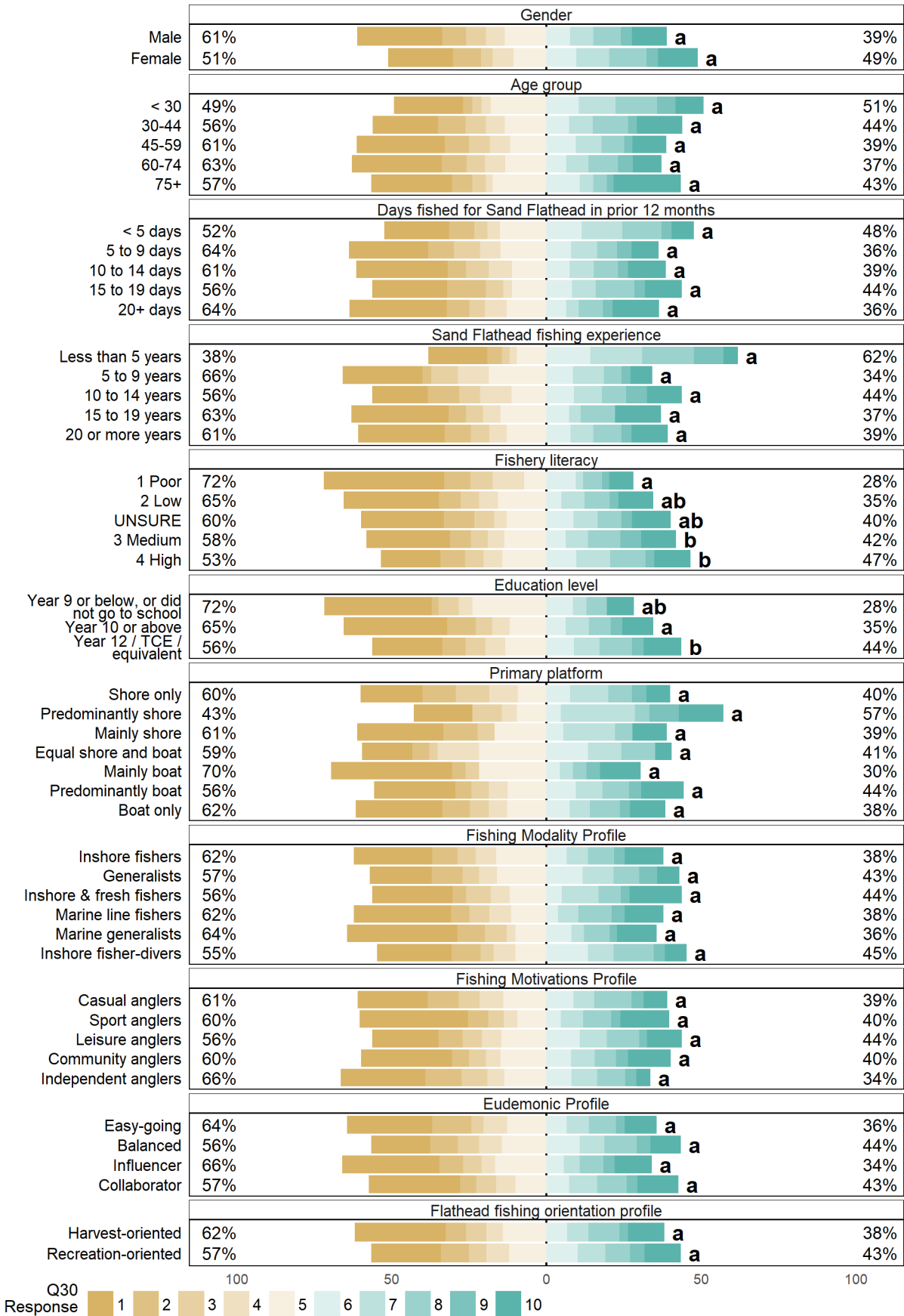


Figure 97. Responses to Q30. Support profile for hypothetical scenario “Halve the bag limit to 10 fish, maintain no boat limit, maintain the minimum size limit of 32 cm, and introduce a maximum size limit of 40 cm”, based on a range of demographic and fishing factors. Letters show significant differences ( $\alpha = 0.05$ ) based on Kolmogorov-Smirnov tests with a Holm multiple comparison correction.

SURVEY OF RECREATIONAL FISHERS IN TASMANIA WITH A FOCUS ON SAND FLATHEAD

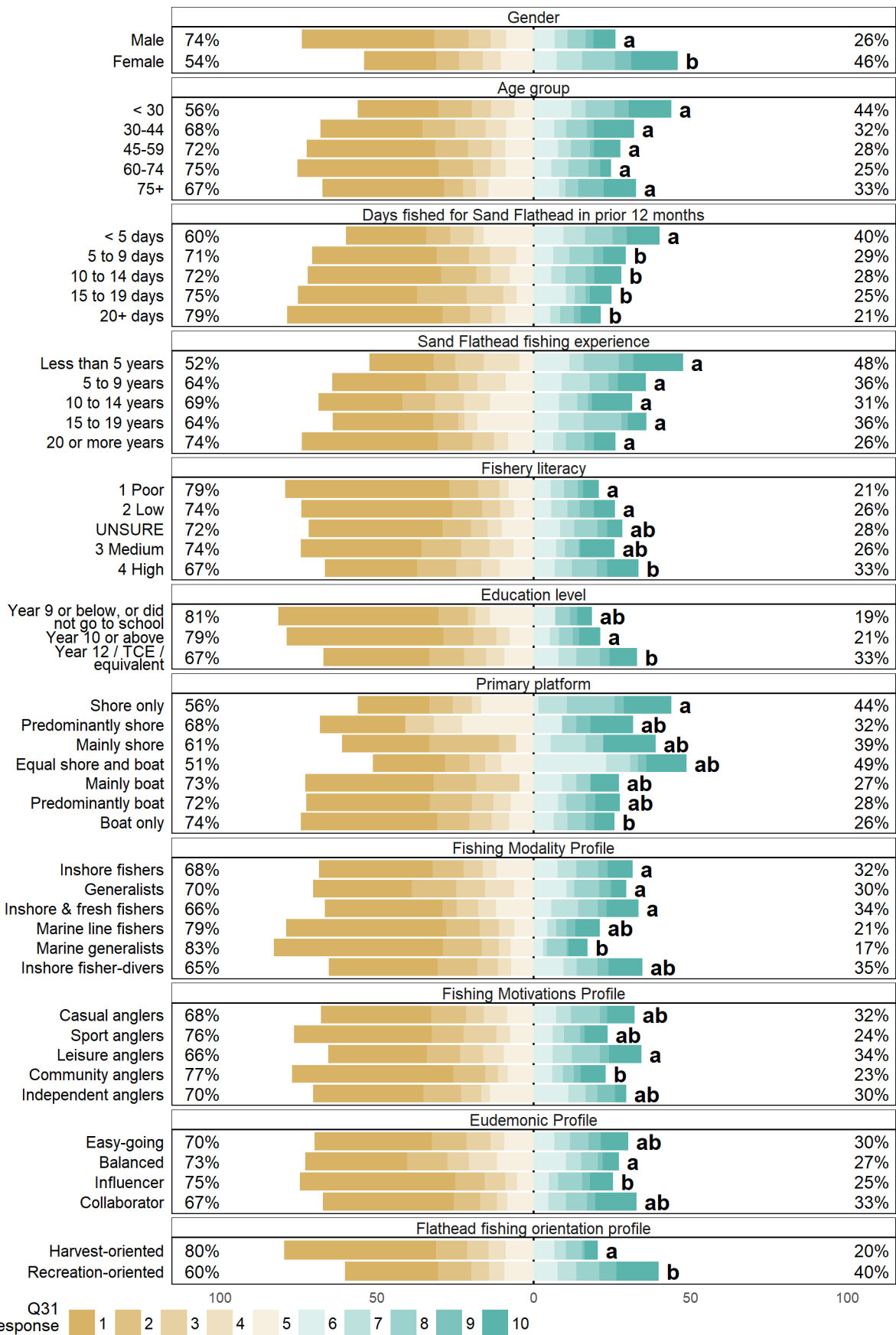


Figure 98. Responses to Q31. Support profile for hypothetical scenario "Reduce the bag limit to 5 fish, introduce a boat limit of 20 fish, maintain the minimum size limit of 32 cm and introduce a maximum size limit of 38 cm", based on a range of demographic and fishing factors. Letters show significant differences ( $\alpha = 0.05$ ) based on Kolmogorov-Smirnov tests with a Holm multiple comparison correction.

SURVEY OF RECREATIONAL FISHERS IN TASMANIA WITH A FOCUS ON SAND FLATHEAD

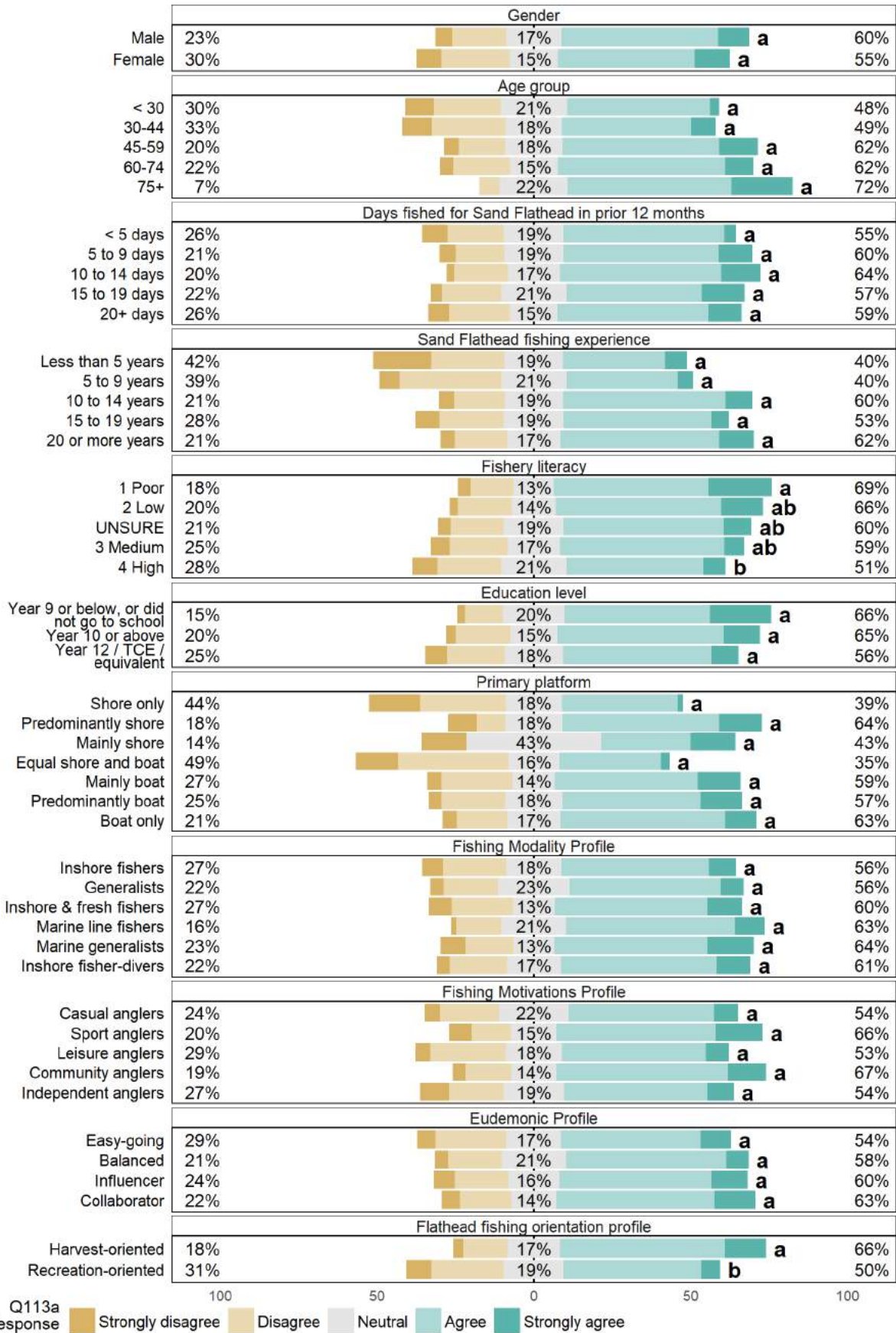


Figure 99. Responses to Q113a. Agreement profile for the statement "Overall, I believe most recreational flathead fishers comply with fishing rules", based on a range of demographic and fishing factors. Letters show significant differences ( $\alpha = 0.05$ ) based on Kolmogorov-Smirnov tests with a Holm multiple comparison correction.

