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Abalone diver observation system

Diver survey data collection, analysis and reporting for improved management decision making in Australia's abalone fisheries

Mr. John Minehan

Dr. Duncan Worthington

Dr. Kirsten Abernethy

Mr. Craig Fox

Mr. Josh Cahill

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Researcher Contact Details
Name: John Minehan
Address: c/o ACV, PO Box 497, Rye, Victoria, 3941
Phone: 0409 580 782
Email: john@nautiluseafoods.com

FRDC Contact Details
Address: 25 Geils Court
Deakin ACT 2600
Phone: 02 6122 2100
Email: frdc@frdc.com.au
Web: www.frdc.com.au

In submitting this report, the researcher has agreed to FRDC publishing this material in its edited form.

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Executive Summary

This project was an industry-led and highly collaborative project to develop a rigorous and cost-effective electronic platform to gather abalone divers' observations of abalone stocks in situ that could be useful to inform the management of Australian abalone fisheries.

The importance of observations of abalone stocks by commercial divers as a complementary data source for stock assessment and decision making is recognised by industry, fisheries managers and scientists associated with abalone fisheries in Australia. By combining diver observations with other data from logbook catch and effort reporting, Vessel Monitoring Systems, measuring and depth loggers and underwater video from fishery-independent surveys, information available for stock assessment is greatly increased. Until now, daily observations by divers have not been collected formally or used during total allocated commercial catch (TACC) setting processes. The survey developed in this project, and the linking to related data, will improve the ability of divers and industry to contribute to the TACC setting process in each state fishery.

The Diver Observation (DiverObs) system is underpinned by a cloud-based web-application that delivers the survey to diver's mobile phones. The system was thoroughly designed and tested to capture essential data and be highly useable for divers. It allows diver observations to be collected after each dive and stored in a purpose-built linked database. The diver observations data can be linked and associated with other data sources used in stock assessments. Observations for each jurisdiction are then available to each Industry organisation for appropriate use. They are collated and summarised in automated reports for consideration during the season as well as at annual TACC setting workshops.

The two-year project, starting in 2020, was led by Abalone Council Victoria but collaborated across jurisdictions with representatives from industry organisations and other stakeholders in South Australia, Western Australia, and New South Wales, and consulted with stakeholders across Australia.

The new data set of daily diver observations of abalone stocks is now expanding rapidly across most of the fishery involved. Several approaches were explored to summarise and analyse the data set to produce key indicators of stocks. The project also considered how best the informative data from the survey could be used in fishery management and TAC setting, and how the survey data should be integrated with other linked data (e.g., survey, loggers, depth, catch, video). It was clear after consultation with stakeholders that there were a wide range of preferred approaches to the use of the survey data in fishery management. Some preferred production of a single indicator for direct use in formal Harvest Strategy, while others preferred to use the data more informally to advise discussion, and there was a strong opinion within much of Industry that the results should not be used to produce an indicator for use in deterministic fishery advice. Therefore, the project has delivered flexibility in how the data can be analysed and presented, including provision of raw data (subject to a privacy agreement), allowing each jurisdiction to determine how the data is used.

The DiverObs system, including cloud site, web application and linked database establishes an opportunity for the abalone industry to build a national approach to the delivery of Diver Observation data, and other linked key fishery data, through a series of dashboards. These digital assets can easily be extended to other projects, such as industry communication, occupational health, and safety, tracking product from reef to market, commercial transactions, fishing efficiency and profitability.

Looking ahead, the DiverObs system has enabled the abalone industry to commence a digital journey that can provide better and more cost-efficient outcomes that lets industry take greater control of its future.

Background

The value of observation by divers cannot be underestimated for abalone management, as divers witness the state of the resource and variation at a fine scale and through time. Feedback from commercial abalone divers on stock levels, habitat and other factors that affect fishing activity are widely used to provide context to scientific data during stock assessment and management decision making. The predominate method for obtaining this feedback is through direct representation by divers at stock assessment workshops where diver observations are included in the multiple lines of evidence approach, alongside catch per unit effort, independent surveys of abundance and size, and industry collected data (e.g., geolocated abalone size and depth).

However, industry identified three key issues with direct representation at annual TACC workshops:

1. Only divers present at the meeting have an opportunity to contribute
2. There may be disincentives to be honest with peers and employers also in the room
3. Recall may be inaccurate with time passed

Building on previous work by Abalone Council Victoria from 2017 to 2019, this project sought to develop a diver observation system suitable for all interested abalone jurisdictions across Australia. The result is a cost-effective electronic platform that provides greater opportunity for obtaining divers feedback anonymously and throughout the fishing season to better inform management decision making.

Objectives of the project

1. Collaborate with industry in each jurisdiction to develop customised surveys for the Diver Observation System
2. Collect, analyse, and report diver observation data using an electronic system
3. Validate Diver Observation data against GPS logger data (where available)
4. Develop a business model for the continuation of the Diver Observation System beyond the life of the project

Methodology

- **Collaboration**: At the heart of this project has been collaboration. The project was guided by a Steering Committee including industry representatives from each jurisdiction (Victoria, NSW, South Australia, and Western Australia) involved in the project. The project was highly iterative with several rounds of consultation at key stages of the Diver Observations System design. The project team extensively consulted with abalone divers, executive officers of abalone associations, government fisheries managers and scientists, independent and university abalone scientists and social scientists. Topics of consultation included purpose of the Diver Observation System, jurisdictional needs, data needs, survey questions, question wording, usability of the platform, data presentation, reporting, improving uptake of the System, data storage and privacy.

- **Survey development**: Interviews were conducted with divers, executive officers of abalone associations, fishery managers and scientists to understand the data requirements, analysis and reporting, the role of the survey in management, and diver participation. The survey was then drafted, reviewed, and finalised with the following six key considerations:
    1. Length of survey: needed to be short so that it wasn't onerous for divers to complete voluntarily
    2. Diver interpretation of questions and response set
    3. Types of data to collect. Only asks questions that collect data to complement key indicators (e.g., biomass), data that could provide additional important information not collected by other data sources (e.g., habitat change), data that could explain variations in other data sources (e.g., catch rates affected by environmental conditions)
    4. Appropriateness of each question to each jurisdiction
    5. Justification of each question was clear
    6. Confidentiality of diver data and data management

- **DiverObs System development**: Customised software was developed in collaboration with SL Digital. There were three elements to developing the system:
    1. Build the Diver Observation Survey Application (DiverObs App) - a progressive web application to be accessed by the divers and used to record their observations. It was designed to give a mobile-optimised experience with a focus on ease of use.
    2. Diver Observation System Administration console (Admin console)- a web application to access, tabulate, filter and report on the data recorded by the divers
    3. NodeJS Back End & Database – a NodeJS application, running on an Amazon Web Services EC2 instance, is responsible for the reading and writing of data to the database Data is stored in an AWS Relational Database Service (RDS) running *MySQL Server* database.

- **Industry piloting and launch:** With the DiverObs App finalised, it was pilot tested for a three-week period in February 2021 to ensure usability and amendments were made. The DiverObs App was then launched to participating industry jurisdictions on March 1st, 2021. Several methods were used to extend the DiverObs App to potential users (i.e., divers, owners, other stakeholders, Researchers, Managers) for trial use, and to encourage participation in the Survey. Perhaps most importantly, the engagement of, and support provided to our project by the abalone industry association executive officers, was essential in extending project outcomes and achieving good uptake of the survey.

- **Data analysis and presentation:** The initial priority was to develop approaches to the summary and display of data for use in TACC setting workshops. However, the project has also been able to automate monthly summary reports for each fishery which are made available to the executive officer from each fishery through the Admin console. Statistical standardisation approaches have been developed to standardise responses, particularly among divers, and will be developed further as more data is available. It is also possible to link the Diver Observations database, with other fishery data including catch and effort logbook data, Vessel Monitoring System (VMS) data, measuring and depth logger data, and geo-tagged underwater video, using the date and each diver's identification number recorded with all data sources.

The linking of these different datasets has two key benefits:

1. It enables validation of the DiverObs survey data
2. It enables greater spatial detail and related information about each fishing day

Key outputs from the project

1. DiverObs Application
2. DiverObs Administration Console
3. DiverObs Database
4. DiverObs user guides for industry (divers and executive officers)

Implications for relevant stakeholders

The outcomes of this project have already had positive impacts for industry, management agencies and the health of the resource. Further development of the DiverObs system will only grow these impacts.

The DiverObs system:

1. Provides divers with a more formal way to provide information and have a voice about the state of the resource, which can be used as important input into fishery assessments and annual quota setting workshops
2. Allows the diver observations to be validated against and compared to other data sources (e.g., logbook catch and effort data)
3. Can improve interpretation of existing fishery assessment data sets, through directly linking indicators from the same diver data, adding value to existing information used in fishery assessments
4. Helps to encourage diver understanding and engagement in stock assessments as well as developing stewardship through building divers' confidence in the stock assessment and the TACC setting process, reducing risk of over exploitation, and increasing potential long-term benefits of more productive and sustainable abalone fisheries

Key recommendations

1. Diver Observation data must be held securely by an entity related to the abalone industry, such as a representative body, and managed in accordance with the Privacy Act 1988. Summarised and aggregated anonymous results should be shared among stakeholders to progress conservative decisions about the management of the resource.
2. Diver Observation System ownership and administration to remain with the Abalone Council of Victoria given the existing data privacy agreements and institutional knowledge developed through the project
3. Data access is provided to participating jurisdictions through the Admin console subject to signed Data Sharing Agreements
4. Minimum funding of ongoing hosting, maintenance and support, system administration, and diver incentive scheme (estimated $5,700 per annum, business model provided) be supported
5. Further investment should be considered to improve and extend the system, including:
    - Increase diver participation in existing jurisdictions through technology solutions, case study documentation and presentation, and local incentives
    - Improving quality of observations through diver training

- Improve the spatial specificity of diver observations (e.g., through time stamping or training)
- Including additional jurisdictions through demonstration of use and benefit of the DiverObs system
- Refine the survey to capture additional observations relevant to particular jurisdictions
- Increase functionality of DiverObs App and delivering summary data through dashboards back to users
- Consider the appropriateness of similar systems to be developed for use in data poor small-scale fisheries

6. A national approach to delivery of results from the Diver Observation survey, and other key fishery indicators, could be developed in a subsequent project through a series of dashboards linked to the cloud databases, enabling, and encouraging standardised use of the data.

Keywords

Abalone, Data collection, Diver observations, Stock assessment, Digital web application, Cost-efficient

1. Introduction

1.1. Background

The Victorian Abalone Industry and Victorian Fisheries Authority (VFA) have been aware of the importance of observations of abalone stocks by commercial divers and have been incorporating these into Total Allowable Commercial Catch (TACC) setting workshops and decisions for years. The importance of observations is, in part, due to both the unique observations possible by divers observing abalone populations, and the inadequacies of traditional fishery performance indicators based on logbook catch rates and fishery independent surveys located in areas not frequently used by the fishery. Alongside diver observations, the Victorian industry independently has also developed new methods for data collection including GPS-enabled loggers that collect validated and geo-referenced data on abalone caught (number, size) and diver effort (time, distance, depth). Over the past 20 years, the Victorian industry and VFA have also developed a TACC setting workshop approach with divers and licence owners to review and interpret all available data, and to encourage use of the data to develop stewardship and determine more conservative and sustainable decisions and outcomes supported by stakeholders. Collection and interpretation of data to develop understanding and stewardship, and its use in conservative decision making by stakeholders, is now being extended and developed through most of Australia's abalone fisheries.

During industry and VFA discussions about the Victorian Abalone Harvest Strategy, the importance of diver observations as a complementary data source to assess the state of the abalone stock, was recognised as a high priority by industry and the VFA. As a result, the Victorian abalone industry took the lead role in developing a survey of observations by divers using an electronic capture and reporting system. Through an in-depth consultation process with fisheries managers, scientists, industry representatives and divers, a survey and prototype system to capture, analyse and report diver observations from a mobile device was developed and trialled (for 12 months) in Victoria in 2018. The Victorian Diver Observation System enabled divers to use their mobile phone to report observations on stock abundance, catch rates and habitat changes.

The survey was promoted to the diver user groups by the Executive Officer of each of the Victorian management zones (Eastern, Central and Western). A Diver Observations report was presented at each of the zonal Total Allowable Commercial Catch (TACC) setting workshops in 2018/19. During the trial period, it became evident that there was interest in further developing the Victorian Diver Observations System and to include other Australian abalone jurisdictions. Through consultation with the Abalone Council Australia (ACA), it appeared that other jurisdictions are also grappling with the same problem of a timely and cost-effective method of collecting and reporting diver observation information. As such, the proposal for this project was developed.

1.2. Need

Feedback from commercial abalone divers on stock levels, habitat and other factors that affect fishing activity are widely used to provide context to scientific data during stock assessment and management decision making. The predominate method for obtaining this feedback is through direct representation by divers at stock assessment workshops. Diver observations are included in

the multiple lines of evidence approach, alongside catch per unit effort, independent surveys of abundance and size, and industry collected data (e.g., geolocated abalone size and depth). These data sources are used for setting the annual TACC as detailed in the Victorian Wild Harvest Abalone Fishery Management Plan. The value of observation by divers cannot be underestimated for abalone management, as divers witness the state of the resource at a fine scale and changes over time.

However, there are three key issues with the approach of in person diver observations at the annual TACC workshops:

1. Only divers present at the meeting have an opportunity to contribute
2. There may be disincentives to be honest with peers and employers also in the room
3. Recall may be inaccurate with time passed

Initial consultations prior to submitting the application for this project revealed that government, fishery management agencies and industry groups in other jurisdictions were interested to develop a diver observation survey on a cost-effective electronic data capture platform that provided greater opportunity for obtaining all divers feedback anonymously and throughout the fishing season to better inform management decision making.

2. Objectives

The objectives of the project were to:

1. Collaborate with industry in each jurisdiction to develop customised surveys for the Diver Observation System
2. Collect, analyse, and report diver observation data using an electronic system
3. Validate Diver Observation data against GPS logger data (where available)
4. Develop a business model for the continuation of the Diver Observation System beyond the life of the project

3. Methods

The purpose of the Diver Observation System was:

1. To support TACC setting workshop discussions
2. To only collect data that would be relevant to stock assessment discussions
3. To be quick and simple for divers to use and to record observations soon after diving
4. To compliment and confirm other data sources (e.g., catch and effort data, fisheries independent biomass surveys, location data) and understand where and why there may be discrepancies

This project aimed to develop a Diver Observation System (the System) on an electronic platform that was suitable for each participating jurisdiction. To do this effectively, the 2018 Victorian trial observation system was reviewed to determine learnings and improvements. Given those multiple jurisdictions were interested in using the System (see Table 1); that each jurisdiction differs in data collected for stock assessment; that divers from different jurisdictions differ in the way they work due to species compositions, biomass, locations, and habitat; and that the need and use for the System would differ, it was important to collaborate closely with each jurisdiction to ensure the product would be appropriate for all. At the heart of this project has been collaboration and consultation with industry, scientists, and fisheries agencies throughout the project. It was also important that, while ensuring the observation survey questions were relevant, the design could be implemented on mobile phones and the data could be extracted and analysed independently alongside stock assessment data sources.

This section outlines the methods for each element of the project, from the development of the Diver Observation System to ensuring the use of the System is extended beyond the project with a recommended and clear business model.

Table 1. Project Participating Jurisdictions

Participating Jurisdictions*
Victoria Eastern Zone
Victoria Central Zone
Victoria Western Zone
New South Wales
Western Australia Area 3
South Australia Central Zone†
South Australia Western Zone†
South Australia Southern Zone†

** Note: all abalone jurisdictions were invited to participate*

† Note: The three South Australian jurisdictions were added during the consultation period

3.1. Collaboration

At the outset a Steering Committee was formed and included industry representatives from each jurisdiction (Victoria, NSW, South Australia, and Western Australia) involved in the project (Table 1). All abalone jurisdictions were invited to participate in the project. The original project plan envisioned face-to-face consultation and port visits. However, given the COVID-19 pandemic, all collaboration was via teleconference and telephone. Five formal Steering Committee meetings were held, as well as multiple phone exchanges with industry members, and regular discussions at ACV Board meetings.

The project was highly iterative with several rounds of consultation at key stages of the System design. The project team extensively consulted with abalone divers, executive officers of abalone associations, government fisheries managers and scientists, independent and university abalone scientists and social scientists. Topics of consultation included purpose of the Diver Observation System, jurisdictional needs, data needs, survey questions, question wording, usability of the platform, data presentation, reporting, improving uptake of the System, data storage and privacy.

There was also extensive collaboration with SL digital who designed the platform, as changes were made throughout the testing process to ensure usability.

3.2. Survey development

3.2.1. Review of 2018 Victorian survey

The 2018 Victorian diver observation survey was reviewed by divers, executive officers of abalone associations, fishery managers and scientists. Twenty-two in depth interviews were conducted in May and June 2020. Interviewees were provided with a copy of the original Victorian survey questions prior to the interview. Interview topics included: investigating diver participation, the types and methods of data collected, analysis and reporting of results of the survey, and the role of the survey in management decision-making. See Appendix 1 for interview template questions. For details on all interviewees, see Table 2.

Table 2. Interviewee details by jurisdiction

Jurisdiction	Interviewee details
Victoria	Divers: 8 Industry Association Executive Officers: 3 Fisheries managers: 1
WA	Executive Officer: 1
NSW	Divers: 3 Executive Officer: 1
SA	Executive Officer: 2
All	Abalone scientists: 3

Interviews were recorded using notes and all interview responses were entered into excel, where responses were then summarised for each question. Four key themes from the responses were then

determined (see below). Specific needs of different jurisdictions were also taken into consideration. The detailed findings of the interviews can be found in Appendix 2.

1. Investigating diver participation
    - When divers complete the survey
    - How long the survey takes
    - Why divers are participating in the survey
    - Why divers are not participating in the survey
    - How training may encourage divers to participate
    - What would work to get more divers participating
2. The types and methods of data collected
    - What types of data need to be collected
    - How to capture long term trends
    - Factors affecting catch rates
    - Types of habitat and reef changes divers may observe
    - Suggested changes to questions in Victorian 2018 survey
    - Question structure
    - Standardisation of data
3. Analysis and reporting of results of the survey
    - How to report the results
    - Confidentiality
4. The role of the survey in management decision-making
    - TACC setting process
    - Harvest strategies

3.2.2. Development of the Diver Observation System survey

Following the analysis of the interview data, a draft set of survey questions were developed. The survey questions required the following considerations:

1. Length of survey: needed to be short so that it wasn't onerous for divers to complete voluntarily
2. Diver interpretation of questions and response set
3. Types of data to collect. Only asks questions that collect data to compliment key indicators (e.g., biomass), data that could provide additional important information not collected by other data sources (e.g., habitat change), data that could explain variations in other data sources (e.g., catch rates affected by environmental conditions)
4. Appropriateness of each question to each jurisdiction
5. Justification of each question was clear

Over a four-month period, the survey questions were refined using an iterative approach. There were several rounds of consultation with divers, industry association representatives, abalone scientists, fishery managers, social scientists. The final set of survey questions (and justifications) are available in Appendix 3.

In parallel, SL digital designed a trial version of the mobile application so that consultations included refining the useability of the platform (see Platform development section below).

3.2.3. Privacy and data release agreement

A key consideration in the development of the Diver Observation System was confidentiality of diver data and how the data collected would be managed. For divers to use the System, it was important to ensure that divers were comfortable that their data would be kept anonymous and only used for the purposes intended.

The platform requires divers to read and accept the Data Collection Notice before proceeding with recording observations. It explains that the diver is required to provide personal information as part of the survey, explains that it (and the data collected) will be used anonymously to aid in fishery assessments. Personal information might be used for secondary purposes including monitoring coverage, encouraging participation and engagement with the platform, undertaking technical improvements to the platform, and complying with our regulatory and other legal obligations. It informs the diver that while personal information will be held privately by the Abalone Council of Victoria under their Privacy Policy, it will be accessed by a database manager, contracted service providers, and to the abalone industry organisation representing the fishery in which the diver operates, subject to the organisation signing a Data Release Agreement. The Data Release Agreement requires the abalone industry organisation to hold diver's data privately but allows the release of anonymised reports to third parties for use in fishery assessment. Abalone industry organisations will also be required to seek permission from the diver for any further use of the data.

See Appendix 4 for the Data Collection Notice, Abalone Council of Victoria (ACV) Privacy Policy and the Data Release Agreement.

3.3. Diver Observation System development

During the review of the 2018 Victorian survey electronic platform, it was determined that to deliver on the project objectives, enable use by multiple jurisdictions, improve the user experience, and improve data security and access, it would be necessary and cost effective in the long term to develop customised Diver Observation System software. The development of new custom software was outside the scope of the project proposed to FRDC and ACA. ACV contributed in kind to this project to enable the budget to include building the platform now in use.

A Software Requirements Specification was developed in consultation with IT Howto (Sara Selvarju) (See Appendix 5). Three market quotes were obtained, and interviews held with IT providers. SL Digital was selected as the provider to:

1. Build the Diver Observation App - a progressive web application (PWA) to be accessed by the divers and used to record their observations. It was designed to give a mobile-optimised experience with a focus on ease of use
2. Diver Observation Admin console - a web application to access, tabulate, filter and report on the data recorded by the divers

3. NodeJS Back End & Database - a NodeJS application, running on an Amazon Web Services (AWS) EC2 instance. It is responsible for the reading and writing of data to the database. Data is stored in an AWS Relational Database Service (RDS) running *MySQL Server* database.

3.3.1. Building the Diver Observation App

The Diver Observation App is a progressive web application (PWA) written in React (JavaScript library for building user interfaces). User's "bookmark" the app to their mobile phone home screen and have a near-native experience. The app functions in both offline and online modes. If the user does not have a mobile data connection at the time they complete the survey, the data are stored securely on the device until connectivity is restored. At that time the data are transmitted to the server. Considerable care was given to the user experience (UX) to maximise diver completion rates close to the point of catch bearing in mind also, that the divers at times use the app in less-than-ideal circumstances.

Here is listed the functionality included in Diver Observation App. Note several the functions were additional to those in the original requirement specifications (marked with a **+**):

- The ability to enter survey responses both from mobile devices such as phones or tablets (e.g., when on the water), and from desktop devices
- Mobile first design
- A system that makes survey responses easy to do on a mobile device increases the chances that abalone observations will be made closer to the point/time of catch
    - Minimising the number of clicks/touches
    - Pre-populating fields and dropdowns depending on diver's fishery, including species, Spatial Management Units (SMUs), and Reef Codes
    - Maximising the readability of the survey (making best use of screen real estate)
    - Colour contrasts on survey page (allowing for usage in full sunlight)
- Online and offline support (allowing for usage where mobile/Wi-Fi coverage does not exist)
- A progressive web app (allowing users to bookmark the survey app on their mobile phones)
- Input validation to ensure data integrity (e.g., not being able to enter a survey response for a date in the future)
- Survey timestamping
- Completion duration logging
- Geo-location tagging
- Maximum of 2000 milliseconds to open survey on a mobile device
- Maximum of 1000 milliseconds to submit survey once completed – in both online and offline mode
- **+** Flexible survey design allowing survey questions to be based on the fishery selected. This was a critical design solution that allowed a sub-set of questions that catered for the differences in fishing effort between jurisdictions. This level of customisation will assist the app accommodating the remaining jurisdictions to come on board for minimal additional development costs
- **+** On screen prompts to guide user to 'Add to home screen' upon first access

- **+** Automated version updates without requiring any input from the user
- **+** Data Collection Notice acceptance landing screen upon first access
- **+** In-app guidance and navigation prompts
- **+** Help menu providing access to about information, support contact numbers, question guidance, privacy policy and settings
- **+** Utilise device security to validate user access and identification. This allowed a (SMS) link to be sent to diver's phones to roll-out the app, rather than having to issue individual log-in and password details

See Appendix 9 to see the DiverObs App format.

3.3.2. Diver Observation Admin console

Diver Observation Admin Console is a React application, and its functions are listed below. Note several functions were additional to those in the original requirement specifications (Marked with a **+**):

- Viewing, filtering, sorting, and exporting of data in a CSV format
- **+** Permission and password-controlled access for nominated representatives of abalone industry organisations
- **+** Data Release Agreement that requires acceptance prior to accessing data
- **+** System administrator access to database, device tables and audit logs
- **+** Help menu including contact support, question guidance, survey questions and ACV privacy policy
- **+** Automated summary reports prepared using Rmarkdown for viewing and printing in html and PDF format. The summary report includes graphs of observations on stock abundance, catch rates, opinions, and impacts on fishing at both SMU and reef level. Diver comments are compiled and listed at the reef level

The Diver Observations Admin Console prototype was developed by SLDigital in July 2021. Following several rounds of consultation and testing with members of the project steering committee the final version was released on 27th September 2021. A demonstration of the Admin console was provided to executive officers of all participating jurisdictions at a project meeting on 13th October 2021. See Appendix 6 for the Admin console.

3.3.3. NodeJS Back End & Database

The system is cloud-based running on Amazon Web Services (AWS). AWS has several advantages including:

- Appropriate information security compliance
- Government approved
- Cost effective for small to large systems
- Appropriate provisions for disaster recovery and the backup of stored data:

    - Database:
        - Automated backups (rolling 7-day snapshots)
        - Manual monthly backups to encrypted AWS S3 storage (6-month retention)
    - EC2 instances:
        - Software is version controlled (git) and is stored in AWS CodeCommit
        - Manual monthly "image" creation of the production instance (3 months retention)
- Protection of any personally identifiable information (PII), with provision for the notification of notifiable data breaches:
    - An eligible data breach arises when the following three criteria are satisfied:
        - there is unauthorised access to or unauthorised disclosure of personal information, or a loss of personal information, that an entity holds
        - this is likely to result in serious harm to one or more individuals
        - the entity has not been able to prevent the likely risk of serious harm with remedial action

https://www.oaic.gov.au/privacy/guidance-and-advice/data-breach-preparation-and-response/part-4-notifiable-data-breach-ndb-scheme#identifying-eligible-data-breaches

    - To reduce harm, the minimum amount of data is collected by the app:
        - Age at time of installing the app (instead of date of birth)
        - No phone numbers or email address are collected
    - The only PII collected is:
        - first name, family name, approximate year of birth, and PFN
    - Access to data is restricted:
        - Only the software developer has access to the AWS RDS instance
        - Only the system administrator has read-only access to the raw data tables via an RStudio Server
        - Only two admin users have access to non-anonymised data
        - All other users can only view anonymised data
    - In the event of a notifiable data breach, affected users can be notified via the Abalone Council Victoria or the relevant jurisdictional abalone industry body

- Identity and access management for all users and the provision of role-based access control
- Ability to store metadata from responses including the time and location of the survey completion (if provided by the user's device), time of upload of data (in the case of offline usage) and time spent completing the survey by the user

A schematic of the database can be viewed in Appendix 7.

3.4. Industry pilot test and launch

With the DiverObs App finalised, it was pilot tested for a three-week period in February 2021 to ensure usability and amendments were made. The DiverObs App was then launched to participating industry jurisdictions on March 1st, 2021.

In June 2021 a project meeting was held with all participating industry association executive officers, reviewing feedback from the first three months of use, which confirmed the useability and suitability of the DiverObs App.

A technical review of the Diver Observation System was completed in June 2021 (See Appendix 8). The review confirmed that the Software Requirements Specification had been met by the I.T. developer, SL Digital. An analysis of the survey meta-data showed 64% of surveys completed within 24hrs of the dive event, 90% surveys completed within four days, 86% of surveys are completed in under 5 minutes and the most popular time of the day to complete a survey is 18.00 hrs.