SURVEY OF RECREATIONAL FISHERS IN TASMANIA WITH A FOCUS ON SAND FLATHEAD

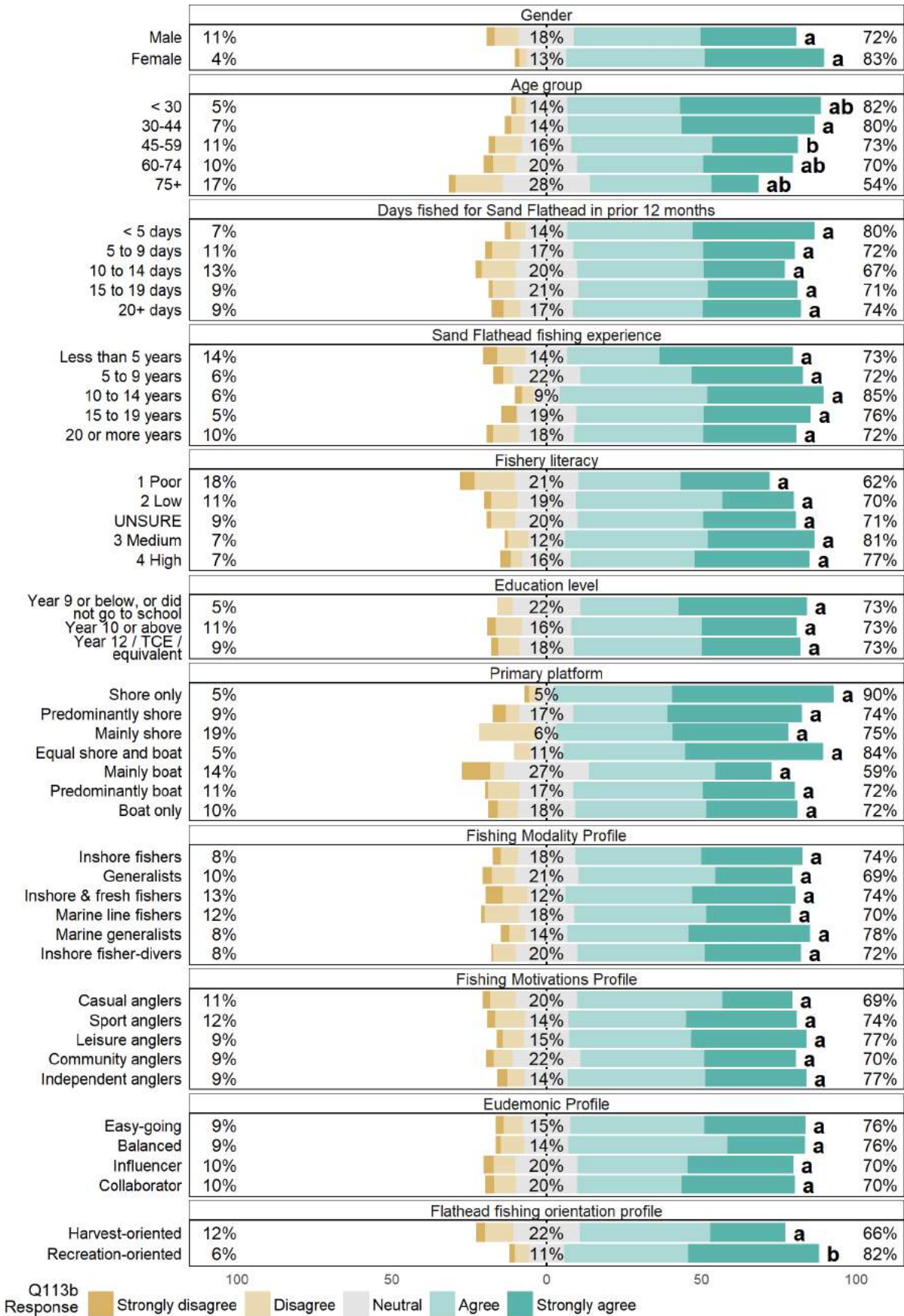


Figure 100. Responses to Q113b. Agreement profile for the statement “There needs to be more compliance checks”, based on a range of demographic and fishing factors. Letters show significant differences ( $\alpha = 0.05$ ) based on Kolmogorov-Smirnov tests with a Holm multiple comparison correction.

SURVEY OF RECREATIONAL FISHERS IN TASMANIA WITH A FOCUS ON SAND FLATHEAD

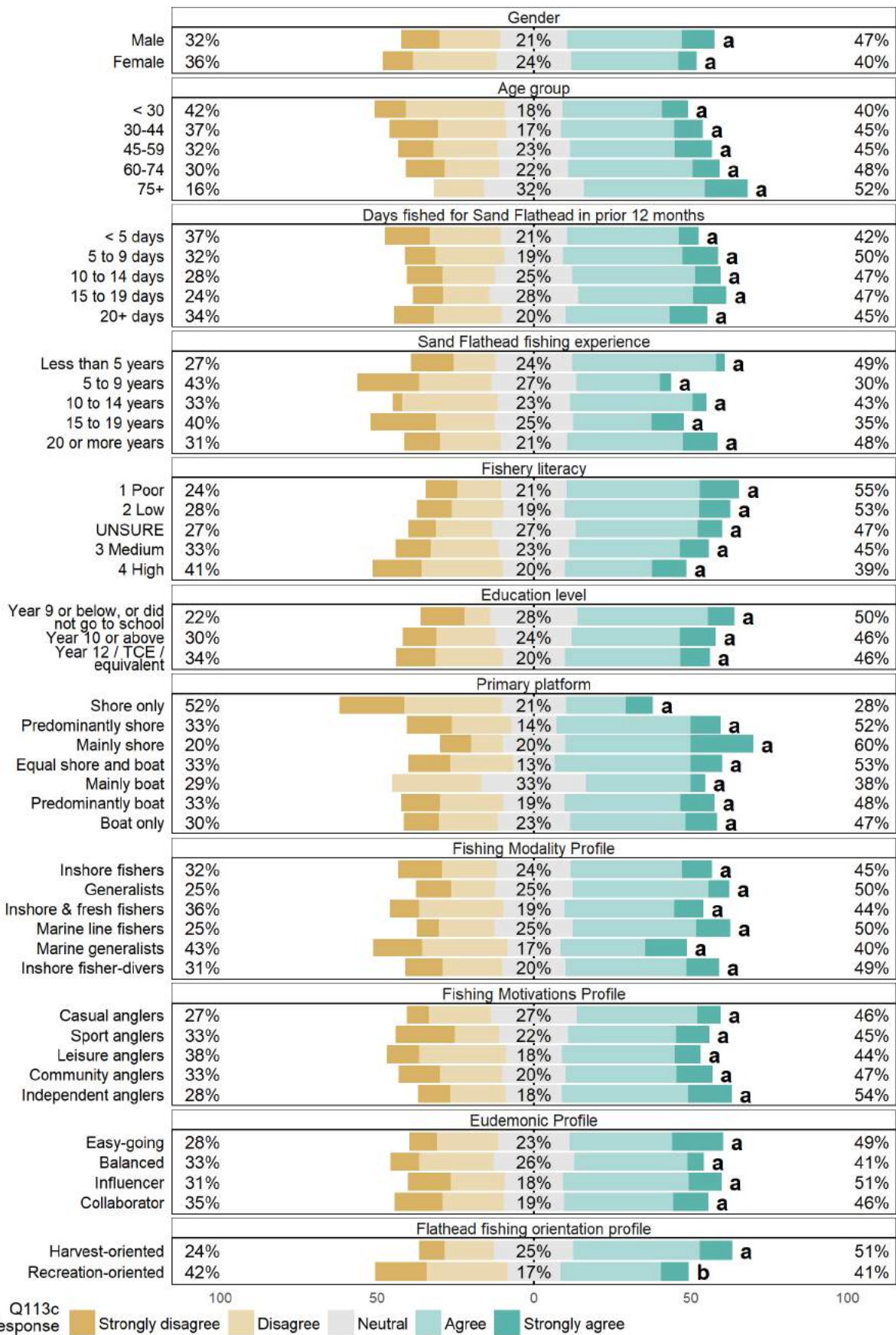


Figure 101. Responses to Q113c. Agreement profile for the statement "Current penalties for non-compliance of fisheries rules are adequate", based on a range of demographic and fishing factors. Letters show significant differences ( $\alpha = 0.05$ ) based on Kolmogorov-Smirnov tests with a Holm multiple comparison correction.

SURVEY OF RECREATIONAL FISHERS IN TASMANIA WITH A FOCUS ON SAND FLATHEAD

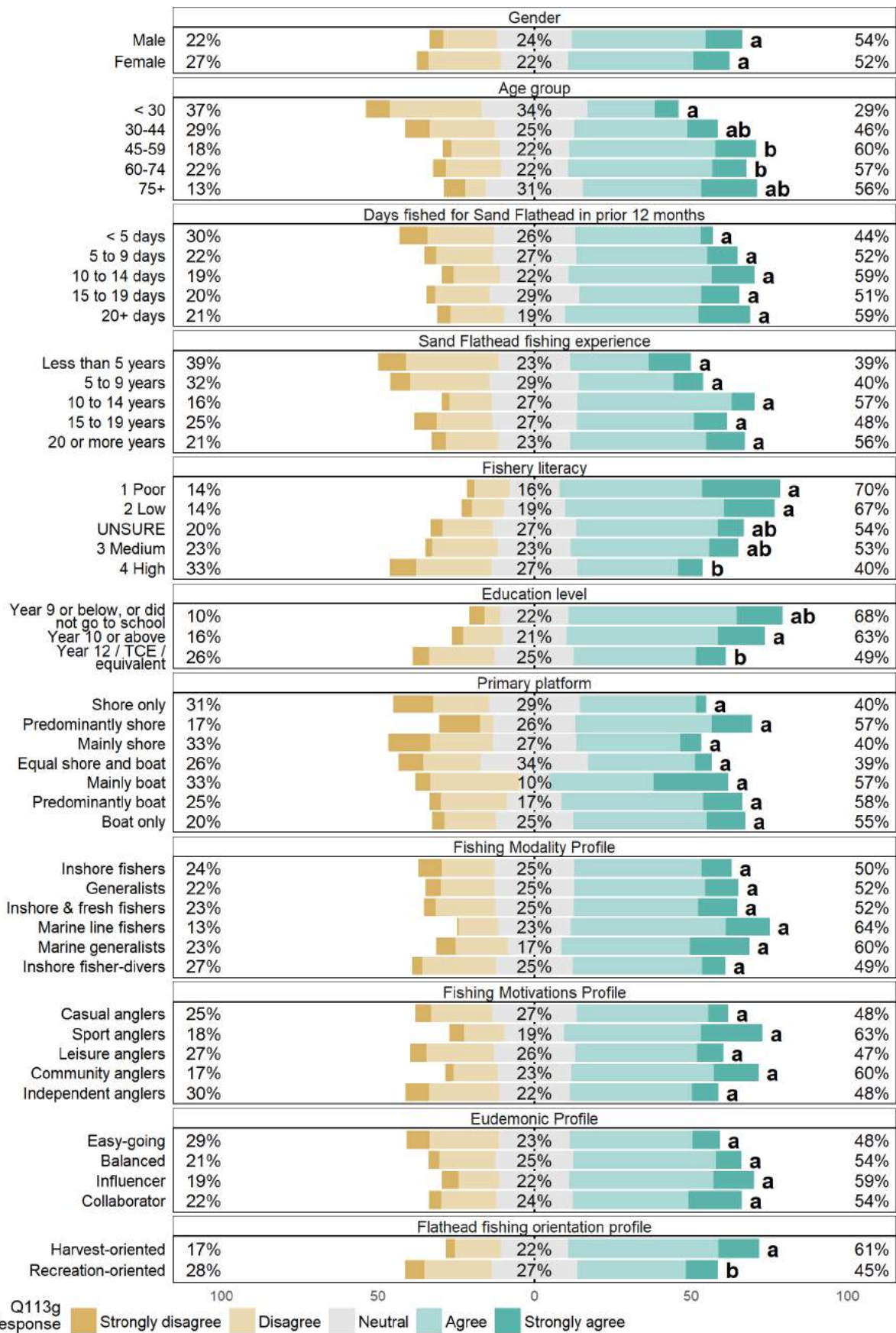


Figure 102. Responses to Q113g. Agreement profile for the statement “Overall, recreational fishers do the right thing to ensure that there are healthy fish stocks for future generations”, based on a range of demographic and fishing factors. Letters show significant differences ( $\alpha = 0.05$ ) based on Kolmogorov-Smirnov tests with a Holm multiple comparison correction.

SURVEY OF RECREATIONAL FISHERS IN TASMANIA WITH A FOCUS ON SAND FLATHEAD

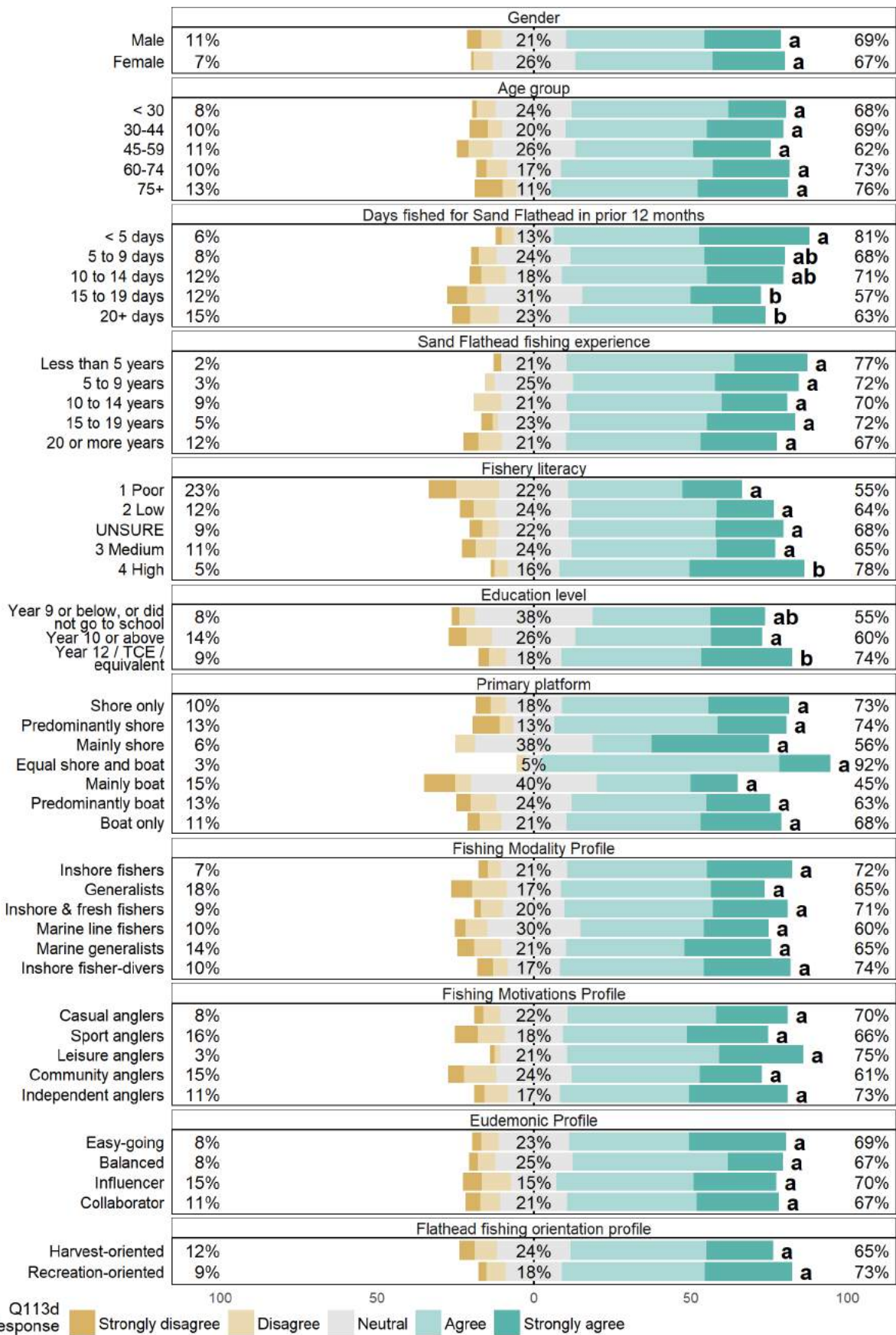


Figure 103. Responses to Q113d. Agreement profile for the statement "Data for managing a recreational fishery should be collected by the Government or a Govt affiliated research agency", based on a range of demographic and fishing factors. Letters show significant differences ( $\alpha = 0.05$ ) based on Kolmogorov-Smirnov tests with a Holm multiple comparison correction.