3.4.1. Methods to encourage participation

DiverObs App design

The design of the DiverObs App was critical to ensure a positive user experience and voluntary uptake. Features such as easy access, in-app guidance, help menus, intuitive navigation, the clever use of graphics and quick to complete, assisted in obtaining and retaining diver participation.

Executive Officers of Industry Associations

The most effective method to encourage participation was to utilise the existing trust, knowledge, understanding and relationships between executive officers and divers in their own jurisdictions.

At the launch of the DiverObs App, a user guide was provided to each jurisdiction's industry association executive officer. This guide is suitable for use in group presentations or to email directly to divers. The user guide outlines the purpose of the DiverObs App, how to install the App, outlines the privacy policy, how to set up personal information, how to complete the survey, and how to submit observations (See Appendix 9).

A Data Collection Trial Plan was also provided to executive officers (See Appendix 10). This plan provided further information about what to expect during the trial period, suggestions on how to encourage participation and how to get further assistance.

A link to the DiverObs App was sent via SMS to diver's mobile phones by their industry association executive officer. This enabled divers to access the app for the first time by simple one touch operation. Upon first access the DiverObs App provides on screen prompts to 'Add to home screen', accept the Data Collection Notice and complete initial user settings.

Executive officers promoted the DiverObs App using a variety of methods including presentations at group meetings, newsletters, SMS, and emails as well as working directly with individual divers' face to face or by phone. These were often repeated for the DiverObs App to become a habit and part of a diver's day.

Monthly reports were also provided to executive officers that included participation rates across jurisdictions and amongst divers within jurisdictions. These reports enabled executive officers to see how their jurisdictions was performing and to follow up with non-participating divers. Timely access

to well-designed data analysis, reports and other useable and actionable information via the DiverObs Administration Console is important for continued engagement of industry representatives.

Diver incentives

A diver incentive scheme was developed to reward divers for completing surveys and encourage new participants. Each diver received one entry in a random prize draw for each survey he/she completed during a month. Two prizes (dive gear) were drawn at the end of each month for six months from July 2021 to December 2021. In September and October, the prize draw was limited to divers that completed their first survey in that month to strongly encourage new participants.

3.5. Diver Observations System data analysis

3.5.1. Survey data analysis

The project reviewed approaches to the summary and analysis of the survey data. The initial priority was to develop approaches to the summary and display of data for use in TACC setting workshops. R-Markdown was used within a server environment on the cloud site to script a range of graphical and text summary of the data produced from the survey, and automated to produce a monthly summary report for each fishery. Monthly summary reports were then made available to users from each fishery through the Admin Console. Initial development involved a range of possible presentation approaches for consideration by users, but current development involves focussing reports on graphical presentation of key performance indicators and extending the within-year presentation of data.

Standardisation of survey data to remove specific confounding effects (e.g., differences among divers' times, and reef codes within SMU) was also considered important for further development of survey data analysis. This is similar to the standardisation used in most analyses of catch and effort used in each fishery. While data was too limited (i.e., larger number of survey responses needed through time) to progress detailed development of an approach to standardisation, preliminary development and analyses suggested a proportional-odds general linear model may be most appropriate for future analyses as the data set grows. Such an analysis would attempt to standardise differences in observations among divers, reef codes and times, to provide fishery and SMU-wide trends in reporting.

3.5.2. Linking DiverObs App data to other data sources

The project plan required the Steering Committee to consider the linking of data from the Diver Observation (DiverObs App) survey to other fishery assessment data. It is possible to link the Diver Observations database, with other fishery data including catch and effort logbook data, VMS data, measuring and depth logger data, and geo-tagged underwater video, using the date and each diver's identification number (PFN in Victoria) recorded with all data sources.

The linking of these different datasets has two key benefits:

1. It enables validation of the DiverObs survey data
2. It enables greater spatial detail and related information about each fishing day (e.g., where on the reef the diver was during his observations and related indicators of the abalone population). See Appendix 12 for example.

Linking of validated logbook catch and effort data has been implemented for two Victorian fisheries and for NSW and is at various stages of implementation for fisheries in Eastern Zone Victoria, Western Australia, and South Australia. Validated logbook catch data has been provided by the Victorian Fisheries Authority (VFA) and NSW DPI to determine actual abalone fishing days because GPS loggers operate on divers' boats at all times, even on days they are not fishing for abalone (e.g., at sea doing something else). Validated catch data (released after a signed privacy release from divers) are available for Western and Central Zone Victoria and NSW fisheries.

Database tables holding data from other data sources used in fishery assessment were developed and linked to the Diver Observation survey database. These other sources of data were linked to the daily diver observations using the date and identification of divers which are associated with each data source, which included:

1. Diver observations survey data, from web-application
2. Logbook catch and effort data, from API (Application Programming Interface)
3. VMS boat location data, from API
4. Length measuring and location data, from SSH (Secure shell connection)
5. Diver depth data, from SSH
6. Underwater video data, from server-form upload

Several examples of the information available for individual diver-days were prepared and provided to the divers involved for assessment and agreement to distribute. Each data source contains personal and confidential information that would not be distributed without agreement of the divers involved, unless in a summary form where the diver could not be identified. Linking of the various data sets should provide a range of possible performance indicators for use in fishery assessment (e.g., workshops).

4. Results and Discussion

The results and discussion are presented in this section with reference to the objectives of the project.

4.1. Objective 1

Collaborate with industry in each jurisdiction to develop customised surveys for the Diver Observation System

As outlined in the methods section, this project was highly collaborative and was co-designed with divers, industry association representatives, abalone scientists, fishery managers, social scientists, and SL Digital.

The rigorous development of the survey included interviews with stakeholders, multiple iterations of the draft survey, expert review, and piloting. This resulted in a survey which we are confident captures the data required to support the TACC processes in multiple jurisdictions, compliment other data sources used in stock assessment, while keeping the survey short, ensuring question interpretation, and remaining easy for divers to complete soon after diving (See Appendix 3). Data privacy was also a key consideration for industry as well as ensuring industry ownership of data. A data collection notice, privacy policy and data sharing agreement were important outputs from this project (See Appendix 4).

Alongside the survey development, the custom design of the DiverObs App (See Appendix 9) with SL Digital was also a collaborative and iterative process, ensuring useability for divers (via piloting testing) as well as a well-designed back-end system for gathering data and reporting diver participation and observations. This enables industry engagement with abalone association Executive Officers able to receive regular updates and reports for use in TACC setting workshops (See Appendix 11 and Objective 2 for more detail).

As part of the collaborative process, support was given to industry executive officers (see Appendix 10) as well as guidance to train divers to use the DiverObs App (See Appendix 9).

4.2. Objective 2

Collect, analyse, and report diver observation data using an electronic system

The DiverObs App survey database, to 1st December 2021, has collected 497 records of observations from 43 registered divers, including some who work in multiple fishery (i.e., 53 diver-fishery combinations, see Table 3). Note that the number of responses was impacted by the activity of the fishery with some fisheries having limited activity and catch during the trial period.

Table 3. Number of observations for each jurisdiction

Participating Jurisdictions	Number of registered divers*	Number of Observations
Victoria Eastern Zone	15	293
Victoria Central Zone	12	21
Victoria Western Zone	7	52
New South Wales	14	117
South Australia Central Zone†	3	14
South Australia Southern Zone	2	0

** Note: One diver may be registered to more than one jurisdiction*

Participation in the survey has been heavily impacted by low catches and diving effort across most of the fishery, related to poor market conditions. However, the various methods of encouragement resulted in a steady increase in the level of participation during the project period. The proportion of potential divers that participated in the survey from each zone varied from more than eighty percent in Victorian Eastern Zone to thirty eight percent in South Australia Central Zone. The higher the proportion of divers and catch and effort represented the more reliable the data.

It is important to note that not all interested jurisdictions have been ready to implement the Diver Observations System during the lifetime of the project for a variety of reasons:

- South Australia Western Zone (SAWZ) has utilised a paper-based diver survey for several years. It has had a high level of participation (>250 assessments/year, 95% of the 22-vessel fleet). It is used to inform their stock assessment process. In 2021, for the first time, the diver survey has been formally recognised by Primary Industry Research South Australia and integrated into their abalone harvest strategy. SAWZ are in a transition period adopting electronic data reporting and the DiverObs platform could link with this.
- South Australia Southern Zone has a very stable TACC and is unlikely to take up the DiverObs App at this stage. There are only six licences and eight divers. Despite promoting the DiverObs App and multiple reminders to divers, it has been difficult to encourage participation to date.
- Western Australia Area 3 has only three divers fishing the eight licences. With the small number of divers working their own areas, it has not been possible to maintain anonymity. However, there continues to be interest and the results for Victoria Eastern Zone will be presented at the WA Area 3 TACC workshop in January 2022.

The Diver Observations System allows the data manager to analyse and report on survey completion statistics (number of responses by diver). These reports are available to the Executive Officers of through the Admin console.

A system of reporting raw and summarised diver observations from the survey database for the TACC setting process in each fishery has been developed. Preliminary analysis of data was completed prior to the Victorian Eastern Zone TACC workshop on 6th December 2021. Eastern Zone had high participation rates in the DiverObs survey, and the information will form a significant part of the workshop process. Refer to Appendix 11 for an extract of the analysis and reporting developed for the Eastern Zone TACC setting workshop.

During the project, Victoria Central Zone and Victoria Western Zone moved their TACC process beyond the end of the project. The NSW TACC process also fell outside the project timeframe. Other

jurisdictions either had no data or too little data available for analysis and reporting. As diver observation survey responses continue to accumulate, particularly with increased catch in each fishery, summary reports will be prepared and available prior to each fishery's TACC setting process.

4.3. Objective 3

Validate Diver Observation data against GPS logger data (where available)

Database tables holding data from the Diver Observation survey and other data sources used in fishery assessment were developed and linked. Other data sources used in fishery assessment include logbook catch and effort, VMS boat location, length measuring and location, diver depth and geo-located underwater video. Linking of these data sources provides further validation of the observations made by divers and provides a range of fishery performance indicators for use in assessment of stocks during workshop and TAC processes. It is intended to extend development of the linked data sources and their use in stock assessment, by the development of digital dashboards summarising the linked data and their distribution to appropriate users, managed through the diver observation system.

Several examples were prepared of the detailed spatial information available from the linking of the Diver Observation survey to other databases used in fishery assessment. Each data source contains personal and confidential information that would not be distributed without agreement of the divers involved, unless in a summary form where the diver could not be identified. An example of the spatial information available from the linking of databases is shown in Appendix 12.

4.4. Objective 4

Develop a business model for the continuation of the Diver Observation System beyond the life of the project

A business model for continuing the Diver Observation System beyond the life of the project has been developed and is presented in the Recommendations section of this report.

A range of possible options have been considered for funding the ongoing use and development of the Diver Observations system (See Further Development section). The project has identified the strong benefits possible from extension of the Diver observations system and cloud-site, through linking the survey database with other databases used in fishery assessment, and the summary and distribution back to divers and other stakeholders, of dashboards containing fishery performance information back to their mobile devices and desktops. ACV has submitted an EOI to FRDC summarising a project to develop digital approaches in Australia's abalone fisheries.

While a business model is important, it is also important to ensure that the DiverObs App builds participation to make sure observations are representative of the fishery and remains an important part of the TACC setting processes. This will require/ensure survey results are respected, considered, and well used at stock assessment meetings if diver participation is to continue. The use of the data at the 2021 Victorian Eastern Zone TACC setting workshop will extend the outcomes of this project directly in its first TACC setting process.

5. Conclusion

This highly collaborative project has rigorously designed and developed an online platform to capture commercial abalone divers' observations. Observations include the state of the stock and fishery at a fine scale which compliments other data sources used (e.g. catch and size data, biomass estimates) and collects data on juveniles which are missing from other data sources; daily or seasonal factors which impact catch rates giving context to catch per unit effort data used in stock assessment; and other important observations about habitat, invasive species or other changes that are not captured in any other data sources.

The design of the DiverObs survey has been flexible to accommodate all jurisdictions involved and allows for future changes if jurisdictions want to make changes or other jurisdictions want to be involved in the future. The design of the DiverObs App itself is easy to navigate and simple for divers to complete quickly soon after the dive day. There has been a marked increase in diver participation as jurisdictions witness how the data can be collected and used effectively. There is confidence in the collection, management, and reporting of data by industry and fisheries managers. The Diver Observations System can provide clear benefits as a supporting line of data to the TACC setting process, to provide more information and compliment other data sources used.

6. Implications

The outcomes of this project have already had positive impacts for industry, management agencies and the health of the resource, and with further development impacts could grow.

The DiverObs system:

1. Provides divers with a more formal platform to provide information and have a voice about the state of the resource, which should be used as important input into fishery assessments and annual quota setting workshops.
2. Means that diver observations can be validated with other validated data sources (e.g., logbook catch and effort data).
3. Can improve interpretation of existing fishery assessment data sets, through directly linking indicators from the same diver data, adding value to existing information used in fishery assessments, particularly when data sources are contradictory.
4. Helps to encourage diver understanding and engagement in stock assessments as well as developing stewardship through building divers' confidence in the stock assessment and TACC setting process and ensuring sensible outcomes. This will hopefully return long term benefits of a more productive fishery with less risk of stock decline.

The use of the DiverObs data in the Victorian Eastern Zone 2021/22 TACC setting workshop revealed the following outcomes and impacts. While these are specific to Eastern Zone, they show the potential impacts for all jurisdiction:

1. Modifying the DiverObs report to be consistent with stock assessment and circulating the DiverObs report prior to the workshop was useful in setting the constructive tone for quota setting discussions. It was important to have discussions prior to the workshop with the fisheries management stakeholders, the independent chair of the TACC workshop and industry to determine how the DiverObs data would be integrated into the TACC workshop. John Minehan (lead author) also gave a presentation about this project and an explanation of graphs of observations at the start of the TACC workshop to ensure it was clear how the DiverObs would be used and interpreted.