SURVEY OF RECREATIONAL FISHERS IN TASMANIA WITH A FOCUS ON SAND FLATHEAD

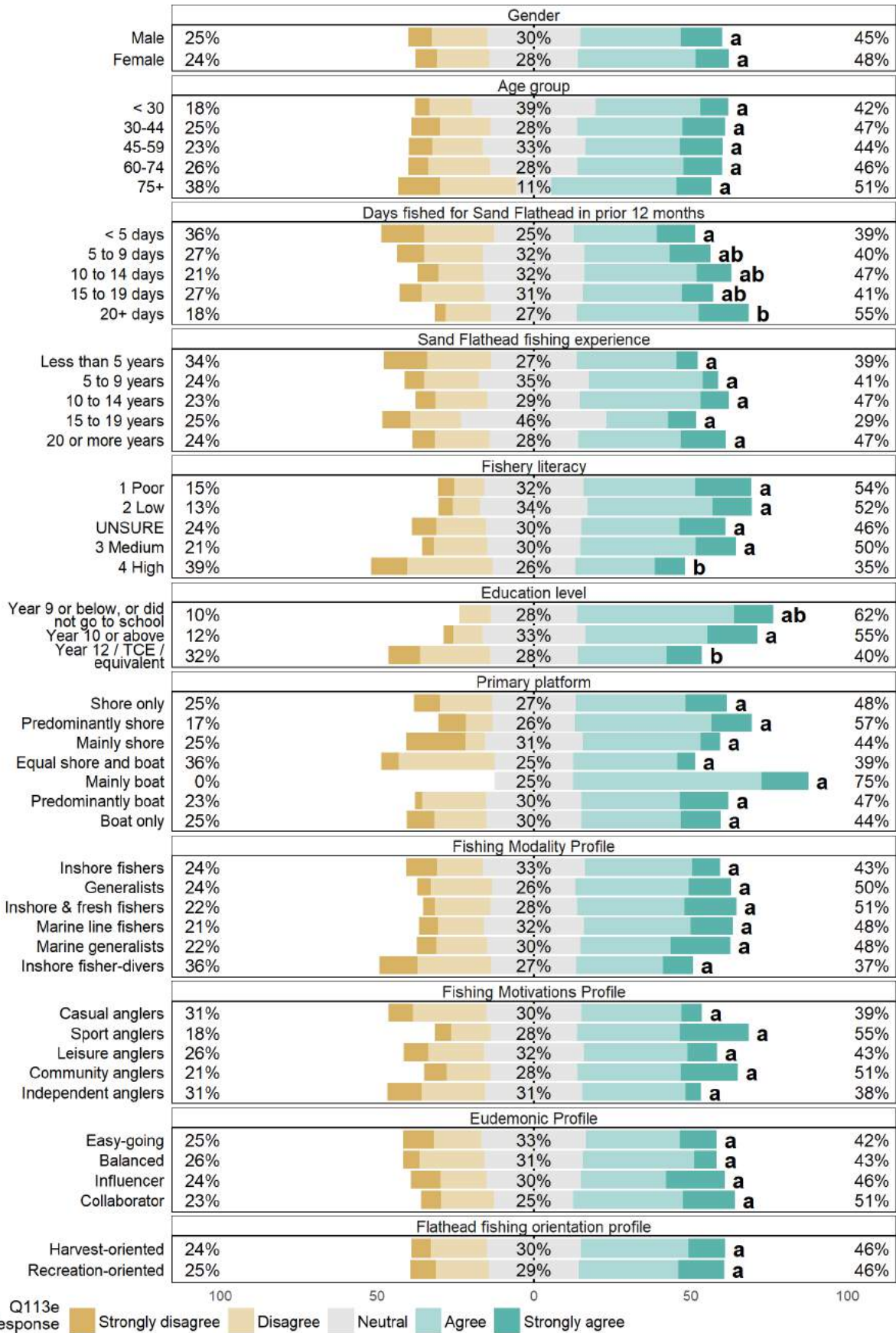


Figure 104. Responses to Q113e. Agreement profile for the statement “Data collected”, based on a range of demographic and fishing factors. Letters show significant differences ( $\alpha = 0.05$ ) based on Kolmogorov-Smirnov tests with a Holm multiple comparison correction.

SURVEY OF RECREATIONAL FISHERS IN TASMANIA WITH A FOCUS ON SAND FLATHEAD

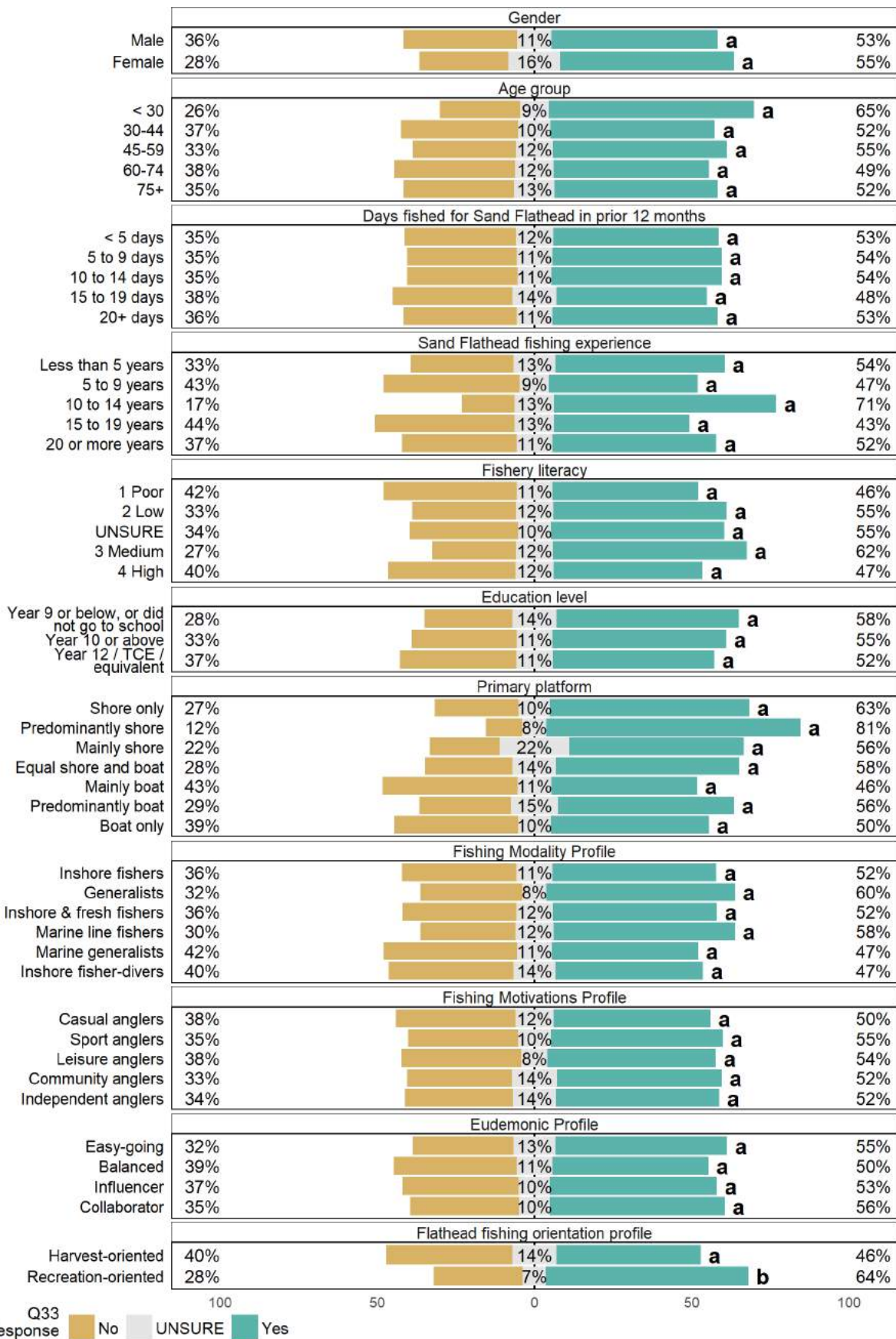


Figure 105. Responses to Q33. "As well as changing fishing rules for Sand Flathead, do you think that encouraging recreational fishers to voluntarily reduce their catches could make a big difference in the recovery of Sand Flathead stocks?"

SURVEY OF RECREATIONAL FISHERS IN TASMANIA WITH A FOCUS ON SAND FLATHEAD

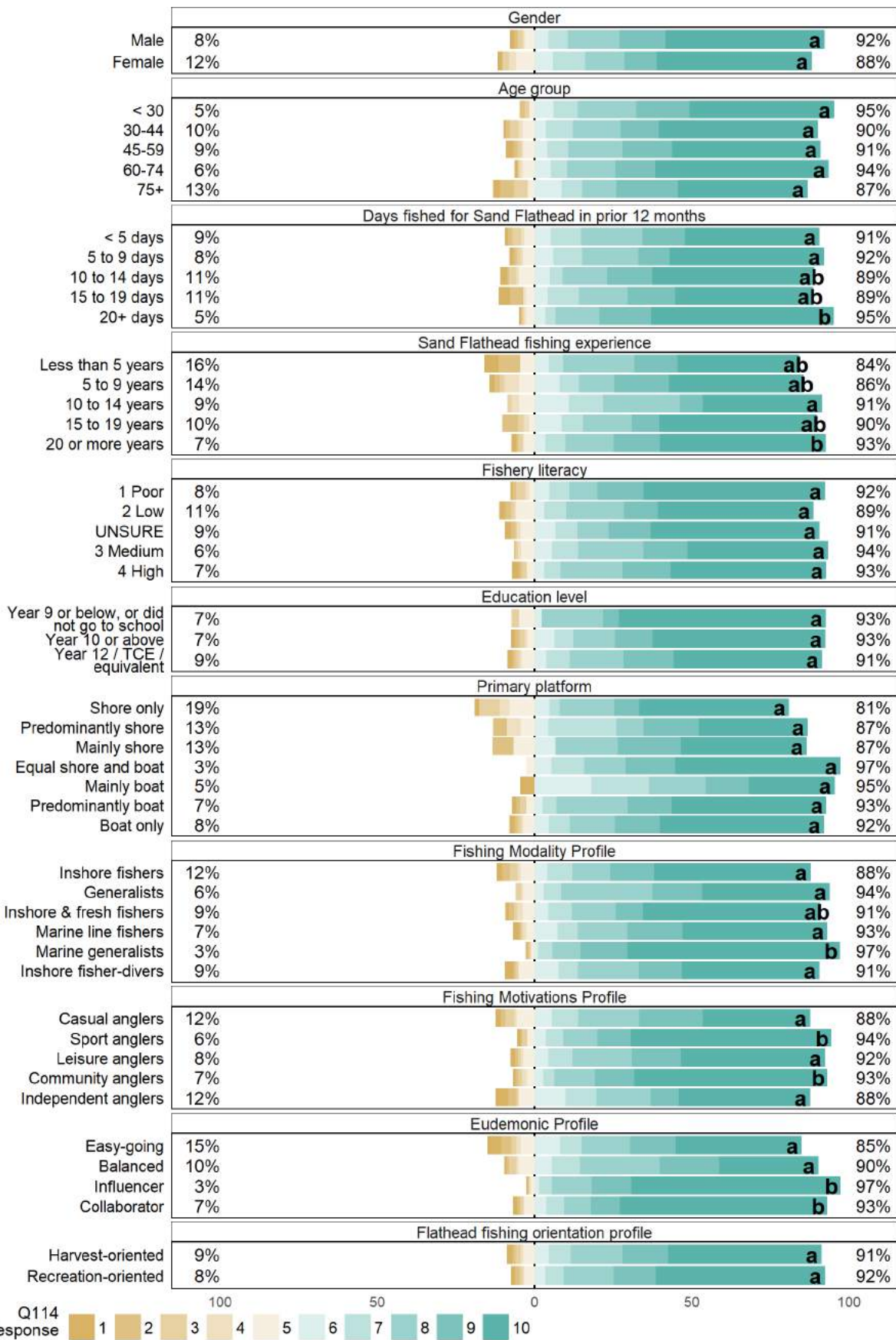


Figure 106. Responses to Q114. "How likely are you to remind or educate friends, family or other recreational fishers about recreational fishery rules with 1 being not at all likely to 10 being extremely likely?".

SURVEY OF RECREATIONAL FISHERS IN TASMANIA WITH A FOCUS ON SAND FLATHEAD

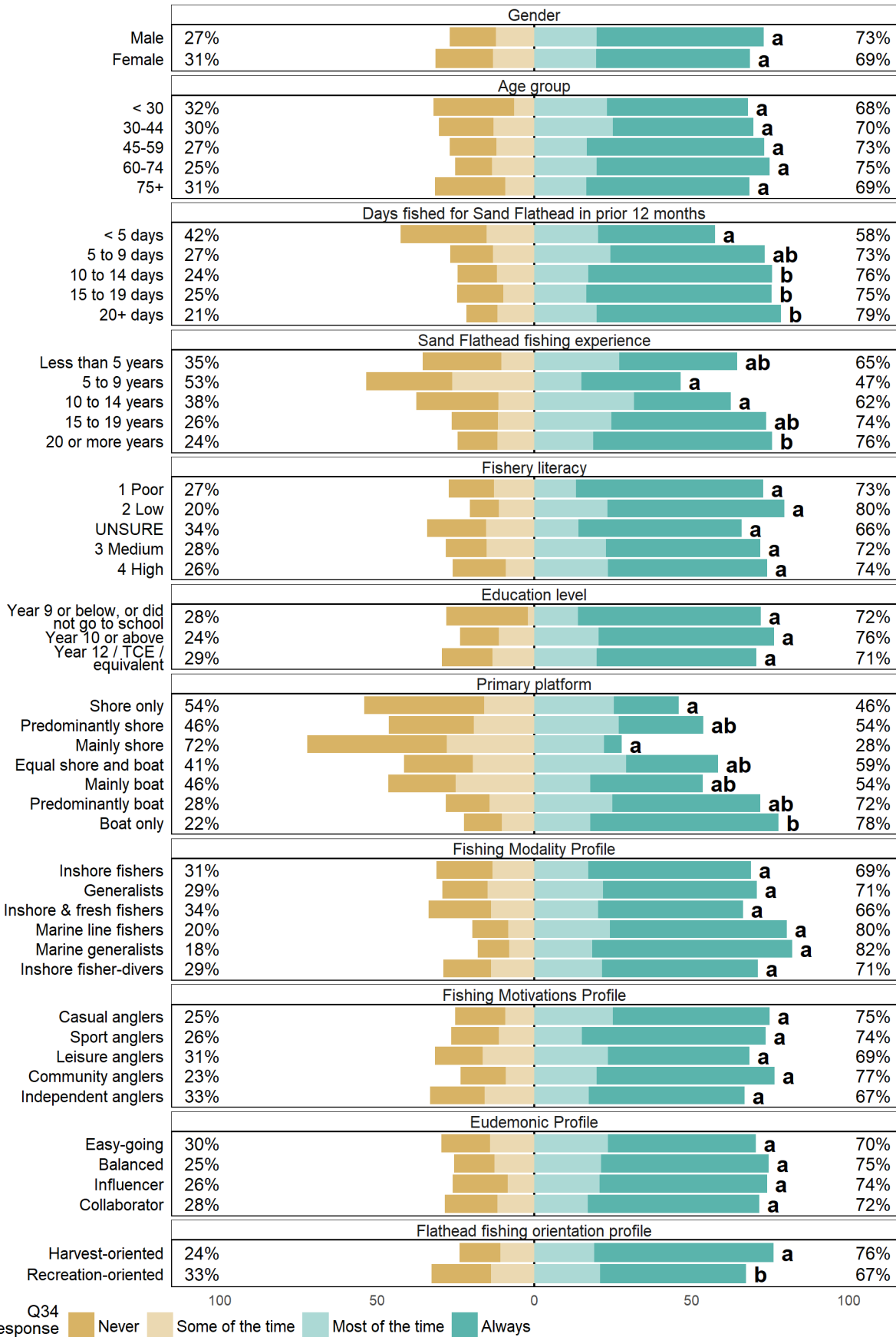


Figure 107. Responses to Q34. "How often do you use a de-hooker when flathead fishing?"

SURVEY OF RECREATIONAL FISHERS IN TASMANIA WITH A FOCUS ON SAND FLATHEAD

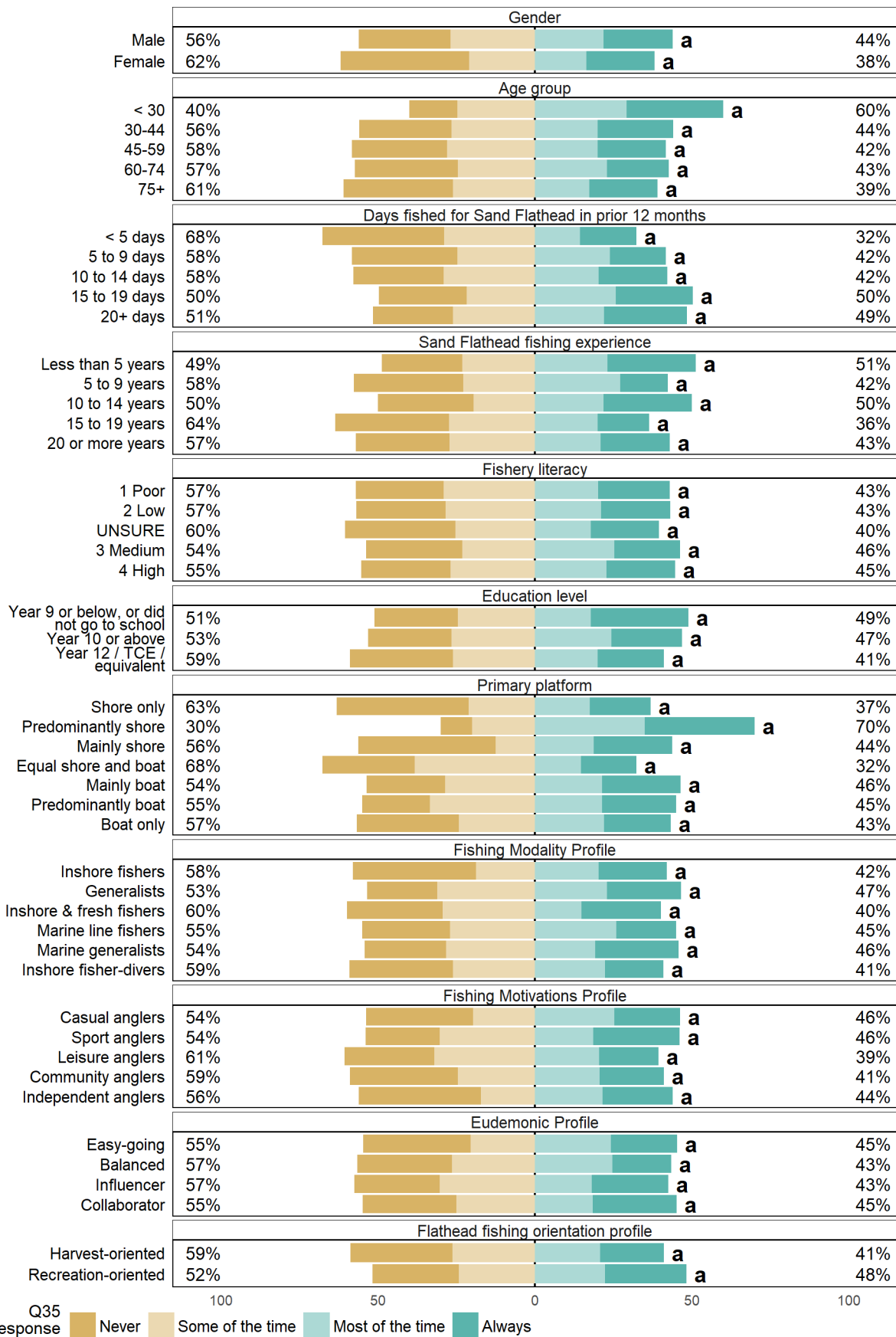


Figure 108. Responses to Q35. "How often do you use circle hooks when bait fishing for flathead."

SURVEY OF RECREATIONAL FISHERS IN TASMANIA WITH A FOCUS ON SAND FLATHEAD

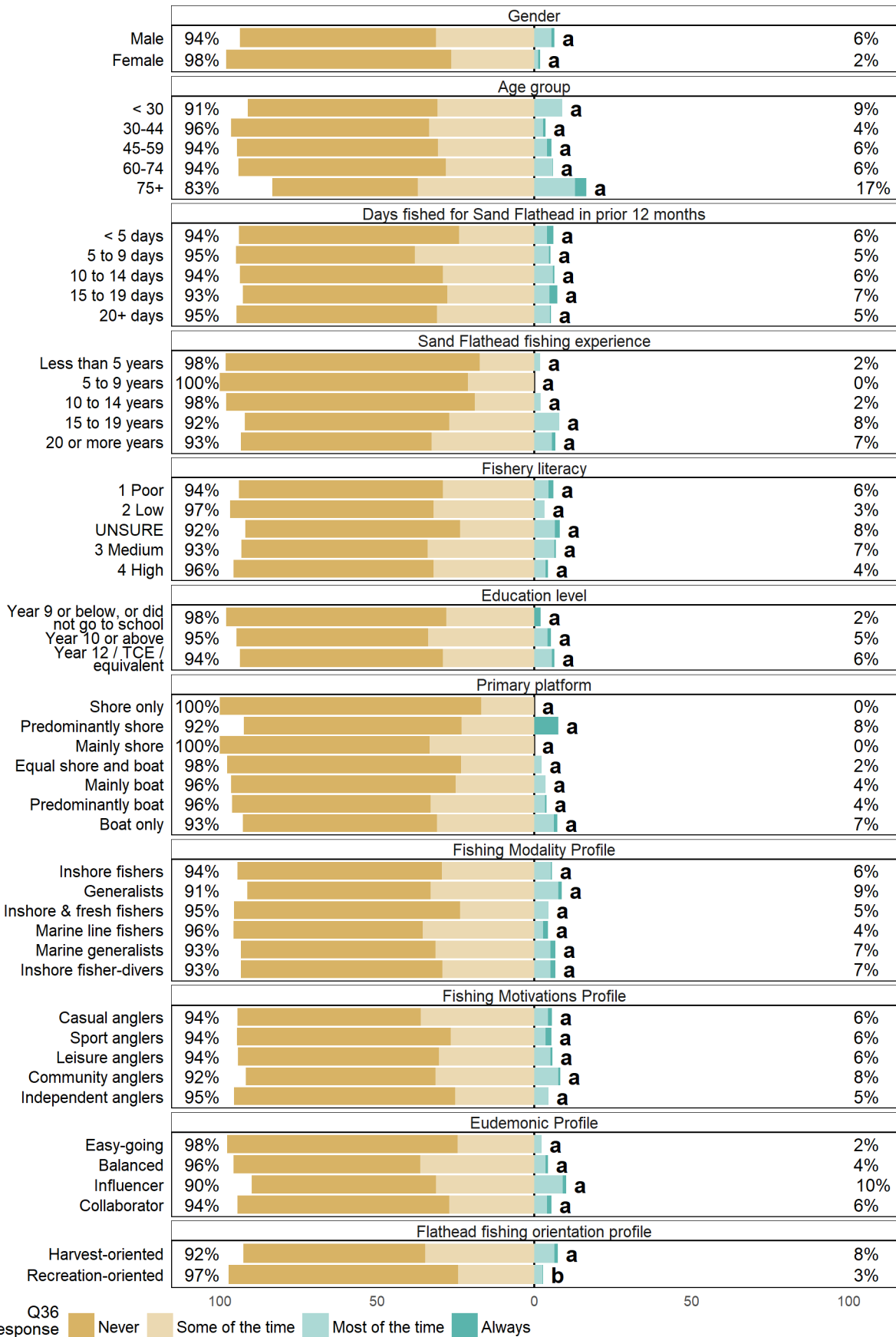


Figure 109. Responses to Q36. "Do you ever use Sand Flathead as bait?".



## Appendix 2 – Survey instrument

UNIVERSITY of TASMANIA

**IMAS**



Institute for Marine and Antarctic Studies

**SURVEY OF RECREATIONAL FISHING IN TASMANIA, 2022/23 'A FOCUS ON SAND FLATHEAD AND UNDERSTANDING THE RANGE OF PERSPECTIVES OF RECREATIONAL FISHERS IN TASMANIA'**

**As a recreational fisher who has fished for flathead in the past, or intend to fish for flathead in the future, we are inviting you to participate in a special survey. The survey is designed to better understand what people value about the recreational flathead fishery and get your opinions on flathead management.**

**Sand flathead is one of Tasmania's most important recreational fishing species. In recent years there have been concerns over its depleting stock status, and changes to management settings will be required to rebuild the stock to sustainable levels. However, there are many logistical and social issues to be considered in making management changes.**

**It is important to the study that we have participants that might fish a lot for sand flathead and also those that fish a little for them. So even if you don't fish much your responses will be an important contribution to the study.**

**Some of the questions might not seem directly related to flathead or fishing but they are important to help us understand who Tasmanian recreational fishers are and what they value in their fishery. This will give us insights into how to best manage recreational fisheries to ensure they match the values and expectations of recreational fishers wherever possible.**

**While you may feel at times you want to answer based on your beliefs or 'what you think we want to hear', please try and answer questions as realistic to your beliefs or actions as possible. The more realistic the answers, the more effective they may be in informing changes to flathead management in ways that are more acceptable to**

**recreational fishers. Please keep in mind that the survey is confidential, and your name or identity will not be related to your answers. When available, reports from this study will be promoted through various IMAS media platforms.**

**This survey should take approximately 30 minutes to complete and we realise this could be a burden on you. There are quite a few questions as we want as much information about recreational fishers as possible. You might want to get it all done in one go, which would be great, but you can also save your progress and complete it over a couple of sessions. All questions are really important to get a good result. By submitting your survey response, you are providing your consent to participate in this survey. If you decide to withdraw your survey response at any time prior submission, please contact the survey team at [imas.surveys@utas.edu.au](mailto:imas.surveys@utas.edu.au)**

**This study has been approved by the University of Tasmania Human Research Ethics Committee. If you have concerns or complaints about the conduct of this study, you can contact the Executive Officer of the HREC on (03) 6226 6254 or email [human.ethics@utas.edu.au](mailto:human.ethics@utas.edu.au). The Executive Officer is the person nominated to receive complaints from research participants. You will need to quote H0028688. Funding for the survey has been provided by the Tasmanian State Government.**

**If you have any questions about the study, feel free to contact our survey team at [imas.surveys@utas.edu.au](mailto:imas.surveys@utas.edu.au)**

**Thank you very much for your participation.**

\* 1. IMAS is currently running a phone-based statewide recreational fishing survey. If you are not part of the phone survey just select 'no' below.

If you are in the phone survey, select 'yes'.