2. The DiverObs report was presented in the TACC workshop alongside other data sources and outcomes from the draft harvest strategy, for each Spatial Management Unit (SMU) and Reef Code. The inclusion of DiverObs meant that comparison of the state of the stock using different data sources was enhanced and was used to explain why there may be differences in what the different data sources were saying (e.g., Catch per unit effort could be impacted by fishing to market size). It was important that the DiverObs was well considered along with the range of fishery indicators currently used in stock assessment, particularly when different data sources are contradictory and some data sources are contested (e.g., locations of FIS, reliability of CPUE), to enable full interpretation. It was also noted that presenting DiverObs as a single (average) score was useful and that having the DiverObs alongside the other data sources aided discussions and helped to focus diver attention, DiverObs data was trusted by divers, and its inclusion drew

greater engagement from divers during the workshop.

3. The DiverObs report along with diver feedback from the room contributed directly to the setting of appropriate optimal catch targets for each spatial management unit (SMU). The optimum catch targets for five SMUs were left unchanged and two were reduced. In comparison to the suggested catch target ranges in the draft harvest strategy, four SMUs remained above the range, two within the range and one below. The DiverObs report also aided discussions on the distribution of effort, resulting in a shift away from thresholds and upper limits to closing SMUs and selected reefs at the optimum catch target. Where DiverObs data differed from other data sources, it resulted in constructive discussions about how to account for differences in the future. For example, poor CPUE compared to previous seasons, on many occasions, was driven by fishing to market size demands ('slot fishing'), according to DiverObs. This prompted discussion on how to better capture and verify when divers are 'slot fishing'. This could be accommodated using the DiverObs App.

4. Ultimately, the DiverObs system in Eastern Zone has had a direct effect on production and product availability and thus economic contribution and employment.

7. Recommendations

7.1. Business Model

Objective 4 of the project was to develop a business model for the continuation of the Diver Observation System beyond the life of the project for participating jurisdictions. Although there is scope for additional jurisdictions to be included in the System, this would need to be developed separately in collaboration with the Abalone Council of Victoria.

The three key components of the Diver Observation System that require planning are:

1. The Diver Observation Application (DiverObs App)
2. The Diver Observation Administration Console (Admin console)
3. The Diver Observation database (Database)

The recommended business model includes:

1. Diver Observation data must be held securely by an entity related to the abalone industry, such as a representative body or related, and managed in accordance with the Privacy Act 1988. Summarised and aggregated anonymous results should be shared among stakeholders
2. Diver Observation System ownership and administration to remain with the Abalone Council of Victoria given the existing data privacy agreements and institutional knowledge developed through the project
3. Data access is provided to participating jurisdictions through the Admin console subject to signed Data Sharing Agreements
4. Funding of ongoing hosting, maintenance and support, system administration, and diver incentive scheme (see Table 4)
5. Options for funding (estimated $5,700 per annum) include:
    a) A cost sharing arrangement between participating states to be established and managed through the ACV
    b) Funding from government as Diver Observations are used in stock assessment, provided control and management of the Diver Observation System and industry data is retained by industry
6. Note that these are estimated minimal costs for system maintenance with no further development. The expectation would be further investment to improve the system or respond to issue arising from further use. For example:
    a) Develop the DiverObs app further to include within day reporting
    b) Use the app as an industry communication tool through notifications
    c) There is an opportunity to develop the linked data sets further, and to deliver fishery indicators back to stakeholders thru development of cloud dashboards delivered through the DiverObs system

Table 4. Estimated cost per month for Diver Observation System

Cost type	Provider	Cost per month
AWS hosting fees	SLDigital	$125
Maintenance & Support	SLDigital	$100
Systems Administration	Ambrad Consulting	$100
Diver Incentive scheme	Industry Association	$150
TOTAL		**$475**

7.2. Further development

Table 5 outlines a list of recommendations for further development resulting from the trial.

Table 5. Recommendations for further development

	Further development	Recommendation
1	Increasing diver participation in existing jurisdictions	• Develop push notifications to the app for reminders to divers to complete and for other communications • Document the Victorian Eastern Zone case study (most successful jurisdiction for uptake) and all the way the divers have been incentivised to increase their engagement, aimed at EOs of industry associations • Develop local incentives for each jurisdiction
2	Improving quality of observations	• Develop training for divers for making environmental change observations. E.g., Signs of spawning, habitat change, seaweed identification, invasive species, virus detection • Consider a national approach through the Abalone Council of Australia
3	Additional commercial abalone jurisdictions could be included in the Diver Observation System	• Further extension of the project demonstrating to non-participating jurisdictions how the Diver Observation System can work with other data at TACCs • Use Victoria Eastern Zone as a case study
4	Developing similar systems for use in data poor fisheries	• Consider the appropriateness of similar systems to be developed for use in data poor small-scale fisheries
5	Commercial exploitation	• Sponsorship of the diver incentive scheme could be commercialised through creating advertising space on the App
6	Diver observations are needed to be more spatially explicit. I.e., One part of the reef may be different other parts of the same reef. The survey data can be linked with Succorfish GPS data to provide geo-referencing of the general area observations relate to. However, if the diver covers a large area, it can be difficult to pinpoint the part of the reef being referred to.	• Consider adding a time stamp within the survey to allow the diver to pinpoint a point in time linking to observations • Consider training divers in how they respond in the comments section, to be more spatially specific

	Further development	Recommendation
7	Refine the survey to capture additional observations relevant to particular jurisdictions e.g., spawning times, urchin encroachment, kelp habitat	• Consider adding additional question prompts in long answer boxes
8	Increase functionality of DiverObs App	• Future development could include checklists and templates to satisfy OH&S AMSA regulations • Industry communication • Dashboards delivering appropriate data back to stakeholders
9	Develop best approach for the use of diver observation survey and linked data in fishery management.	• Develop a national approach to delivery of results from the Diver Observation survey, and other key fishery indicators, in a subsequent project through a series of dashboards linked to the cloud databases, enabling, and encouraging a more standardised and National use of the data.

8. Extension and Adoption

Much of this project has been focussed on adoption of the DiverObs system. To achieve this, and building on existing working relationships, a close collaboration between industry, government agencies, scientists and the project team was required. This has been described in detail in the Methods section of the report.

During the project:

- Abalone industry Executive Officers attended project meetings (video conferences) and kept up to date with monthly written reports
- The DiverObs Admin Console provided access to reports on demand
- An industry appointed database administration provided direct support
- State abalone managers and scientist were consulted by phone and email
- Other researchers were consulted by video conference and email
- Divers were communicated with through the relevant Executive Officers
- Project updates were provided to the Abalone Council Australia board and FRDC

After the project:

- The ACV will appoint a database administrator who will continue to provide data analysis & support services to Executive Officers
- The ACV will maintain a service contract with SL Digital for ongoing data hosting and technical support
- The DiverObs Admin Console will continue to provide access to reports

The Diver Observation System has been adopted by five jurisdictions and ACV have committed to continue support and operation of the DiverObs system (see Business Model).

ACV and several other jurisdictions are also looking to extend investment in the system managing DiverObs and linked data. This could include development of the system to include more data sources from all fisheries (e.g., the Victorian Fisheries Authority catch, and effort database now automatically provides Victoria Western Zone catch and effort data through API) and reporting of data through digital dashboards back to stakeholders. The DiverObs web-application could also be extended to improve industry communication (e.g., push notifications), occupational health and safety forms and other improvements useful for Industry efficiency. ACV has submitted an Expression of Interest to Abalone Council Australia and the FRDC Industry Partnership Agreement to develop the DiverObs system further and prioritise further digitisation supporting the industry.

9. Project materials developed

The project materials developed include:

1. DiverObs App (See Appendix 9)
2. DiverObs Administration Console (See Appendix 6)
3. DiverObs Database (See Appendix 7)
4. DiverObs App guidelines (See Appendix 9)
5. Data collection Trial plan (See Appendix 10)
6. DiverObs logo (licenced) (See Figure 1)

Figure 1. DiverObs logo (licenced)

Appendices

Appendix 1

Diver Observation System: Review of Victorian Survey (interview template)

Note: Interviewee has been provided with the original Victorian survey in advance of interview

Interview Date:				
Interviewee Name(s):				
Organisation:				
Jurisdiction:				
Position: (please circle)	Diver	Executive Officer	Manager	Researcher

Introduction:

The purpose of the Diver Observation Survey is to enable divers to easily report observations of reefs dived/worked while it is fresh in their minds. This information is collated and reported to the relevant industry executive officer to assist in management decision making, such as TACC setting. It is intended to be used to complement and better understand catch data and independent survey data (not to be used as an indicator), and to give divers a chance to have input into management decisions confidentially, to talk about what they are seeing under the water and any changes the industry, researchers and managers should be aware of.

1. **Participation, Awareness & Training**
    a. (Diver) Have you participated in the diver survey? – PROMPTS: please also explain the level of participation (i.e., how often), when (just before the TACC or after each dive) and why or why not?
    b. (Diver) How long does it take you to complete the survey?
    c. (Diver/EO) Have (other) divers in your Zone participated in the survey? Why do you think they have/haven't participated? PROMPTS: Worries about confidentiality? Can't be bothered? Don't understand the purpose of it?
    d. (Diver/EO) Have divers been trained to use the diver survey? Do you think a training session would be a good idea?
    e. (Diver/EO) What do you think would work to get more divers completing surveys, more often, and straight after diving? PROMPT: Are divers aware of the link on the catch app – could there be tech solution? Would getting reports, say monthly or quarterly of the (non-identifiable) diver obs in the zone help? Who should get these?
    f. (Manager/Researcher) Are you aware of the diver observation survey? Do you have any comments/suggestions to make on how to get more divers participating more often?

2. Survey Design and Data

The diver observation survey currently asks divers whether there have been changes in abalone abundance (above LML, below LML) and their catch rates compare to the year before and 3 years before. It also asks divers what could have affected their catch rate on the day (e.g., weather conditions, divers working the spot before you) and to list any other observations (e.g., habitat changes, invasive species) (see attached survey)

a. (All) Do you think the Diver Survey is collecting the right kind of observation data to be able to inform management decisions?
b. (All) What changes do you think are needed? PROMPT: Do you think it is useful to compare to 3 years before or should we remove this set of questions? Should we be asking about the abundance of abalone that are right on the measure? Do you think we should be asking any other questions about how the stock is looking on a reef?
c. (All) We are thinking it might be a good idea to create a tick box list of the factors that could affect a diver's catch rate, instead of getting them to type it out. The purpose of this question is in the case of a catch rate being lower/higher because of something other than the biomass, this can be explained. Do you think this is a good idea?
d. (All) If yes, can you list the factors (apart from stock abundance), that can affect your catch rates? (e.g., poor visibility, poor weather, another diver recently at the spot, new deckhand, a lot of urchins)
e. (All) We also think it might be a good idea to provide a list of general observations about changes to the habitat and reef area that are important for the Zone to be keeping an eye on, like the level of urchins or other invasive species, a change in the composition of seaweed, a white shark siting, etc). Can you tell me about the things that you can readily observe and would like to report (or have reported) that might affect abalone stocks so we can compile a list?

3. Analysis & Reporting

a. (All) Have you seen how the diver survey can be reported in your Zone? When? PROMPT: Have you seen a report at your TACC setting workshop?
b. (All) What do you think of the way it is reported? And/or, what do you think is the best way to report it?
c. (All) When and how often do you think you should get reports?
d. (All) What role does diver observations have in your quota setting process?
e. (All) Do you think diver observations should have a role in the harvest strategy? Why/why not? How?

4. Reviewing the survey

(Diver) Would you be willing to review the survey once changes have been made to make sure it makes sense?

Appendix 2

Interview results

The results presented here describe the key findings and recommendations from interviews conducted in May-June 2020.

Participation in the Diver Observations Survey

When are divers completing the survey?

- Interviewees indicated there seems to be an increasing effort to complete the survey at the end of the day's diving (noting interviewees are already engaged divers)
- If participants don't do the survey straight away, they say they are completing surveys a day or two later, or maybe little while later and use dive records to remember, or they wait and do it at the end of the season
- It was emphasised by one interviewee that is important that the diver completes the survey while it is fresh in their mind

How long does the survey take?

- Interviewees said the survey takes them between 1 minute to 5 minutes, but they get quicker each time they use it
    - If interviewees answered the long answer questions, it took longer to complete
    - One diver said it took him a couple of goes before he clearly understood what the survey was asking him

Why are divers participating in the survey?

- They know it will be beneficial to the TACC setting process
- Divers want their information recorded
- One diver said he had no worries about confidentiality and trusts the system
- Victorian Eastern Zone divers seem to be participating more than other jurisdictions (perhaps because there has been more awareness of the survey in EZ). The Central Zone divers who have participated tend to also be EZ divers

Why are divers are not participating in the survey?

- There are more critical work tasks to get done e.g., catch reporting, preparing the boat
- It is easy to forget to do it especially if it is not a requirement
- Already trying to cope with new e-catch reporting in Victoria
- Anything that is not a legislative requirement is hard to get the divers to do
- There may be a perception that it is only worth completing when there is something to say or something worth noting
- There is a perception there is no need to repeat the survey if working the same reef as recently dived
- Older divers, especially those who are not tech savvy are reluctant to change (Maybe moving to e-catch in Victoria will help)
- Divers need one-to-one training to understand how to use it
- It has not been promoted yet (in NSW)
- Divers need to be constantly reminded so it becomes part of a diver's routine

Would training help or encourage divers to participate in the survey?

- A couple of divers thought that training wasn't necessary especially if the questions are kept simple
- However, the majority felt that training was a good idea (although might be more beneficial to some divers than others) and gave several suggestions for how to go about training:
    - One-to-one training is a good idea like what John has done during these interviews
    - Brief training at quota workshops or as part of other diver meetings would be one way to go about training but this may not be suitable for CZ where many divers don't turn up to meetings
    - There seems to be good support for Mark Asplin's e-catch training in Vic, perhaps look to his approach on how to do training, particularly because it was face-to-face
    - The training needs to be more about being observant (about relevant things that are important for setting TACCs) rather than using the survey instrument itself
    - Brief 'e-catch style' quick reference guide would be a good idea
    - You tube step by step guide could be an idea
    - Training also needs to have follow up encouragement

What would work to get more participation from divers?