**\* 2. What is your statewide survey code? If you are unsure check with your survey interviewer next time they call, or you can email [imas.surveys@utas.edu.au](mailto:imas.surveys@utas.edu.au) and it can be sent to you.**

The following series of questions collect important information to help us understand more about people who recreationally fish in Tasmania. They also allow us to match the profile of the people responding to the Australian census data to see if our results represent the demographics of the Tasmanian population.

**\* 3. Firstly, can you add your postcode?**

**4. and your residential suburb?**

**\* 5. What is your age group**

- younger than 18
- 18-29
- 30-44
- 45-59
- 60-74
- 75+

SURVEY OF RECREATIONAL FISHERS IN TASMANIA WITH A FOCUS ON SAND FLATHEAD

\* 6. What is your gender

- Male
- Female
- Other (please specify)

\* 7. What is the highest level of school you have completed?

- Year 12 / TCE / equivalent
- Year 10 or above
- Year 9 or below, or did not go to school

\* 8. And have you completed a university degree?  
(incl. Bachelors, Masters, or other postgraduate degree)

- Yes
- No

\* 9. And the final demographic question is, what was your country of birth?

\* 10. In the last 12 months on how many separate days did you do any kind of recreational fishing in Tasmania? (BEST ESTIMATE IS FINE)

- Less than 5 days
- 5 to 9 days
- 10 to 14 days
- 15 to 19 days
- 20 or more days
- UNSURE (when you see this option, only use it if you really can't answer the question)

SURVEY OF RECREATIONAL FISHERS IN TASMANIA WITH A FOCUS ON SAND FLATHEAD

Ok, let's get into the flathead questions.

11. Thinking about your fishing in Tasmania, in how many years have you fished for flathead whether you caught any or not? (BEST ESTIMATE)

12. (And) now, thinking back over the last 12 months, on how many days have you fished for flathead in Tasmania)? (JUST YOUR BEST ESTIMATE)

13. When fishing for flathead in Tasmania in the last 12 months, what percentage of time would you spend fishing from a boat versus the shore, including jetties, beaches, rockwalls, etc? (BEST ESTIMATE), must equal 100%

Boat	<input type="text"/>
Shore	<input type="text"/>

14. The two main species of flathead caught in Tasmania are sand flathead and tiger flathead. How confident are you in your ability to tell the difference between them?

- Very confident
- Somewhat confident
- Not so confident
- Not at all confident
- I didn't know there were different species
- UNSURE

The following statement is about these two species, you may already know this, but to ensure all survey participants are basing their responses on the same understanding we provide this statement for clarity.

“Sand flathead (sometimes known as bay flathead) are caught in shallower inshore waters and are predominantly caught by recreational fishers. Tiger flathead (sometimes known as king flathead) can be caught in shallow water too, but most often are caught in deeper water. Tiger flathead are caught by recreational fishers but are most commonly caught by commercial fishers for sale to domestic and interstate seafood markets. Furthermore, tiger flathead generally grow to larger sizes than sand flathead”.

SURVEY OF RECREATIONAL FISHERS IN TASMANIA WITH A FOCUS ON SAND FLATHEAD

15. Based on this knowledge, what percentage of your flathead catch in the last 12 months do you estimate was sand flathead vs tiger flathead? (BEST ESTIMATE), must equal 100%

Sand flathead

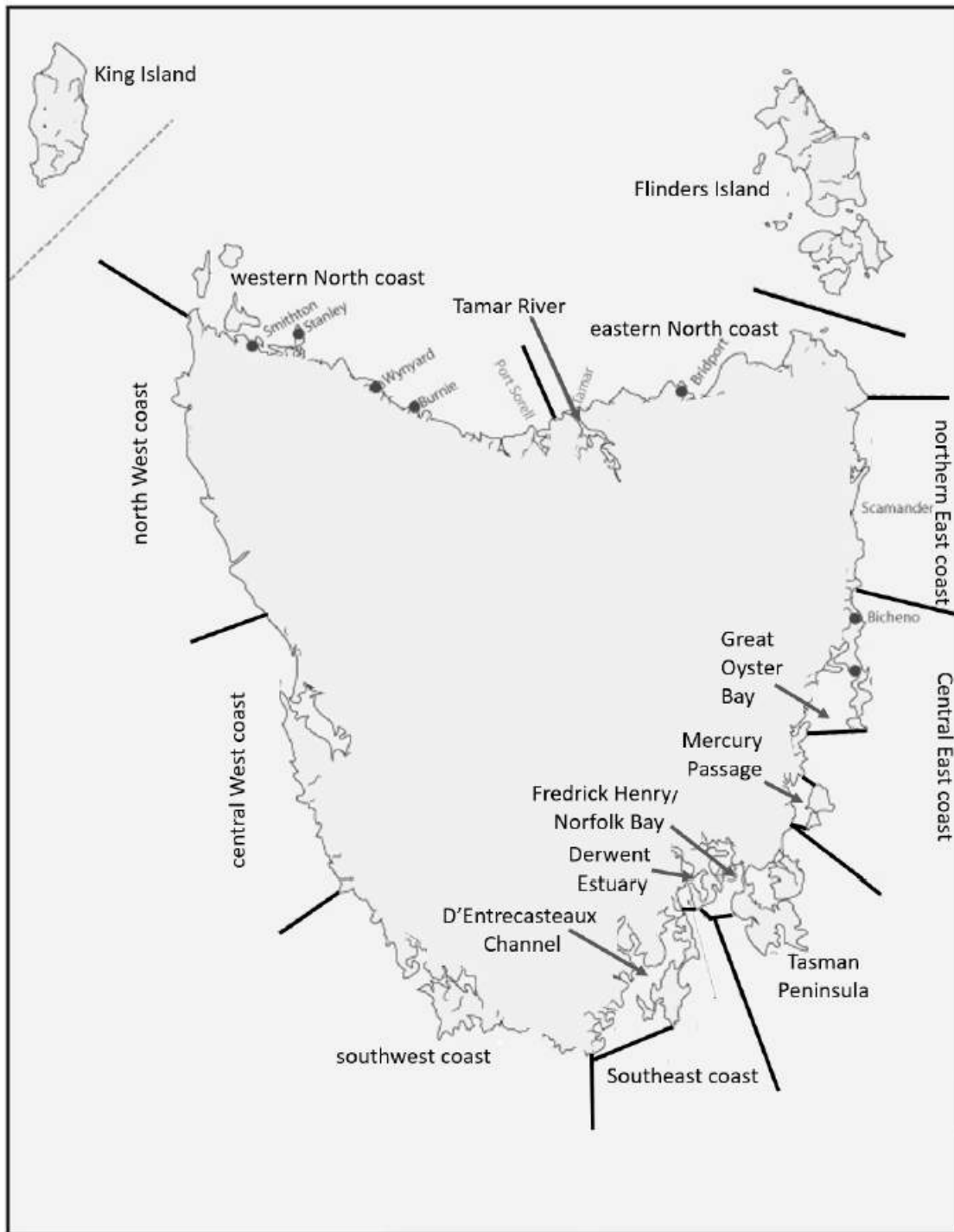
Tiger flathead

Other

16. If you put a percentage against 'other' above, what species of flathead were they?

Species 1

Species 2



17. Based on the map above (bold black lines are area boundaries) In which area do you most commonly fish for sand flathead in Tasmania?

SURVEY OF RECREATIONAL FISHERS IN TASMANIA WITH A FOCUS ON SAND FLATHEAD

18. What percentage of overall sand flathead catch do you estimate is taken by recreational fishers compared with commercial fishers in Tasmanian waters? (BEST ESTIMATE), must equal 100%

Recreational	<input type="text"/>
Commercial	<input type="text"/>
UNSURE	<input type="text"/>

19. Do you know which season you are most likely to catch spawning sand flathead in Tasmanian waters?

- Winter
- Spring
- Summer
- Autumn
- UNSURE

20. In your opinion, how do you think the sand flathead stock is currently doing in Tasmania?

- Very good
- good
- ok
- poor
- very poor
- UNSURE

The following questions relate to your thoughts around current and potential management of the sand flathead fishery in Tasmania.

21. In the last 12 months, how satisfied have you been with the number of sand flathead you caught on your fishing trip(s)? (IF YOU DIDN'T FISH FOR SAND FLATHEAD IN LAST 12 MONTHS YOU CAN LEAVE THIS BLANK)

- Very satisfied
- Quite satisfied
- Not very satisfied
- Not at all satisfied
- UNSURE
- Didn't fish

SURVEY OF RECREATIONAL FISHERS IN TASMANIA WITH A FOCUS ON SAND FLATHEAD

22. In the last 12 months, how satisfied have you been with the size of sand flathead you caught on your trip(s)? (IF YOU DIDN'T FISH FOR SAND FLATHEAD IN LAST 12 MONTHS YOU CAN LEAVE THIS BLANK)

- Very satisfied
- Quite satisfied
- Not very satisfied
- Not at all satisfied
- UNSURE
- Didn't fish

23. Do you think the current bag limit for sand flathead, which is 20 per person per day, is...

- Much too low
- A bit low
- About right
- A bit too high
- Much too high
- UNSURE

24. Do you think the current size limit for sand flathead, which is 32 cm in length, is...

- Much too big
- A bit too big
- About right
- A bit too small
- Much too small
- UNSURE

## SURVEY OF RECREATIONAL FISHERS IN TASMANIA WITH A FOCUS ON SAND FLATHEAD

The current best available scientific knowledge has indicated that the sand flathead stock in Tasmania is in a depleted state while tiger flathead are assessed as sustainable. To allow sand flathead stocks to recover, some rule changes for recreational fishers will be required. Again, you may be aware of this, but this is a reminder so all respondents have the same information.

Note in the scenarios in the following questions that in each case, the management of tiger flathead would remain unchanged at a bag limit of 20 fish, no boat limit, and a minimum legal size of 32 cm.

It is also likely that any new management regulations for sand flathead will be reviewed as the stocks improve.

As a reminder, current management of sand flathead includes a bag limit of 20 fish per day per fisher, there is no boat limit, and a minimum legal size of 32 cm.

These scenarios are designed as part of a research technique known as choice modeling. They may not necessarily reflect the management settings proposed by NRE Tasmania in the upcoming scalefish review.

25. The following are a range of possible rule changes that could help sand flathead stocks recover to sustainable levels. Please rate your support for each package of rules, from 1 to 10: 1 means you don't support it at all while 10 means you support it very strongly.

Halve the bag limit to 10 fish, introduce a boat limit of 20 fish and increase the minimum size limit to 35cm?

1    10

26. -

Reduce the bag limit to 5 fish, keep no boat limit, and increase the minimum size limit to 35cm?

1    10

27. -

an 18-month closure of the sand flathead fishery, then a bag limit of 10 fish, no boat limit and a minimum size limit of 35 cm?

1    10

28. -

Halve the bag limit to 10 fish, keep no Boat limit, and keep the minimum size limit of 32cm?

1    10

29. -

Reduce the bag limit to 5 fish on the southeast and mid-east coast and 10 fish everywhere else, introduce a boat limit of 15 fish statewide and maintain the minimum size limit of 32cm?

1 10

30. -

Halve the bag limit to 10 fish, maintain no boat limit, maintain the minimum size limit of 32cm, and introduce a maximum size limit of 40cm?

1 10

31. -

Reduce the bag limit to 5 fish, introduce a boat limit of 20 fish, maintain the minimum size limit of 32cm and introduce a maximum size limit of 38cm?

1 10

32. What do you think would be the best way to help rebuild the sand flathead fishery? It is ok to state you don't have an opinion, or you trust management and research to make the decision, etc.

33. As well as changing fishing rules for sand flathead, do you think that encouraging recreational fishers to voluntarily reduce their catches could make a big difference in the recovery of sand flathead stocks?

- Yes
- No
- UNSURE

34. How often do you use a de-hooker when flathead fishing?

- Always
- Most of the time
- Some of the time
- Never
- I don't know what a de-hooker is

35. How often do you use circle hooks when bait fishing for flathead?

- Always
- Most of the time
- Some of the time
- Never
- I do not bait fish for flathead
- I don't know what a circle hook is

36. Do you ever use sand flathead, as bait?

- Always
- Most of the time
- Some of the time
- Never

37. How important is fishing for sand flathead to you compared to fishing for other species?  
With 1 being least important and 10 being most important.

1 10

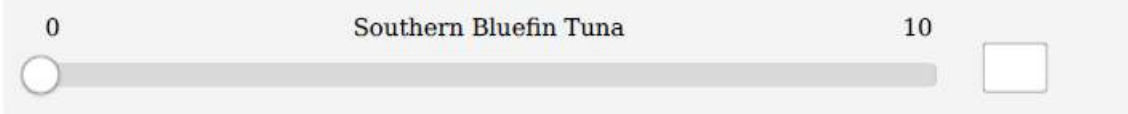
38. How strongly do you agree with the statement, "if I couldn't catch sand flathead I would go fishing less"? With 1 being I basically wouldn't go fishing and 10 being it would not change my fishing behaviour.

1 10

39. The next two questions might seem similar but are inherently different. The first is about species preferences for fishing for the experience of the fishing itself, the second is about species preferences for catching fish to eat.

For the following species please rate how important they are to your fishing experience to you from 1 to 10, where 1 is your least favourite fish to catch for the experience and 10 is your most favourite fish to catch. If you don't catch the fish species listed, that is fine, just click the slider on zero (0)

0 Southern Bluefin Tuna 10



40. -

0 Striped trumpeter 10



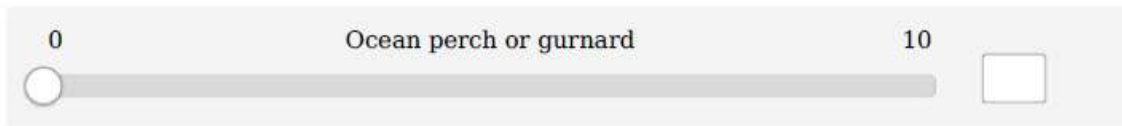
41. -

0 Blue-eye trevalla 10



SURVEY OF RECREATIONAL FISHERS IN TASMANIA WITH A FOCUS ON SAND FLATHEAD

42. -



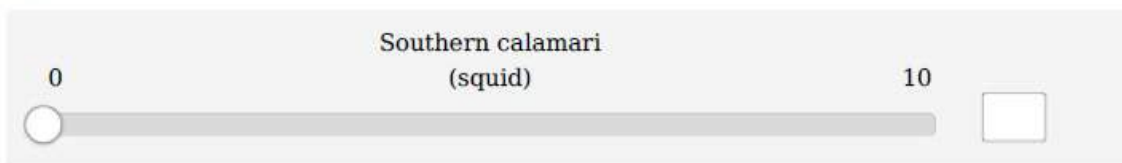
43. -



44. -



45. -



46. -



47. -



48. -



49. -



SURVEY OF RECREATIONAL FISHERS IN TASMANIA WITH A FOCUS ON SAND FLATHEAD

50. -

0 Trout or atlantic salmon 10

51. -

0 Yellowtail kingfish 10

52. -

0 Tiger flathead 10

53. -

0 Mullet 10

54. Are there any other fish that you catch that are important to your fishing experience? List them below and rank them as above from 1 to 10. If there are no other species just write 'NO' in the first box

Specify

Specify

Specify

55. For the following species please rate how important they are for you to catch and eat from 1 to 10, where 1 is your least favourite fish to catch for the experience and 10 is your most favourite fish to catch. If you don't catch the fish species listed, that is fine, just click the slider on zero (0)

0 Southern Bluefin Tuna 10

56. -

0 Striped trumpeter 10

SURVEY OF RECREATIONAL FISHERS IN TASMANIA WITH A FOCUS ON SAND FLATHEAD

57. -

0 **Blue-eye trevalla** 10



58. -

0 **Ocean perch or gurnard** 10



59. -

0 **Australian Salmon** 10



60. -

0 **Sand flathead** 10



61. -

0 **Southern calamari  
(squid)** 10



62. -

0 **Black Bream** 10



63. -

0 **Mackerel** 10



64. -

0 **King George Whiting** 10



SURVEY OF RECREATIONAL FISHERS IN TASMANIA WITH A FOCUS ON SAND FLATHEAD

65. -

0 **Snapper** 10

66. -

0 **Trout or atlantic salmon** 10

67. -

0 **Yellowtail kingfish** 10

68. -

0 **Tiger flathead** 10

69. -

0 **Mullet** 10

70. Are there any other fish that you catch that are important for you to catch and eat? List them below and rank them as above from 1 to 10. If there are no other species just write 'NO' in the first box

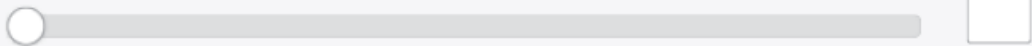
Specify

Specify

Specify

**71. Compared to your other hobbies, activities or sports, how important is fishing to you? With 1 being least important and 10 being most important.**

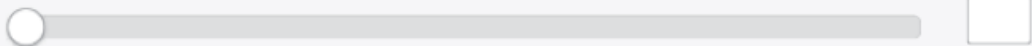
1 10



**72. The following lists a number of recreational fishing activities and reasons for doing them. Please rate how important each type is for you from 1 to 10 where 1 is the lowest level of importance and 10 is the most important to you. If you don't do the type of fishing in question, that is fine, just click the slider on zero (0)**

0 10

Gamefishing for tuna,  
billfish or pelagic shark  
for food



73. -

**Gamefishing for your personal enjoyment of the activity**

0 10

74. -

**Gamefishing to share catch or the experience with others**

0 10

75. -

**Gamefishing for a 'trophy' or memento (whether a competition trophy or a great photo)**

0 10

76. -

**Potting/ringing for rock lobster for food**

0 10

77. -

**Potting/ringing for your personal enjoyment of the activity**

0 10

78. -

**Potting/ringing to share catch or the experience with others**

0 10

SURVEY OF RECREATIONAL FISHERS IN TASMANIA WITH A FOCUS ON SAND FLATHEAD

79. -

Potting/ringing for a 'trophy' or memento (whether a competition trophy or a great photo)

0 10

80. -

Deepwater line fishing for food (e.g. striped trumpeter, trevalla, etc)

0 10

81. -

Deepwater line fishing for your personal enjoyment of the activity

0 10

82. -

Deepwater line fishing to share catch or the experience with others

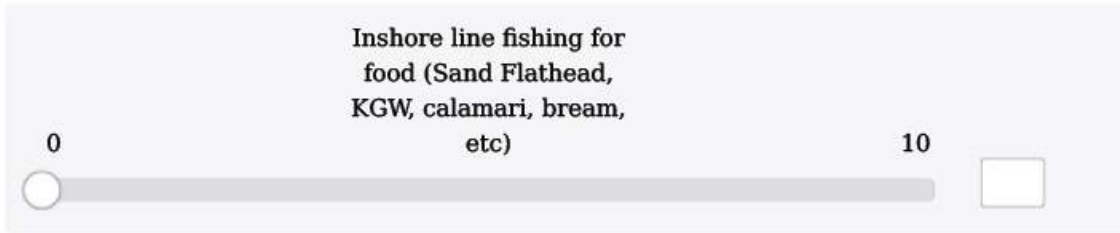
0 10

83. -

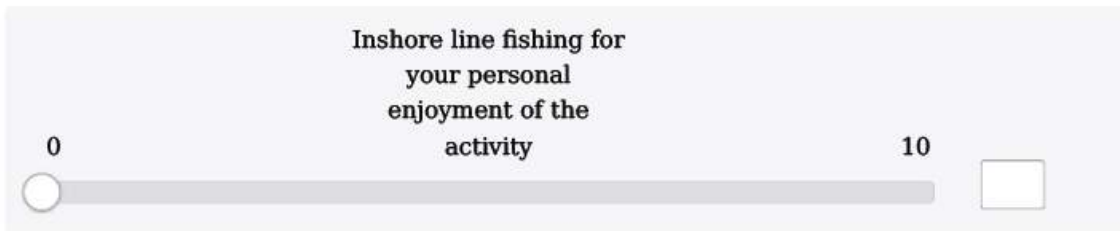
Deepwater line fishing for a 'trophy' or memento (whether a competition trophy or a great photo)

0 10

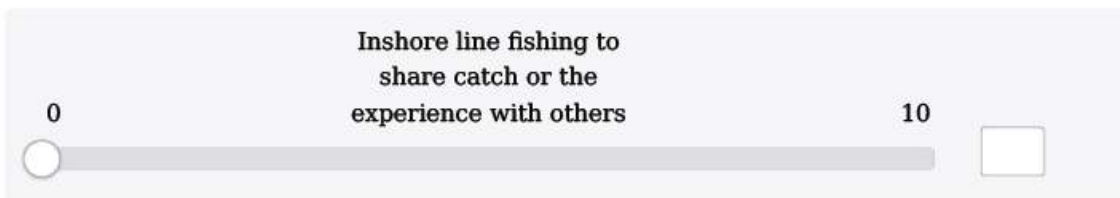
84. -



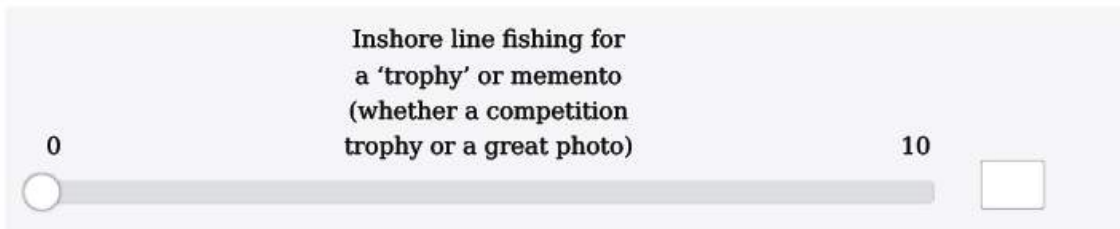
85. -



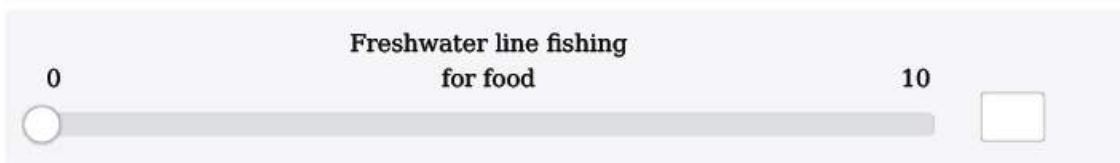
86. -



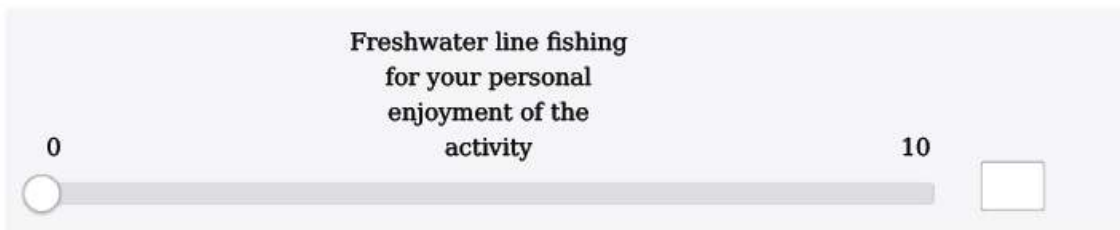
87. -



88. -



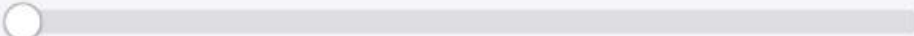
89. -



90. -

Freshwater line fishing to share fish or the experience with friends and family


0 10

A horizontal slider bar with a circular knob at the 0 position and a rectangular box at the 10 position. The bar is currently at 0.

91. -

Freshwater line fishing for a 'trophy' or memento (whether a competition trophy or a great photo)


0 10

A horizontal slider bar with a circular knob at the 0 position and a rectangular box at the 10 position. The bar is currently at 0.

92. -

Harvest diving for food (snorkel, SCUBA or SSBA) (abalone, rock lobster, scallops, spear fishing, etc)

0 10

A horizontal slider bar with a circular knob at the 0 position and a rectangular box at the 10 position. The bar is currently at 0.

93. -

Harvest diving for your personal enjoyment of the activity

0 10

A horizontal slider bar with a circular knob at the 0 position and a rectangular box at the 10 position. The bar is currently at 0.

94. -

Harvest diving to share catch or the experience with others

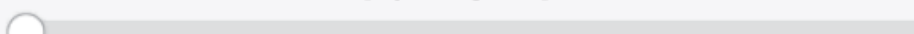
0 10

A horizontal slider bar with a circular knob at the 0 position and a rectangular box at the 10 position. The bar is currently at 0.

95. -

Harvest diving for a 'trophy' or memento (whether a competition trophy or a great photo)

0 10

A horizontal slider bar with a circular knob at the 0 position and a rectangular box at the 10 position. The bar is currently at 0.

96. Below are some common reasons why people go recreational fishing. Please respond to how important each reason is for you.

	Very important	Quite important	Not all that important	Not at all important	UNSURE
to relax or unwind	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
to be outdoors ... in the fresh air ... to enjoy nature	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
to be on your own ... to get away from people	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
to spend time with family	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
to spend time with other friends	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
to compete in fishing competitions	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
for the enjoyment or sport of catching fish	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
to catch fresh fish for food	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
to catch a trophy fish	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
to catch fish to share with friends and family	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

97. Which of these reasons would say is the main reason you go recreational fishing?

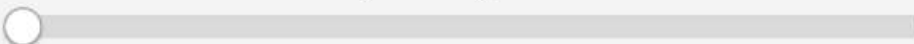
98. Below are some statements about recreational fishing for sand flathead. Please indicate how much you agree with each one.

	Strongly agree	Agree	Neutral	Disagree	Strongly disagree	UNSURE
A fishing trip can still be successful, even if no sand flathead are caught	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I'd rather catch one or two bigger sand flathead than ten smaller fish	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
If I thought I wouldn't catch any sand flathead on a trip, I wouldn't go fishing	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The more sand flathead I catch the happier I am	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

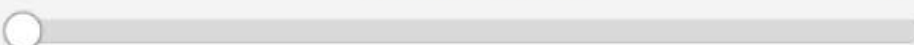
SURVEY OF RECREATIONAL FISHERS IN TASMANIA WITH A FOCUS ON SAND FLATHEAD

I'm just as happy if I don't keep the sand flathead I catch	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I prefer to fish for sand flathead where I know I may catch a very big one	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I would rather keep just enough sand flathead for a feed than take the bag limit	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I'm not satisfied unless I catch at least some sand flathead	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The bigger the sand flathead I catch the better the fishing trip	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I usually eat the sand flathead I catch	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A successful fishing trip is one in which many sand flathead are caught	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
'Bagging out' on sand flathead is the best indicator of a good fishing trip	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I want to keep all the legal sized sand flathead I catch	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I wouldn't go fishing as much if I couldn't catch sand flathead	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

99. The following are comments about human values. Some of these values might not seem related to fishing or a bit repetitive from previous questions but they help us understand why people like fishing and what they value about it. Please indicate how much each of these align with your own values, where 1 does not align with your values at all and 10 aligns extremely well with your values.

1	protecting the environment, preserving nature	10	<input type="checkbox"/>
<input type="radio"/>			

100. -

1	feeling close to nature when I am fishing	10	<input type="checkbox"/>
<input type="radio"/>			

SURVEY OF RECREATIONAL FISHERS IN TASMANIA WITH A FOCUS ON SAND FLATHEAD

101. -

collecting food from the environment

1 10

102. -

I like the visual beauty of nature

1 10

103. -

I like it when everyone on a fishing trip catches a fish

1 10

104. -

I care that my friends and family are having a good time on a fishing trip

1 10

105. -

I like it when everyone gets along on a fishing trip

1 10

106. -

I like to influence where my friends or family go fishing and what we target while fishing

1 10

SURVEY OF RECREATIONAL FISHERS IN TASMANIA WITH A FOCUS ON SAND FLATHEAD

107. -

I am competitive with  
my friends and family  
when I go fishing

1 10

108. -

I like to be the trip  
leader or the 'captain'  
on a fishing trip

1 10

109. The following are some potential situations which may reduce your ability to catch sand flathead resulting from either a depleted sand flathead stock or changes to management regulations. Please let us know how much of an impact each situation would have to your overall fishing experience in Tasmania.