- There needs to be consistent and constant within-industry encouragement and reminders to get divers to participate in the survey:
    - EOs should have a role in reminding divers. E.g., in EO's monthly update, through subtle supervision by EO, regular reminders by EOs
    - Hold an information evening about the survey
    - Licence owners/shareholders could also put pressure on divers to complete surveys
    - For NSW, getting the TACC committees to endorse the survey
    - Need to get 50% of the divers doing it, then the rest may follow, peer pressure from other divers, or using industry/diver leaders/champions to promote participation with other divers
    - Duncan Worthington could also advocate for divers using the survey
- Divers need to be able to see the value in the survey:
    - Divers should be encouraged as it is a means to have say, strengthens diver input when TACC meetings can be difficult to do so (with owners in the room, and pressure from other divers)
    - Divers need to see the value in it and believe it what the survey is doing, as well as having ownership of it – it is to inform stock assessment and fishery management, and avoid misinterpretation of other data used in TACC setting (which would result in bad decisions)
    - Benefits including how it compliments other data and cost saving achieved
    - Divers also need to understand that it is only of use if most divers are participating
    - Using the outputs of the survey in TACC meeting effectively
    - Regular aggregated reports to divers
    - It could be used with Divers personal log
- There were also technical suggestions to encourage participation:
    - The e-catch link (Vic) needs to stand out more, suggestion it is on the final page, as an icon with a logo which becomes like a brand or even as a tab in e-catch, it could also show you which days you've forgotten to complete the survey if linked to e-catch

    - The survey needs to be more phone compatible – zooming in to see the questions makes it difficult
    - Suggestion that it have a link from the Fisher Mobile App in NSW
    - Needs to be simple and easy to complete
    - Two divers said they got frustrated with technical issues – It can take a long time to load, it is annoying to have to log in every time, enter the date etc, when it could be automated
- There could be some sort of incentive system (e.g., slab of beer!)
- It is important that the data is reliable and there are no false reports, so maybe we should not worry about the last 20% of divers that don't use the survey
- There were suggestions that the only way to get divers to participate was to make it compulsory, but there was also a strong belief that it should not be compulsory

Data collected in the Survey

There was consensus that the observation data being collected was the right kind of data that was needed to inform management decisions. Observations about abalone abundance above and below LML, and catch rate are the most important data to collect.

There was also strong support for the survey if the data collected can inform stock assessment in ways other data sources can't, e.g., immediately undersize abalone, juveniles, habitat changes that could affect abundance/CPUE, market forces, weather, etc.

Participants felt that the survey needed to be kept simple and quick to complete after a day's diving. This is a balancing act between a few questions asked regularly and more questions answered rarely.

It was also mentioned that it was important for the managers and stock assessment scientists to support the survey for it to be used in decision-making.

What if the diver hasn't worked the reef the year before?

- There could be an option to give an opinion on the reef even if not worked the year before
- Might need a stop/go question if the diver hasn't worked the reef the year before

What is the best way to capture long term trends?

- There were various opinions about whether to keep the current question which asks divers to recall abalone abundance and catch rates three years ago:
    - Questions about the accuracy of recall responses to this question
    - The 3-year question becomes irrelevant as we collect observation data (comparing to the year before) over time
    - It is important to get some sort of an idea of the long-term trend. If a diver says that over several years there is less fish (even if the fishing is still good), this is important to capture. Although the 3-year question aligns with the harvest strategy, there were suggestions about not using specifically 3 years because, for example it may be important to capture divers' observations from other time periods, however, will need to work out how to standardise. Perhaps asking how long since you worked the reef or asking their opinion more generally on longer term trends

Do we need a question about abalone that are right on the LML?

- There was no agreement on whether it is important to have a question on this:

- Some said there was no need for a question about abalone are right on the measure
- Others argued it is a good idea because it can reveal how much knife-edge fishing is being done Suggested question: Did you have to do a lot of measuring today?

Factors affecting catch rate

- There was consensus that it would be a good idea to turn this survey question from an open question to a tick box/choice question.
- There was also a suggestion that these questions could have the same 5 level response values, another suggestion was 3 level - optimal, marginal, poor.
- Another suggestion was to see if the survey can grab the local weather conditions on the day/location?
- List of suggested factors given by interviewees were:
  - ENVIRONMENTAL CONDITIONS (Swell, Surge, Depth, Visibility, Current, Tide).
  - DIVER CAPACITY (Fatigue, hung over, Injured)
  - DECKHAND CAPACITY
  - EQUIPMENT/MECHANICAL (Failure or incorrect)
  - TIME IN SEASON/PREVIOUS EFFORT
  - FISHING TO MARKET DEMAND
  - Catch rates: Abalone being corralled by urchins or sand inundations
  - Diver psychology??
  - Fishing method (e.g., shift to cage diving)
  - OTHER ….

Observational changes to the habitat and reef area

- One of the interviewees said that it is important that these observational changes are restricted to those that help to interpret other data.
- Most of the interviewees felt that it would be a good idea to change this question from an open question to a tick box/choice question, although there was still a perceived need for an open response option.
- There was also a suggestion that these questions could have the same 5 level response values to collect quantitative data.
- The list of suggested changes to include:
  - Changes in abalone predators (starfish, octopus, red crabs)
  - Changes in abalone competitors/invasive species (Urchins/barrens/encroachment, 11-arms, turbo shells, white urchins, purple urchins, wrasse, crayfish?)
  - Habitat change (Weed/kelp cover increase/decrease, feed/evidence of abalone grazing)
  - Shark sightings – although some divers don't want this because of psychological effects
  - Sand movement
  - Seal abundance
  - Dead whales
  - Disease
  - Food source (given new research on diet) e.g., what was the dominant grass on the reef?
  - Changes to the abalone themselves (growth rates on shell, shell more brittle)

Other suggested changes to questions

- Catch rate questions could be removed because it is already captured using Succorfish/e-catch/D/T data. Perhaps a watching brief on the usefulness of this question.

- Be good to focus on fish below the measure where we have less data for.
- Need to stick to more questions that are factual rather than subjective.
- Potential to use biomass in addition to abundance e.g., do you think the biomass is stable/increasing/decreasing?
- How much fish (over the measure) did you leave behind? Or what percentage of stock did you take.
- Do you think the size limit is appropriate for this reef?
- Has the reef been culled of urchins recently?
- Question around cryptic/first emergent stock.
- Amount that divers move around during the day (shows that divers are having to look more because of depletion).
- Having a way to report that VMS isn't working through the Diver Obs survey app.
- Would be interesting to test how long after diving the diver completes the survey and may provide some information on reliability of recall data.
- In SA, they use the word density as it is interpreted by divers as abundance.

Question structure

- Could look at/test a different question structure, e.g. "I observed a greater number of abalone above LML on the reef this year: strongly disagree, disagree, agree, strongly agree, not sure"
- The answers to the question about observations 3 years ago, should have a 'not applicable' as well as 'not sure' response.
- Mark Asplin's questions about survey design???
- Consider using a scaled response set to questions e.g., 1-10

Standardisation of data

- Should some divers who work the reef more regularly have greater weight to their opinion?
- Presentation of responses needs to consider when in the fishing year the diver fished because the responses will be different.
- Need to account for where on the reef is being observed (e.g., depth)
- Script a list of questions about diver capability and capacity e.g., self-rating questions such as 'I am harvesting at the same rate as last year' or 'I have an impairment that is affecting my harvesting (agree/disagree), please explain further. Diver behaviour, capability, and preferences – a set of questions that standardise the data. This could be a pre-survey
- Can the data be presented with other data collected, e.g., Succorfish and Depth/time data?

Reporting Diver Observation Survey results

- All the participants from Victoria (except one) said they had seen the divers survey report, mainly at TACC setting workshops.
- The Victorian respondents were generally positive about how the survey results are presented because it is simple. Key additional comments:
    - It needs to stay anonymous
    - It needs to be as transparent as possible without breaching confidentiality to industry, managers, and researchers
    - It needs more participation so that it is meaningful and useful
    - It would be good to have it tied to harvest strategy categorisations

    - It needs to presented in alignment with stock assessment results. E.g., Overlay Logbook and Logger CPUE over these data to see how the survey results compare visually with the recorded measures (similarly for other variables).
    - Integrating the Diver Survey with Succorfish spatial data should be a key objective
    - When there are multiple years of data available, look at one variable through time. This might be best presented as a stacked bar chart, one for each year (x-axis = Yr., y-axis percent response
    - Remove 'not sure' data from graphs
- The opinions on how often to get the report differed depending on whether divers, EOs or the fisheries manager was asked.
    - Divers
        - Once per year before the TACC workshop (circulated before)
        - At divers meeting only
        - Would love to get access to own reports to see what days has missed doing the survey. It would be good to have this record because doesn't have a docket book anymore
        - One diver said they would also like to see a report quarterly
    - EOs
        - Quarterly. It would be good because things could be picked up quickly especially because there is often a lag with CPUE and FIS data
        - Available on demand as well as a report sent out
    - Fisheries manager
        - Annual report is good. It is good to have alongside the stock assessment. Given higher participation it would be good to have while the stock assessment report is being written as it is a good validator for the stock assessment
        - Circulating the report prior to the TACC setting workshop alongside the stock assessment
    - Scientists
        - As often as is appropriate to inform updates to the stock assessment, more than just at the TACC
        - It could be used during the season as a trigger given how responsive the survey is e.g., when 50% of a certain number of divers report 'Much less' stock >LML and/or <LML in a certain area, if there is enough participation

What role should the Diver Observations Survey have in fisheries decision making?

TACC setting process

- Diver observations of what the bottom is looking like are important and complimentary to the stock assessment and CPUE data, although the value of the observations data may increase over time.
- It is the chance for divers to give their honest opinion in the face of pressure from stakeholders who may be motivated to push quotas up and risk sustainability.
- Having a written report to support what divers say in the TACC setting meeting is good.
- Diver observations at present are not as influential as they could be because of the lack of participation.
- It is particularly important if diver observations are counter to what the stock assessment or CPUE data say.
- Seen as an aid to diver's memories in TACC setting workshop.

- One diver felt that diver observations were still not being considered enough in TACC setting.
- Use as a weight of evidence approach and look to see where the data sources diverge.
- Arguments for both keeping the observation data separate from stock assessment data to see how closely they track together, but also using the observation data as a component of the assessment to see where they complement/diverge.

Harvest strategy

- There were a range of interviewee responses to how the Diver Observations Survey could be used with the harvest strategy, but most respondents felt the diver observations data wasn't yet robust enough to be an indicator in the harvest strategy, but that it should be used alongside the harvest strategy:
    - A few of the divers didn't know how to respond to this question
    - With more participation, diver observations could be more influential and be an indicator, used as a trigger or used if other data got to trigger point
    - Diver observations should be a critical to TACC setting and used alongside the harvest strategy
    - Should not be a numerical indicator in the harvest strategy
    - We would need to be confident in the accuracy of the observations for diver observations to be considered as an indicator. If divers see it influences quota setting, then there will be false reporting
    - Not directly in the harvest strategy but as a way of standardising data used in harvest strategy
    - Initially it probably shouldn't have a role in the harvest strategy, but ultimately might prove to provide a reliable indicator of undersize abalone, especially in places where FIS are not done
    - If the harvest strategy objectives relating to social, economic, or broader ecological issues, the observations survey may be a platform to obtain additional information regarding these

Appendix 3

Diver Observation System Survey questions

Settings questions	Response set	Justification for question
Name		Identification
Age		Potentially able to account for Age in diver responses.
What year did you commence as an abalone diver?		Potentially able to account for experience of diver in responses
In what State(s) do you dive?	WA/ SA/ VIC/NSW	To bring up list of relevant fisheries.
PFN/Diver #		The PFN/Diver # together with Dive Date is used as the unique record key to identify the survey and link to other data sources.
Which fisheries do you dive?	Depends on State(s) Selected	To bring up list of reef codes and question set for jurisdiction
Home screen		
Select date of dive	Calendar date	Flexibility for diver to complete survey on the day of fishing or any time post fishing. If diver completes at sea, then there the survey will be able to be geolocated. While currently out of scope, this function could lead to real time reporting of an urgent issue in the future
Help menu		Gives information about the survey, support contact numbers and question guidance
Select reef and species		
Select a reef to report on	Reef list for fishery(s) with 10 most recently dived reefs coming up first	Diver may dive multiple reefs in a day, we need to know which reef the survey refers to. If divers want to report on multiple reefs, then they can complete the survey again for another reef. All observations refer to 'this part' of the reef because one part of a reef could be very different to others. The key is to get divers to compare with same part of the reef
Select (one or more) species to report on	Depends on reef selected: Common name species	Diver may harvest multiple species in a day and may select to report on multiple species or not. Only applicable for reefs selected that have multiple species. If divers report on a second species, only part of survey repeated
Survey questions		
Compared to **EARLIER THIS SEASON**, how much *spp* abalone **ABOVE LEGAL SIZE** did you observe on **THIS PART** of the reef?	Much less/Less/Same/More/Much more/ Not sure/Did not dive here earlier this season	Divers may dive and make observations on the same part of the reef within a season. Observations of change within the season may be useful to record the extent of change such as early season increases in catch rates, or end of season reduction.