	Low or no impact	Low to medium impact	Medium impact	Medium to high impact	High impact
Not being able to catch MANY <u>sand flathead</u> because of a <u>depleted stock</u>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Not being able to catch many BIG <u>sand flathead</u> because they have been <u>depleted</u> from the stock	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Not being able to KEEP many <u>sand flathead</u> because of low bag or boat limits	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Not being able to KEEP many <u>sand flathead</u> because of size limits	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

SURVEY OF RECREATIONAL FISHERS IN TASMANIA WITH A FOCUS ON SAND FLATHEAD

110. Now can you please rank the level of impact a further depleted sand flathead stock will have on the following?

	Low or no impact	Low to medium impact	Medium impact	Medium to high impact	High impact
Your personal fishing experience	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Your personal financial well-being	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The ecosystem and environment where you fish	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Your mental wellbeing	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The overall fishing experience for all Tasmanians	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The overall Tasmanian economy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The overall Tasmanian ecosystem and environment	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

111. This next question is to get your thoughts on what may be causing the depletion of the sand flathead stock in Tasmania. (IF YOU ARE REALLY UNSURE YOU CAN LEAVE THE QUESTION BLANK, BUT REMEMBER IS WHAT YOU THINK MIGHT BE CAUSING IT, RATHER THAN WHAT MAY ACTUALLY BE CAUSING THE DECLINE)

	Low or no impact	Low to medium impact	Medium impact	Medium to high impact	High impact
Climate change	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Marine farming operations	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Environmental factors other than climate change or marine farming operations	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Commercial fishing	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Recreational fishing	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Other (please specify) - Also note here if you don't think sand flathead are depleted

SURVEY OF RECREATIONAL FISHERS IN TASMANIA WITH A FOCUS ON SAND FLATHEAD

112. This question is about your thoughts on what is the most effective group or groups to communicate facts on fisheries science and regulations. On a sliding scale of 1 to 10, where 1 represents communication should be solely from the Government or an affiliated agency and 10 represents that communication should be solely from recreational fishing organisations (such as TARFish or other representative bodies) and where 5 indicates an equal contribution from both groups. Indicate on the sliding scale from 1 - 10 what you think would be the most effective contribution from each group to communicate facts on fisheries science and regulations.

A horizontal sliding scale interface. It consists of a light gray rectangular background. On the left side, the number '1' is positioned above a small white circle with a gray border. A horizontal gray line extends from this circle across the width of the box. On the right side, the number '10' is positioned above the line. To the right of the line, there is an empty square box with a gray border.

SURVEY OF RECREATIONAL FISHERS IN TASMANIA WITH A FOCUS ON SAND FLATHEAD

113. The following statements are about stewardship and compliance around recreational fishing. Please respond with whether you agree or disagree with the statement. You can also indicate whether you are neutral about a statement, or simply unsure.

	Strongly agree	Agree	Neutral	Disagree	Strongly disagree	UNSURE
Overall, I believe most recreational flathead fishers comply with fishing rules	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
There needs to be more compliance checks	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Current penalties for non-compliance of fisheries rules are adequate.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Data for managing a recreational fishery should be collected by the Government or a Govt affiliated research agency	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Data collected for managing a recreational fishery should be collected by a recreational fishing organisation	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Swift and appropriate management measures to ensure a fishery is managed sustainably is important for recreational fishers.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Overall, recreational fishers do the right thing to ensure that there are healthy fish stocks for future generations	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

114. How likely are you to remind or educate friends, family or other recreational fishers about recreational fishery rules with 1 being not at all likely to 10 being extremely likely.

1 10

115. Do you use social media to share your fishing experiences?

- Yes
- No
- I don't used social media

116. And of the following social media platforms which do you like to share your fishing experiences on ( CAN SELECT MULTIPLE)

	Yes	No	
FaceBook	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
YouTube	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Instagram	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
WhatsApp	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
TikTok	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Other (please specify)

117. Which is your favourite social media platform to share your experiences on

118. (And) lastly, is there anything else that we haven't covered that you would like to say to us about the sand flathead fishery or its management?

Once submitted it will not be possible to withdraw responses.

119. Would you like us to send you a summary of the results?

### Appendix 3 – Stock status relative to satisfaction regional correlation table

Table 3. Correlation between respondents' perception of the state of the Sand Flathead stock in Tasmania and satisfaction with their catch of Sand Flathead by number and fish size using Spearman's rank correlation coefficient ( $\rho$ ) for ordinal data. All correlations were significant at  $p < 0.005$ .

Region	$\rho$ (Catch Number)	$\rho$ (catch Size)
Total	0.66	0.63
northern East coast	0.70	0.57
West coast	0.65	0.65
eastern North coast	0.64	0.59
Great Oyster Bay	0.60	0.58
central East coast	0.73	0.57
D'Entrecasteaux Channel	0.66	0.57
Mercury Passage	0.60	0.67
Fredrick Henry/Norfolk Bay	0.62	0.59
Derwent Estuary	0.59	0.65
Tamar River	0.60	0.49
southeast coast	0.51	0.52
Tasman Peninsula	0.59	0.625
western North coast	0.75	0.66

Appendix 4 – Cluster diagnostic plots

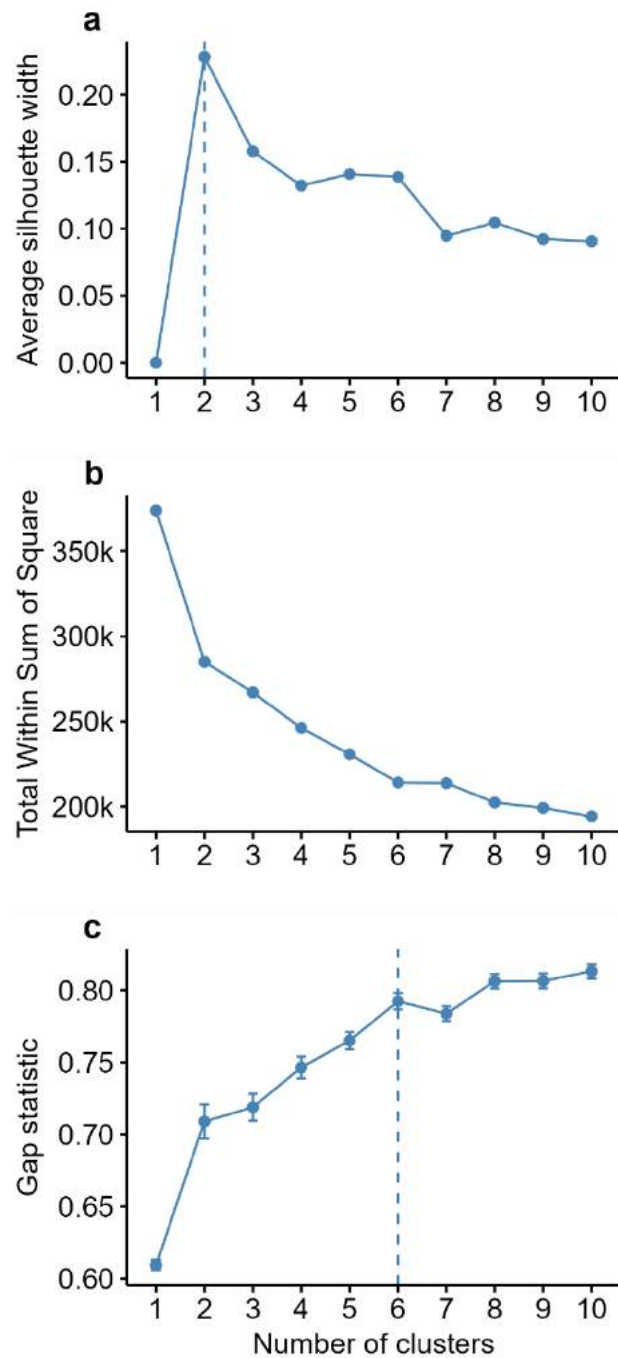


Figure 110. Diagnostic metrics for the fishing modality and value orientation-based profiling exercise (Partitioning Around Medoids [PAM] clustering of Q72–Q95 responses). Each metric indicates the number of clusters at which different aspects of the clustering is optimised (i.e., the best number of distinct profile groups to classify similar respondents by responses). Average Silhouette Width (a) indicates optimal cluster separation when maximised (dashed line). Within Sum of Square (b) indicates better compactness when minimised, i.e., the ‘elbow’ at five clusters indicates diminishing returns beyond this point. The Gap statistic (c) indicates goodness-of-fit, and the point at which additional clusters do not significantly improve fit is indicated by the dashed line. Respondents were divided into six fisher profiles based on the agreement between the latter two diagnostics (b, c). See section 3.7.2 for more details on clustering methods.

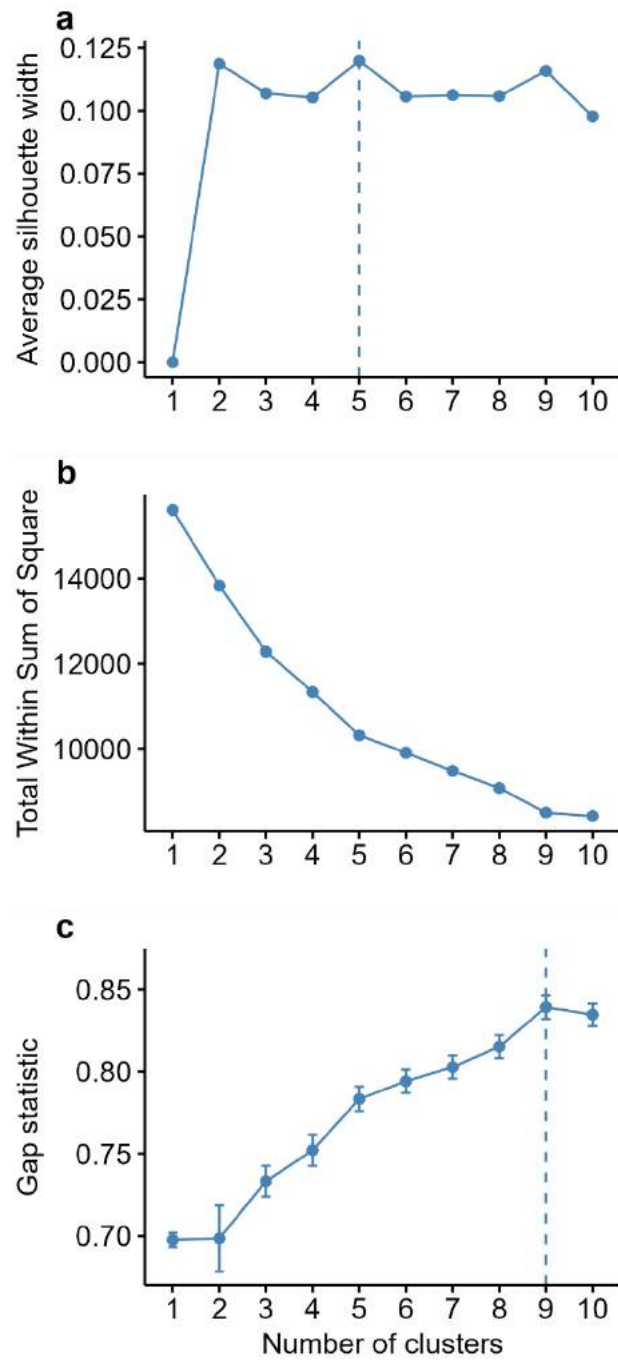


Figure 111. Diagnostic metrics for the Value Proposition-based profiling exercise (Partitioning Around Medoids [PAM] clustering of Q96 responses). Each metric indicates the number of clusters at which different aspects of the clustering is optimised (i.e., the best number of distinct profile groups to classify similar respondents by responses). Average Silhouette Width (a) indicates optimal cluster separation when maximised (dashed line). Within Sum of Square (b) indicates better compactness when minimised, i.e., the ‘elbow’ at five clusters indicates diminishing returns beyond this point. The Gap statistic (c) indicates goodness-of-fit, and the point at which additional clusters do not significantly improve fit is indicated by the dashed line. Respondents were divided into five Value Proposition profiles based on the agreement between the first two diagnostics (a, b), and the Gap statistic local maxima (c) at five clusters. See section 3.7.2 for more details on clustering methods.