Compared to **LAST SEASON**, how much *spp* abalone **ABOVE LEGAL SIZE** did you observe on **THIS PART** of the reef?	Much less/Less/Same/More/Much more/ Not sure/Did not dive here last season	Divers can make observations comparable to the previous season. This data allows direct comparison of observations against FIS and Catch rate, logger and abundance survey data, and be used to support in TACC decision-making. This comparison of current observations with data from the previous season is considered the key observation data for the survey for all stakeholders.
Compared to **LAST SEASON**, how much *spp* abalone **JUST UNDER LEGAL SIZE** did you observe on **THIS PART** of the reef?	Much less/Less/Same/More/Much more/ Not sure/Did not dive here last season	Indication of abalone stock moving into fishery in the next year or two. Able to compare observations against FIS data to support TACC decision-making BUT FIS have challenges in different jurisdictions. Thus considered a key observation by abalone scientists and industry stakeholders. Language of 'just under' equates to 0-20mm according to divers
Compared to **LAST SEASON**, how much **JUVENILE** *spp* abalone did you observe on **THIS PART** of the reef?	Much less/Less/Same/More/Much more/ Not sure/Did not dive here last season	Only limited FIS data available therefore if it is possible for divers to estimate juveniles then this is good. In consultation many divers said they do not focus on juveniles while harvesting unless they are obvious. Therefore, may need to be a test question with potential for removal if no good response rate during testing period. We do need a better understanding of diver interpretation of 'juveniles'. At this stage we believe the interpretation is 'cryptic' individuals.
Compared to **2-4 YEARS AGO**, how much *spp* abalone **ABOVE LEGAL SIZE** did you observe on **THIS PART** of the reef?	Much less/Less/Same/More/Much more/ Not sure/Did not dive here 2-4 years ago	See 2a. Captures longer term trends considered important to stakeholders. In line with harvest strategy timelines. However, memory may pose problems for reliability. For some jurisdictions and divers, reefs are only fished every 2-4 years, therefore without this set of question, no observations data would be collected.
How was your *spp* abalone **CATCH RATE** today compared to you what you expected for **THIS PART** of the reef?	Not sure/Very poor/Poor/Fair/Good/Very good	Comparing catch rate to expectation attempts to remove the effect of factors not related to the stock, such as fishing late in the season where catch rates may be lower, or fishing to market. This approach is strongly supported by the SA diver survey. Observation compared to expectation also encourages the diver to consider what has influenced his fishing and catch rate, leading into the next question specifically about factors effecting catch rate and their intensity. Answers to this question can still be compared to logbook catch data by considering 'anomalies' from average catch rate. For example, if catch rate was observed below expectation by a diver, this might also be related to below expected catch rate in standardisation of the diver's catch rate. In this way, answers to this question could be used to support TAC decision making.
Did any of these factors impact your catch rate of abalone on **THIS PART** of the reef?	For each factor response set is No impact/Small impact/Medium impact/Large impact	Can be used to explain discrepancies with CPUE data. This type of explanatory data not gathered elsewhere. Industry stakeholders felt this was a key

	- Changing fishing method - Fishing to size/market - Amount of measuring - Equipment or mechanical issues - Diver or deckhand capacity - Reef had been worked - Environmental conditions - Habitat changes - Other factors	question. Added strength of effect in this iteration but will be up to IT to test how possible without making the survey long
For **THIS PART** of the reef, what is your **OVERALL OPINION** on the *spp* abalone stock level?	Not sure/Very poor/Poor/Fair/Good/Very good	Directly gives the diver an opportunity to rate the state of the stock given their observations to support TACC decision-making. Acknowledging that the survey has been asking about trends but does not (until this question) take into consideration the baseline state of the reef. E.g., it could be better than last year but still have very poor biomass levels overall
Would you like to make any other observations or comments for **THIS PART** of the reef?	Long answer response to three types of observation - Habitat change - Invasive or predator species - Any other observations	Question could be useful for early warning/monitoring of environmental changes. Data not gathered elsewhere

Appendix 4

Data Collection Notice

On the DiverObs splash Screen

Welcome AbDiver!
DiverObs will give divers a voice about the state of the fishery by reporting your observations.
This is an industry-led initiative, and your responses will be sent to your industry organisation.
Your DiverObs will be used together with other data sources to aid in the management of your fishery.
It is important to complete a survey soon after every dive.

To proceed please scroll down and accept the Data Collection Notice below.

Abalone Council Victoria Inc – Data Collection notice
The Abalone Council Victoria Inc ABN 24 981 664 394 (ACV) has developed and operates the "DiverObs" Application (App).
Use of the App will require you to provide personal information, including your name, age and experience in abalone fishery, state government fisheries agency identification number, dive date, general location, observations relating to diving activities, and specifications of your mobile device.
The primary purpose of collecting your personal information is to aid in fishery assessments. We may also use your personal information for secondary purposes including monitoring coverage, encouraging participation and engagement with the App, undertaking technical improvements to the App, and complying with our regulatory and other legal obligations.
While personal information will be held privately, it will be accessed by a database manager and contracted service providers. We will also provide your personal information to the Abalone Industry Organisation representing the fishery in which you operate, subject to them signing a Data Release Agreement. The Data Release Agreement will require the Abalone Industry Organisation to also hold your information privately but allow the release of anonymised reports to third parties to aid in fishery assessment. Your abalone industry organisation may link your DiverObs surveys to your GPS logger, catch and measuring data for verification and analysis to help understand your fishery. Abalone Industry Organisations will also be required to seek permission from you for any further use of the data. Your personal information will not be disclosed to overseas recipients.
If personal information is not collected, we will be unable to accept data submitted by you through the App.
More detailed information about how ACV manages your personal information is set out in our privacy policy, which can be found on our website at: www.abalonecouncilvictoria.com.au.
Any requests or questions about how we deal with your personal information, including request for access or correction, should be sent to info@abalonecouncilvictoria.com.au.

By clicking the accept button below, I confirm I have read and accept Data Collection Notice
I ACCEPT (button)

Abalone Council Victoria Privacy Policy

The ACV Privacy Policy can be found here: https://3a378f19-61b5-4210-992c-2890f8bd796c.filesusr.com/ugd/614ddd_e4946ae5d9374d15a75cdfb0c4b38177.pdf

Data sharing agreement

ABALONE COUNCIL VICTORIA INC ABN 24 981 664 394

DATA-SHARING AGREEMENT

Date of Agreement:	day of 20
Recipient of Data:	[Representative body e.g., Abalone Victoria (Central Zone) Ltd]
Recipient's ABN:	## ### ### ###
Recipient's Address:	[address]
Zone:	[insert zone e.g., Victoria – Eastern Zone]

Points of Contact:

	ACV	**Recipient**
Person:	[insert]	[insert]
Post:	[insert]	[insert]
Phone:	[insert]	[insert]
E-mail:	[insert]	[insert]

SIGNED BY THE RECIPIENT by its authorised officer:)
)

…….. ……..
Signature of witness Signature of authorised officer

…….. ……..
Print name of witness Print Name & Position

SIGNED BY ABALONE COUNCIL VICTORIA INC ABN 24 981 664 394 by its authorised officer:)
)

…….. ……..
Signature of witness Signature of authorised officer

…….. ……..
Print name of witness Print Name & Position

1. Data Access

a) During the term of this agreement, the ACV agrees to allow the Recipient and the Authorised Users to access the Data via the Data Custodian, with said access to be in accordance with the terms and conditions of this agreement and any instructions given by ACV and the Data Custodian.

b) The Recipient must:

(i) ensure that the Data is only accessed by the Authorised Users for the Purpose and in accordance with the terms of this agreement.

(ii) ensure the Authorised Users are made aware that the Data is confidential, and its use and disclosure are restricted.

(iii) ensure the security of the Data at all times and promptly inform ACV of any unauthorised access, or if data is lost, altered, corrupted, destroyed or damaged; and,

(iv) ensure that reports prepared for publication by the Recipient and Authorised Users contain aggregated data only, from which divers cannot be identified individually.

2. Privacy

a) The Recipient agrees that:

(i) it will implement all appropriate measures to guard against breaches of clause 1, including but not limited to adopting appropriate procedures to manage access and use of the Data.

(ii) it will comply with all Privacy Legislation applicable to it.

(iii) immediately notify ACV in writing if they become aware of any unauthorised access to, or unauthorised disclosure of the Data and, in that case, cooperate with ACV in investigating and responding to the said unauthorised access; and,

(iv) if it receives a complaint or other notice advising of an actual or potential breach of Privacy Legislation, security or other like obligation in relation to the Data, it will give ACV written notification of same within 10 business days

b) The parties agree that they will provide each other all reasonable assistance to ensure they each comply with all Privacy Legislation applicable to each party.

3. Release and Limitation of Liability

a) The Recipient hereby releases ACV and the Data Custodian from any claim they may have in respect to the provision of the Data, including but not limited to any claims relating to the collection, maintenance, quality or security of the Data.

b) The liability of ACV and the Data Custodian to the Recipient for breach of contract, or in tort, or for any other common law or statutory cause of action arising out of the operation of this agreement will (except to the extent that an exclusion or limitation of liability is prohibited by law) be limited to an amount of $10.00 (**Liability Cap**).

c) The Liability Cap applies to each occurrence giving rise to a cause of action.

d) If the Liability Cap is ineffective or unenforceable, ACV and the Data

Custodian's liability to the Recipient to the supply of the services provided for in this agreement again or the cost of having the services supplied again.

4. Indemnity

The Recipient must at all times indemnify and keep indemnified ACV and the Data Custodian against any and all claims, liabilities, damages, losses, costs and expenses (including legal costs and expenses) arising out of or relating to or is a consequence of:

a) any breach or alleged breach of any term, condition, or warranty of this agreement by the Recipient, including a breach or alleged breach arising due to the conduct of an Authorised User.

b) any negligent act or omission to act or any wilful misconduct, unlawful act or omission to act by the Recipient or the Authorised Users; any disclosure or use of the Data in breach of this Agreement.

5. Definitions

The following definitions apply unless the context requires otherwise:

a) **Authorised Users** means individuals authorised to access the Data on behalf of the Recipient.

b) **Recipient** means the recipient industry body described in the schedule.

c) **Data Custodian** means the person nominated by ACV from time to time to administer access to the Data.

d) **Data** means the DiverObs database developed by ACV and containing data submitted in respect of the Zone.

e) **Purpose** means to aid in fishery assessment including linking to other data sources for verification and further analysis and other uses expressly permitted by the diver that submitted the data.

f) **Privacy Legislation** means all state and federal privacy laws applicable to the Recipient, including but not limited to the *Privacy Act 1988* (Cth); and,

g) **Zone** means the Abalone fishery zone described in the Schedule.

6. Termination of Agreement

a) Either party may terminate this agreement on fourteen (14) days written notice to the other. Termination under this clause will not affect any previously accrued rights of either party.

Appendix 5

Software Requirements Specification

1. Introduction

Abalone fisheries are valuable fisheries in Australia, with almost all the catch being exported to international markets. A core component of the information used to model and manage the industry, and the impact of fishing, is diver observations.
The Victorian Diver Observation System enables abalone divers to report their observations on stock abundance, catch rates and habitat changes. These observations are stored, analysed, and reported back to industry personnel for on-going stock assessment and the setting of quotas.

1.1 Purpose

This document presents a description of the software required to support the Victorian Diver Observation System (the system). i.e.:

a. Provide a mechanism to capture observations about abalone stock levels from divers.
b. Collect, and store these answers in a relational database.
c. Produce reports for industry purposes.

This software requirements specification is based on the IEEE 29148:2018 standard.

1.2 Intended Audience

The audience for this document is:

a. Key project stakeholders from the Diver Observations project.
b. Implementation partners, including business analysts and developers.
c. Additional secondary stakeholders, as determined by the project team.

1.3 Project Scope

The scope of this requirements specification includes:

a. The implementation of a system that allows for the collection of diver observation surveys, either at the point of the catch (on the water), or after the fact.
b. The design, and development of a database for storage of survey responses.
c. The ingestion of additional, defined data sources, in MS SQL databases
d. Exporting of data; in a CSV format.
e. The development of simple dashboards using BI tools. Diver, Industry Executive Officer of each fishery, government departments.
f. Reporting for industry purposes; in a PDF format.
g. Coverage for locations and responses, in VIC, NSW, SA (1 location), WA (1 location).

The scope of this requirements specification does not include the following. However, they are potential requirements as this platform evolves.

a. The design, and development of a data warehouse.
b. The provision of business intelligence and advanced analytics.
c. Sentiment analysis or other analysis of unstructured text responses.

2. Requirements

2.1 Overall description

There are 2 components to the system:

a. The diver observation survey which is a lightweight survey application which allows divers to make observations about abalone stock levels.
b. The diver observation server which stores the collated survey responses and combines this with data obtained from other sources (in MS SQL databases).

2.2 Product features

Product functional requirements are listed using the MoSCoW* method for feature prioritization.

Note: A supplier workshop will be conducted to review these details and response to any queries or clarifications.

2.2.1 Diver Observation Survey

The major features of the diver observation survey are as follows:

Must Have	1. The ability to enter survey responses both from mobile devices such as phones or tablets (e.g., when on the water), and from desktop devices. 2. Mobile first design. A system that makes survey responses easy to do on a mobile device increases the chances that abalone observations will be made closer to the point/time of catch. 3. Require users to login so observations, and profiles can be linked to specific users. 4. Online and Offline support, i.e., allowing for usage where mobile/Wi-Fi coverage does not exist. 5. Survey timestamping 6. Pre-populated fields and dropdowns depending on diver's fishery. E.g.: 6.1. Species 6.2. Spatial Management Units (SMUs) 6.3. Reef Codes Note: There will be a maximum of 10 fisheries
Should Have	1. Preference is for a progressive web app, i.e., allowing users to bookmark the survey page on their mobile phones, and minimising reliance on the App Store and Play Store. 1.1. Note: Application could also be accessed from a link in the eCatch** application 2. Input validation to ensure data integrity (e.g., not being able to enter a survey response for a date in the future).
Could Have	1. Option for A/B testing of new questions on the survey 2. Geo-location tagging.

* Ref: "MoSCoW Prioritization (11.1.2.2)" *A Guide to the Business Analysis Body of Knowledge* (3 ed)
** Ref: VFA factsheet for e-catch: https://bit.ly/2ZMwgLY.