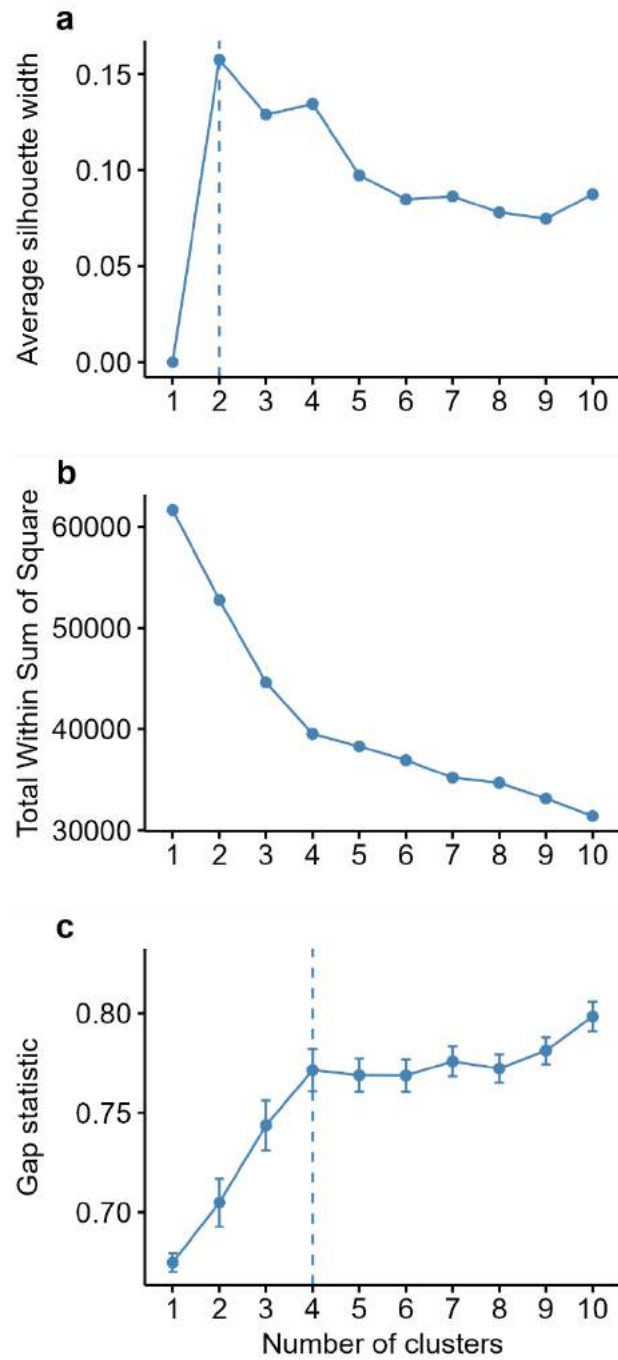


Figure 112. Diagnostic metrics for the Eudemonic-based profiling exercise (Partitioning Around Medoids [PAM] clustering of Q99–Q106 responses). Each metric indicates the number of clusters at which different aspects of the clustering is optimised (i.e., the best number of distinct profile groups to classify similar respondents by responses). Average Silhouette Width (a) indicates optimal cluster separation when maximised (dashed line). Within Sum of Square (b) indicates better compactness when minimised, i.e., the ‘elbow’ at four clusters indicates diminishing returns beyond this point. The Gap statistic (c) indicates goodness-of-fit, and the point at which additional clusters do not significantly improve fit is indicated by the dashed line. Respondents were divided into four Eudemonic profiles based on the agreement between the latter two diagnostics (b, c) along with the Average Silhouette Width local maxima at four clusters (a). See section 3.7.2 for more details on clustering methods.

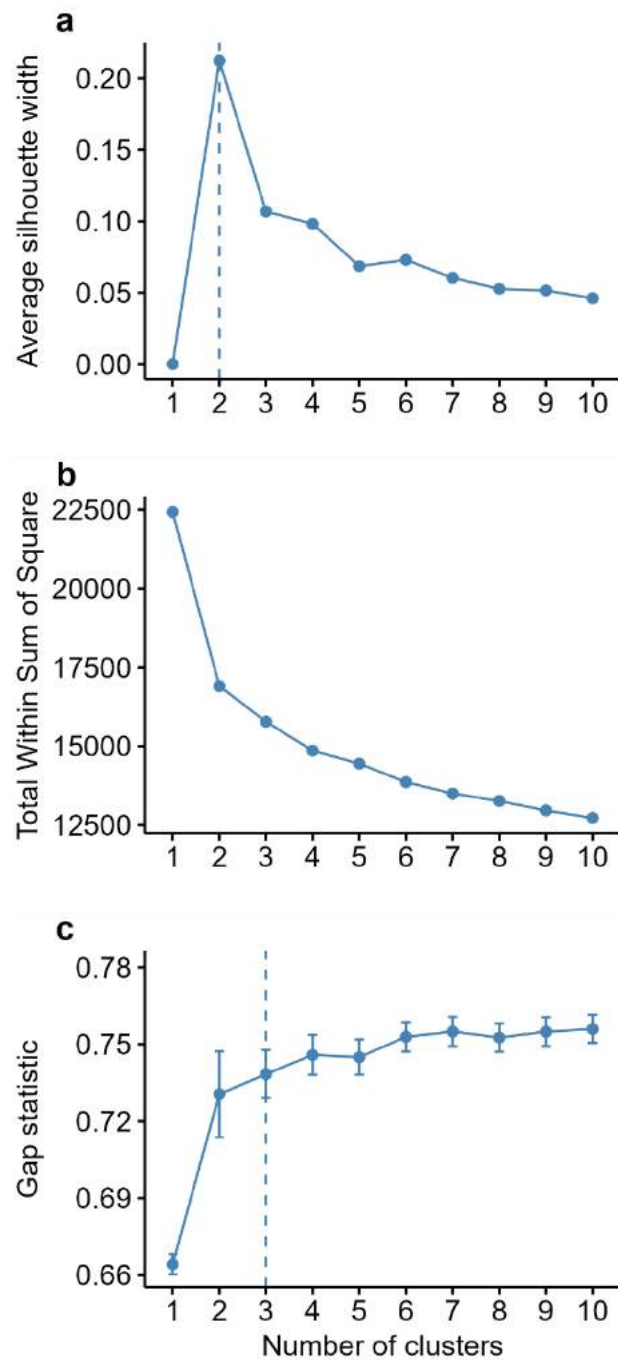


Figure 113. Diagnostic metrics for the Flathead fishing orientation (consumptive orientation-based) profiling exercise (Partitioning Around Medoids clustering of Q99–Q106 responses). Each metric indicates the number of clusters at which different aspects of the clustering is optimised (i.e., the best number of distinct profile groups to classify similar respondents by responses). Average Silhouette Width (a) indicates optimal cluster separation when maximised (dashed line). Within Sum of Square (b) indicates better compactness when minimised, i.e., the ‘elbow’ at two clusters indicates diminishing returns beyond this point. The Gap statistic (c) indicates goodness-of-fit, and the point at which additional clusters do not significantly improve fit is indicated by the dashed line. Respondents were divided into two Flathead fishing orientation groups based on the agreement between the first two diagnostics (a, b) along with the Gap statistic having nearly plateaued at this point (a). See section 3.7.2 for more details on clustering methods.

## Appendix 5 – Other feedback on the sand flathead fishery or fisheries management

Respondents were invited to provide further comments about the Sand Flathead fishery, including its management. A total of 1,266 responses were received. When coded, 24 themes were identified. (Table 3).

The three most prominent themes were perceived impacts on sand Flathead by the commercial fishery, the need for bag and size limits to reduce fishing pressure, and the need to improve compliance in the recreational fishery (Figure 64).

Table 4. Summary coding from 1,266 free-text responses to a question asking for any further comment on the Sand Flathead fishery or its management.

Response Code	Example comment
<b>Commercial fishing is responsible</b>	<i>“Less focus on recreational fishers. A lot of families do this for food and take only what they need .... remove all commercial fisheries for flathead. Seems to be a popular commodity that fisherman get a good price for pushing recreational fishers out further.”</i>
<b>Need to use bag limits and/or size limits to reduce fishing pressure</b>	<i>“Go hard on introducing small bag limits and a maximum size limit.”</i>
<b>There is a need to improve compliance amongst rec fishers</b>	<i>“Wharf fishing needs to be regulated and checked on more.”</i>
<b>Urgent need for action / government should have acted earlier</b>	<i>“There is a huge increase in the number of boats and the number of people fishing for SF. These boats are often full of people, not just 1 or 2 like in the past.”</i>
<b>Salmon farming is responsible</b>	<i>“Remove salmon farms from inshore waters, it’s a no brainer.”</i>
<b>More education programmes are needed</b>	<i>“Catching flathead is important but more education about the species and the way it is affected by overfishing is required.”</i>
<b>More area-specific management is needed</b>	<i>“Have spatial rules focusing on areas where sand flathead depleted.”</i>
<b>General need to 'improve' fishery management</b>	<i>“It needs to be managed better, at least a 6-month break, however stocks may not recover due to climate change.”</i>
<b>There is plenty of flathead / no issue</b>	<i>“I found current temps this year was colder than last in my spots. I just fished 6 weeks later and found heaps of flathead.”</i>
<b>Need for a fishery closure</b>	<i>“It needs to be managed better, at least a 6-month break, however stocks may not recover due to climate change.”</i>
<b>There is a need to reduce fishing pressure / effort</b>	<i>“I think the problem is so many people fishing for sand flathead now days.”</i>
<b>Need for better / more consultation</b>	<i>“The broader rec fishing community needs more consultation and information in real time rather than rolling out decisions after actions have been decided on.”</i>

<b>Need for a seasonal closure</b>	<i>"I would happily consider a closed season to protect spawning stock if research showed that this would have a positive increase in fish stocks."</i>
<b>I oppose any management which will reduce my fishing</b>	<i>"MY VIEWS ON DECREASED BAG LIMITS ETC REFLECT [THAT] ... IF WE DO GET ONTO A FEW I WOULD LIKE TO CATCH A FEED AND I OFTEN FISH ON MY OWN, SO A LIMIT OF 5 WOULD BE VERY ANNOYING."</i>
<b>General agreement that flathead is depleted</b>	<i>"Fishing for Sand Flathead is in real trouble !! - last few years has been the worst for fishing in Frederick Henry / Norfolk Bays in my lifetime (I am 74 years of age)."</i>
<b>Need for (more) transparency in management decisions</b>	<i>"Transparency and consultation with recreational fishers/ representative bodies is important in building a long-term sustainable fishery."</i>
<b>More research is needed</b>	<i>"More research as to the impact of freshwater runoff as the flathead dispersed [in] the last big rain event."</i>
<b>Other alternate solutions</b>	<i>"Is there some way of governing numbers of people out fishing to reduce the amount of fish taken rather than the other things?"</i>
<b>Alternate reasons for depletion</b>	<i>"It needs to be managed better, at least a 6-month break, however stocks may not recover due to climate change."</i>
<b>Other</b>	<i>"Fishing for me is about the family outing."</i>
<b>Seal populations are responsible</b>	<i>"Seals are everywhere, they are eating all fish stocks, they are eating gummy sharks in nurseries, eating all bottom dwelling fish, the real problem is the smelly horrible seals."</i>
<b>Thank you, general support expressed for measures that will 'save the flathead'</b>	<i>"Only "Thank you" for attempting to take some action in this space, albeit reactive."</i>
<b>Need to (increase) trust in the science, management</b>	<i>"IMAS acting independent of government is the best means of collecting data."</i>
<b>This survey is too long and, or complex</b>	<i>"Survey was too complex and long. Should consider future surveys in parts and simplified."</i>

SURVEY OF RECREATIONAL FISHERS IN TASMANIA WITH A FOCUS ON SAND FLATHEAD

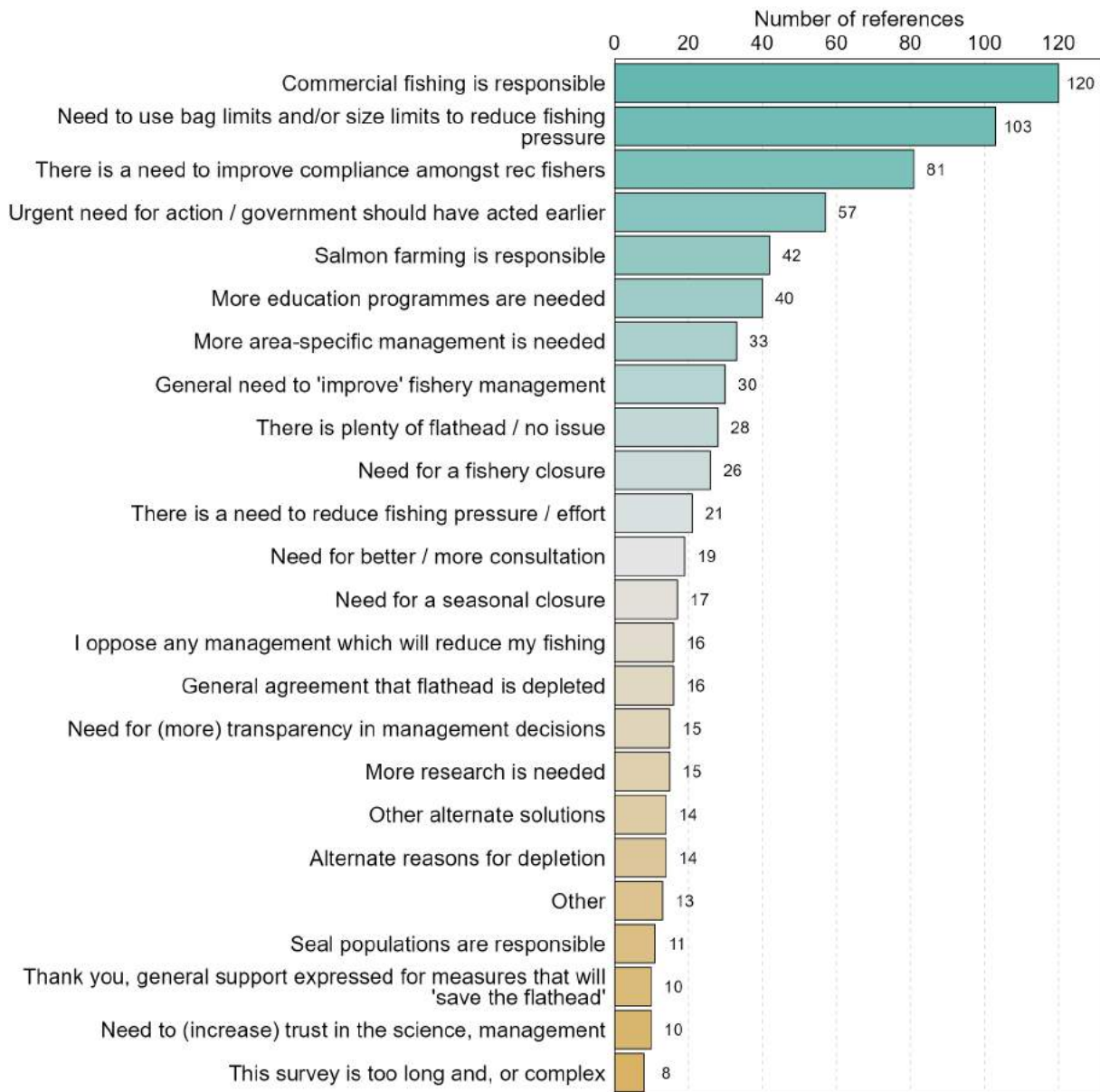


Figure 114: Frequency of respondents' perspectives on the most effective measures for rebuilding flathead stocks (responses to Q118 ("...lastly, is there anything else that we haven't covered that you would like to say to us about the sand flathead fishery or its management?") based on coding structure presented in Table 3.