2.2.2 Diver Observation Server

The major features of the diver observation server are as follows:

Must Have	1. A cloud-based solution 2. The ability to integrate data from other sources, which will be in MS SQL format including: 2.1. Fisheries data (catch data) 2.2. Location tracking data sourced from Inshore Vessel Monitoring System (iVMS from Succorfish). 2.3. Fish length data 3. Integration with business intelligence platform to deliver dashboards
Should Have	1. Ability to store metadata from responses including but not limited to: 1.1. Time 1.2. Location

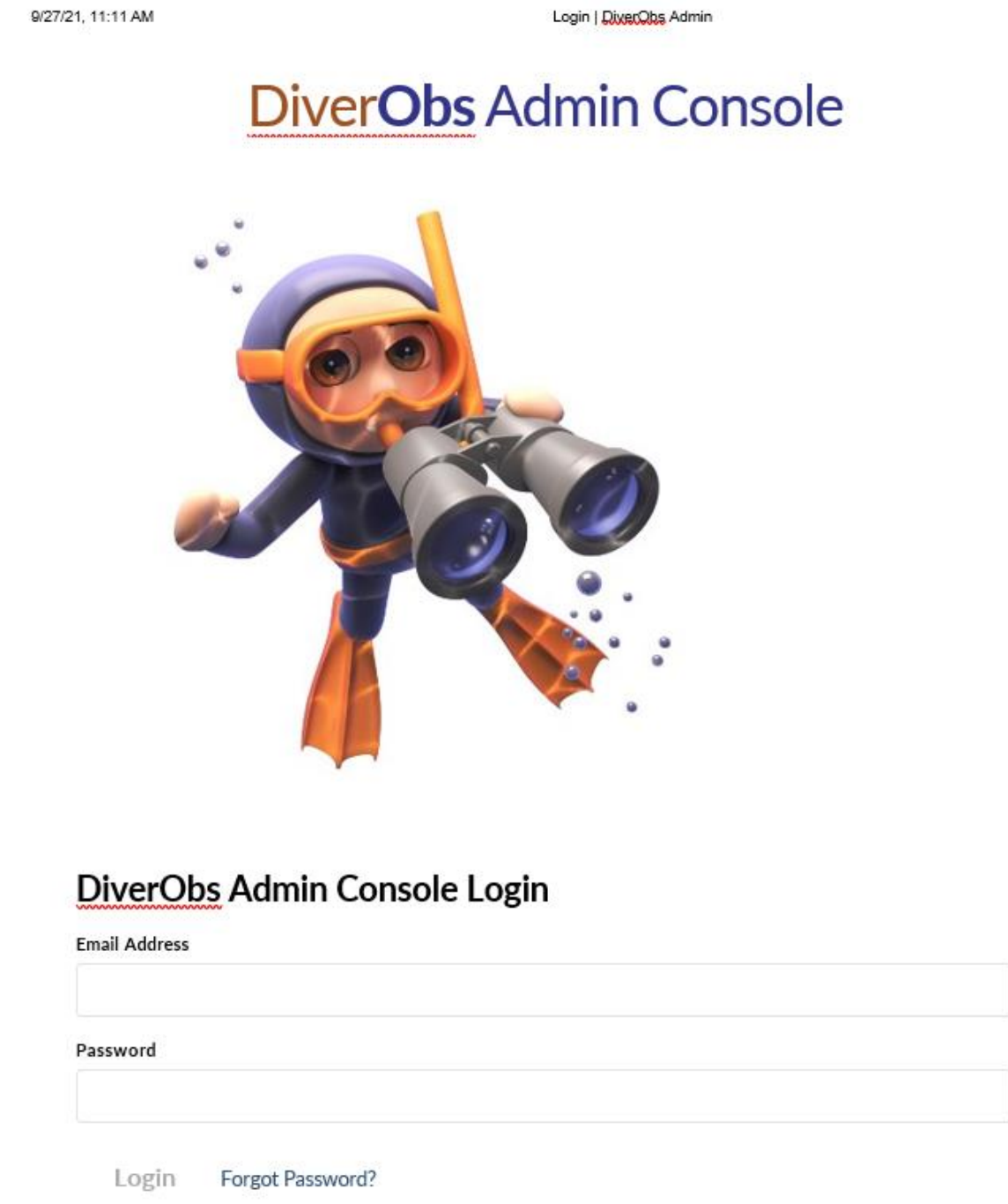
2.3 Non-functional requirements

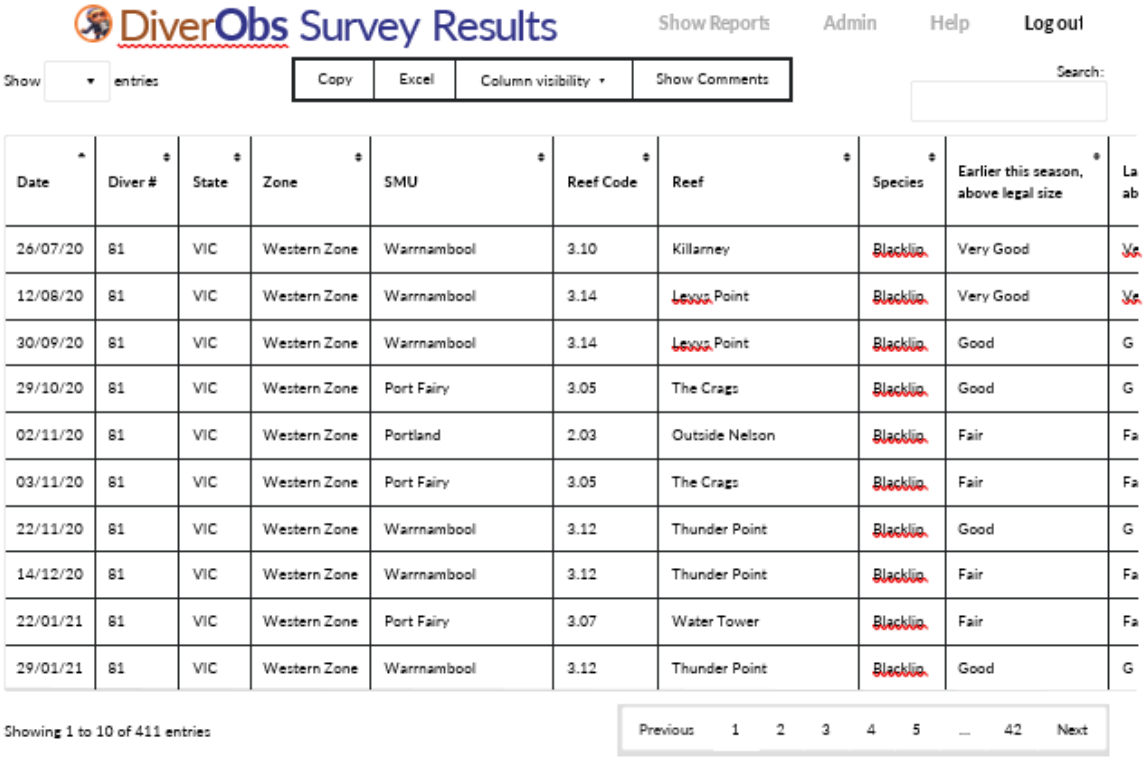
Key non-functional requirements for the system are as follows:

Information Security	1. Cloud platform has appropriate information security compliance, e.g., from Cloud Security Alliance. 2. Government approved, i.e., noting that some users of this system will be government users (both state and federal). 3. Protection of any personally identifiable information (PII), with provisions for the notification of notifiable data breaches. 4. Identity and access management for all users and the provision of role based access control. 5. Appropriate provisions for disaster recovery and the backup of stored data.
Performance	1. Maximum of 2000 milliseconds to open survey on a mobile device (phone or tablet). 2. Maximum of 1000 milliseconds to submit survey once completed – in both online and offline modes.
Accessibility	1. Accessibility is primarily focused on: 1.1. Readability of the survey, i.e., allowing for increase in survey font size without overly impacting the user experience. 1.2. Colour contrasts on survey page, i.e., allowing for usage in situations where lighting maybe less than ide

Appendix 6

Admin console





DiverObs Survey Results

Show Reports Admin Help Log out

Show entries

Copy Excel Column visibility Show Comments

Search:

Date	Diver #	State	Zone	SMU	Reef Code	Reef	Species	Earlier this season, above legal size	La ab
26/07/20	81	VIC	Western Zone	Warrnambool	3.10	Killarney	Blacklip	Very Good	Ve
12/08/20	81	VIC	Western Zone	Warrnambool	3.14	Lewis Point	Blacklip	Very Good	Ve
30/09/20	81	VIC	Western Zone	Warrnambool	3.14	Lewis Point	Blacklip	Good	G
29/10/20	81	VIC	Western Zone	Port Fairy	3.05	The Crags	Blacklip	Good	G
02/11/20	81	VIC	Western Zone	Portland	2.03	Outside Nelson	Blacklip	Fair	Fa
03/11/20	81	VIC	Western Zone	Port Fairy	3.05	The Crags	Blacklip	Fair	Fa
22/11/20	81	VIC	Western Zone	Warrnambool	3.12	Thunder Point	Blacklip	Good	G
14/12/20	81	VIC	Western Zone	Warrnambool	3.12	Thunder Point	Blacklip	Fair	Fa
22/01/21	81	VIC	Western Zone	Port Fairy	3.07	Water Tower	Blacklip	Fair	Fa
29/01/21	81	VIC	Western Zone	Warrnambool	3.12	Thunder Point	Blacklip	Good	G

Showing 1 to 10 of 411 entries

Previous 1 2 3 4 5 ... 42 Next

DiverObs Report List

Home Log out

CZ – Diver Obs Survey Summary Report
CZDvrObsSummary.html (Updated 6 days ago)

EZ – Diver Obs Survey Summary Report
EZDvrObsSummary.html (Updated 6 days ago)

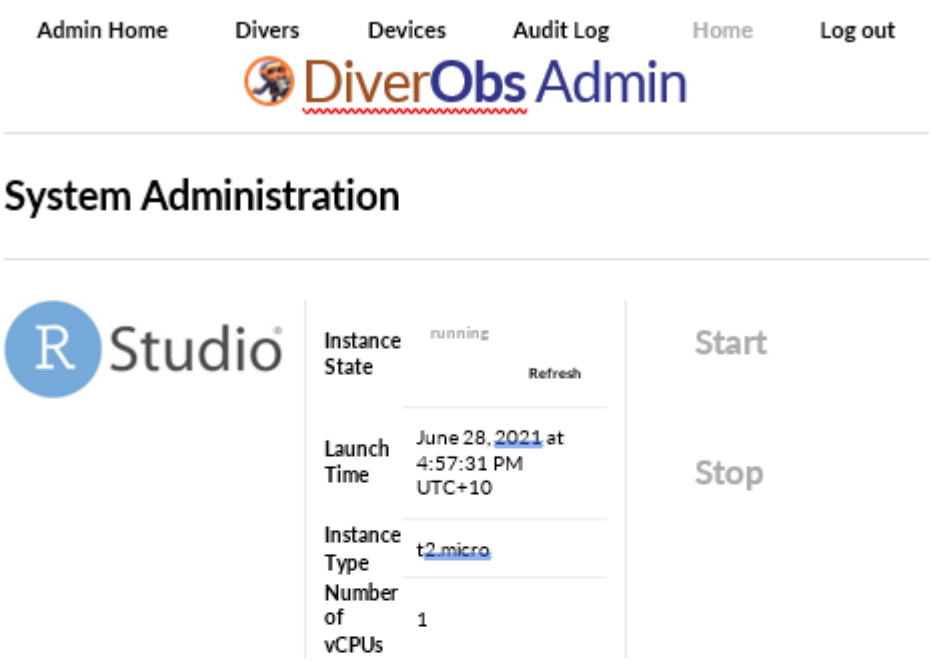
NSWZ – Diver Obs Survey Summary Report
NSWZDvrObsSummary.html (Updated 6 days ago)

WZ – Diver Obs Survey Summary Report
WZDvrObsSummary.html (Updated 6 days ago)

To Print a Report:

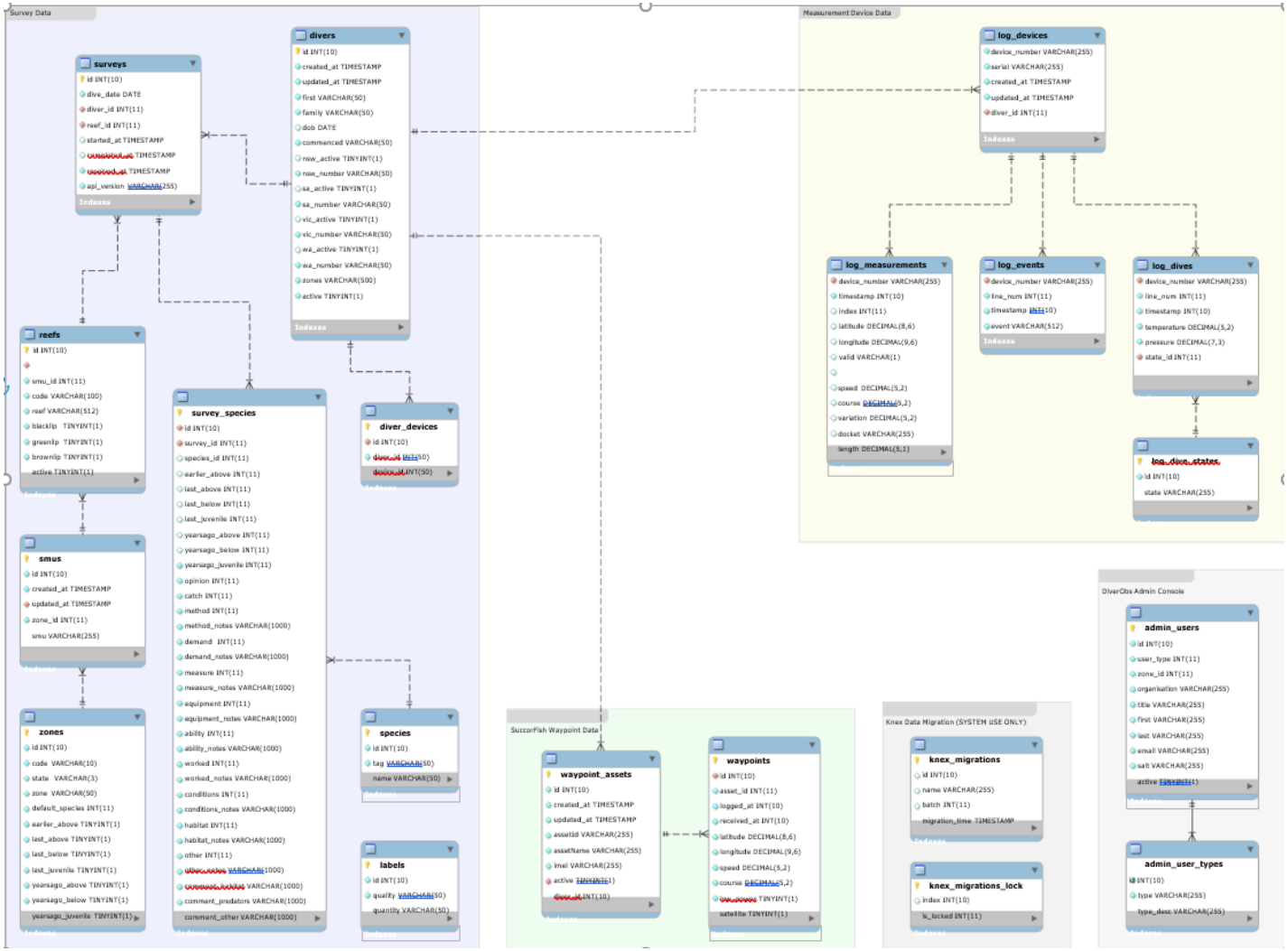
Open the report and press the **<CTRL>+<P>** keys together.

<Command>+<P> on an Apple.


Admin Home
Divers
Devices
Audit Log
Home
Log out
DiverObs Admin
System Administration
RStudio
Instance State
running
Refresh
Start
Launch Time
June 28, 2021 at 4:57:31 PM UTC+10
Stop
Instance Type
t2.micro
Number of vCPUs
1
41 ACTIVE DIVERS
410 SURVEYS
13.82°C AVERAGE WATER TEMPERATURE
A DAY AGO MOST RECENT LOGGER
A FEW SECONDS AGO MOST RECENT WAYPOINT

Appendix 7

Schematic of Database



Appendix 8

Interim review of the suitability and useability of the survey

Technical Review (Has the 'Diver Observation System met the design brief).

Requirement	Outcomes
DIVER OBSERVATION SURVEY APP (PWA)	
Offline & online functionality	Achieved through incremental development
Multiple device compatibility	Achieved: IOS, Android, phone, tablet & desktop compatible.
Mobile first design	Achieved: A mobile-first progressive web app (PWA) was developed and rigorously tested on a variety of handsets (iPhone and Android)
User Experience (UX), Maximise readability of the survey	Achieved: The survey design was iterated over many times, and numerous design solutions were trialled. To maximise readability of the survey, a custom left-to-right strength-of-relationship scale was designed to give a clear pictorial indication. The keywords and species of abalone were also highlighted to allow for quick parsing of the questions. Reef, SMU and Zone data is stored in the app, and favourite or frequently dived reefs are presented at the top of the reef list to allow for rapid data entry.
Minimise the number of clicks/touches	
Pre-populate fields & dropdown lists based on the Divers fishery, SMUs & Reef codes.	
User Log-in	Not Implemented: It was deemed unnecessary to make the divers log in to the app. The app does not retrieve any data from the server, and only very basic demographic information is stored on the phone. All users can protect their data using standard mobile phone security.
Input validation	Achieved: Survey responses are structured such that the user can only provide input
Survey timestamping	Achieved: A timestamp is recorded when the survey is started, completed, and when it is received by the server.
Completion duration log	Average time to complete a survey = 3 minutes, 1 second 36% of surveys are completed in less than 2 minutes 86% of surveys are completed in under 5 minutes
Geo-location tagging	Not Implemented: Geolocation tagging of the survey response was not implemented for several reasons: 1. Under the privacy policy all metadata collected must be disclosed the user, 2. Additionally, the user must give explicit permission to the app to access the location data, 3. On a PWA, the data supplied comes from the location services (such as Wi-Fi signals and mobile tower distance) and not directly from the GPS. In most use cases, this is an acceptable trade-off between accuracy and power consumption. However, given the remote locations of the divers, a very high level of inaccuracy could be expected. Therefore, given potential user resistance to suppling the information coupled with poor accuracy of data, it was

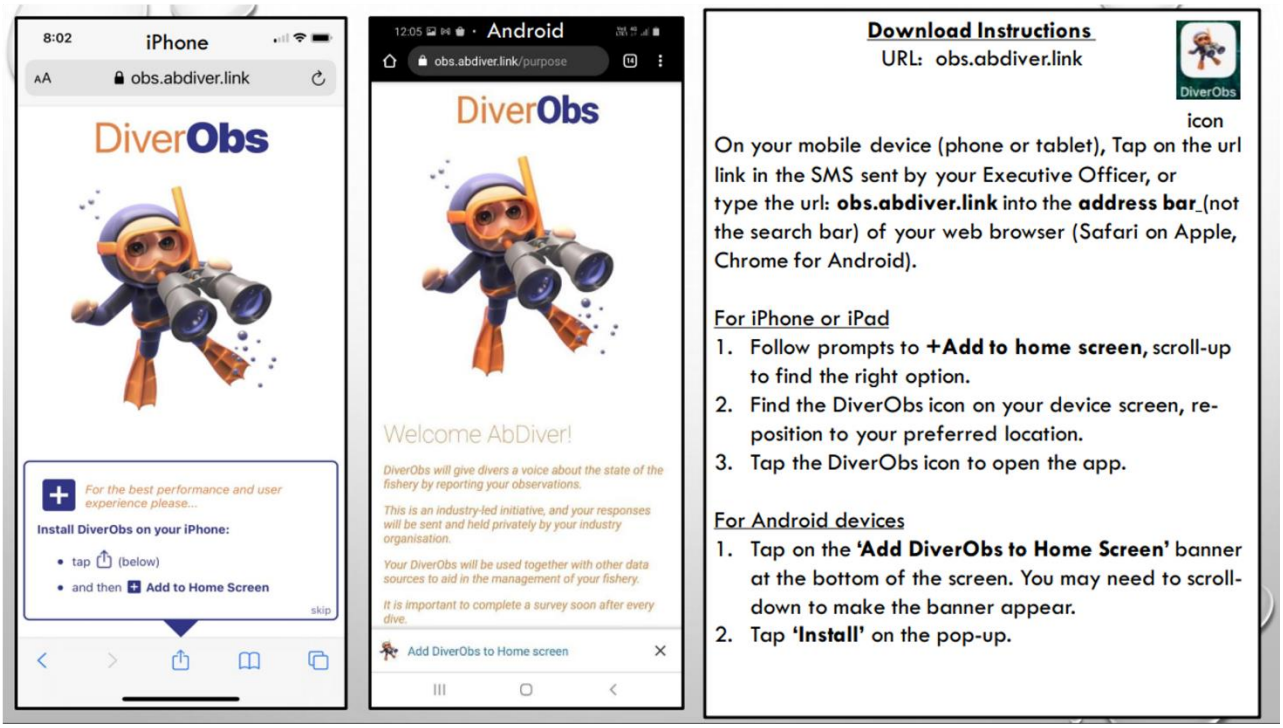
	decided not to implement geo-location tagging of the survey results.
Maximum 2000 milliseconds to open survey on mobile device	Using current generation mobile device, the app takes less than 200 milliseconds to open if running in the background. It takes approximately 900 -1100 from a cold start (not running in background).
Maximum 1000 milliseconds to submit survey once completed in both online & offline mode.	The app UI is updated immediately upon submission. Data transfer is sent or queued for later transmission in the background.
Link from E-Catch & other government applications	NOT Achieved: Steering committee decision not to pursue.
DATABASE	
Security compliance	Access to the Database back end is IP limited and encrypted.
Disaster recovery & backup	Automated backups (rolling 7-day snapshots), with a 10 minute restore window. Manual monthly backups to encrypted AWS S3 Storage (6-month retention). Software is version controlled (git) and stored in AWS CodeCommit. Manual monthly "image" creation of the production instance (3-month retention).
Cost effectiveness	Smallest available instance, CPU average load 3%
Notifiable data breaches	None.
ADMINISTRATION CONSOLE	
A restricted-access web app for the maintenance and evaluation of survey results.	In Progress: the console is deployed to a staging server for evaluation and development
Permission level access	In Progress: there are currently to levels of access, SYSTEM users and EO users. SYSTEM users can perform maintenance tasks on the data (all changes will be tracked and auditable). EO users have read-only access for data pertaining only to their fishery/zone.
View, Filter & export in CSV	In Progress
Basic reports	In Progress
OTHER	
Integration with other data sources	Achieved: NodeJS back-end running on AWS instance inserts data from other industry sources into MySQL database
Patches & Bug fixes	Database and EC2 instances patches applied.
Down time	100% uptime to date
Technical support issues	No issues open currently

Appendix 9

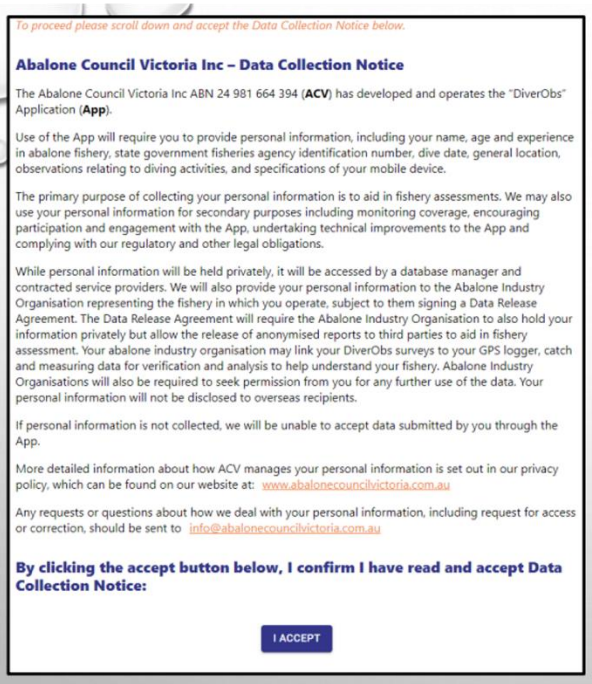
DiverObs App User Guidelines

P1

P2



P3



To proceed please scroll down and accept the Data Collection Notice below.

Abalone Council Victoria Inc – Data Collection Notice

The Abalone Council Victoria Inc ABN 24 981 664 394 (**ACV**) has developed and operates the "DiverObs" Application (**App**).

Use of the App will require you to provide personal information, including your name, age and experience in abalone fishery, state government fisheries agency identification number, dive date, general location, observations relating to diving activities, and specifications of your mobile device.

The primary purpose of collecting your personal information is to aid in fishery assessments. We may also use your personal information for secondary purposes including monitoring coverage, encouraging participation and engagement with the App, undertaking technical improvements to the App and complying with our regulatory and other legal obligations.

While personal information will be held privately, it will be accessed by a database manager and contracted service providers. We will also provide your personal information to the Abalone Industry Organisation representing the fishery in which you operate, subject to them signing a Data Release Agreement. The Data Release Agreement will require the Abalone Industry Organisation to also hold your information privately but allow the release of anonymised reports to third parties to aid in fishery assessment. Your abalone industry organisation may link your DiverObs surveys to your GPS logger, catch and measuring data for verification and analysis to help understand your fishery. Abalone Industry Organisations will also be required to seek permission from you for any further use of the data. Your personal information will not be disclosed to overseas recipients.

If personal information is not collected, we will be unable to accept data submitted by you through the App.

More detailed information about how ACV manages your personal information is set out in our privacy policy, which can be found on our website at: www.abalonecouncilvictoria.com.au

Any requests or questions about how we deal with your personal information, including request for access or correction, should be sent to info@abalonecouncilvictoria.com.au

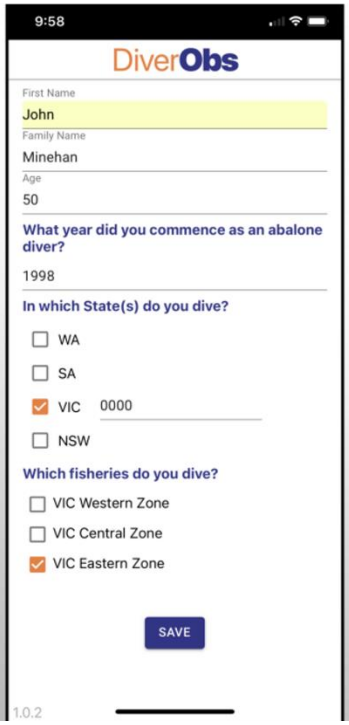
By clicking the accept button below, I confirm I have read and accept Data Collection Notice:

I ACCEPT

Data Collection Notice

- When the Diver taps on the DiverObs icon for the first time, The Data Collection Notice will be presented.
- The proceed please scroll down and tap on the I ACCEPT
- The ACV privacy policy can be viewed on the ACV website: www.abalonecouncilvictoria.com.au
- The ACV privacy policy can also be viewed at any time from the DiverObs app menu bar.

P4



Settings

- The settings screen appears once the diver has accepted the Data Collection Notice, upon first use of the App.
- Settings are remembered the next time the App is opened, but can be changed later from the menu button, top right-hand corner of the **Home screen.**
- The App relies on the security features of the mobile device, no separate password is required.
- Age - response is optional but encouraged.
- What year did you commence as an abalone diver? - response is optional but encouraged.
- The diver should select all the States and fisheries in which he/she operates.
- Tap SAVE

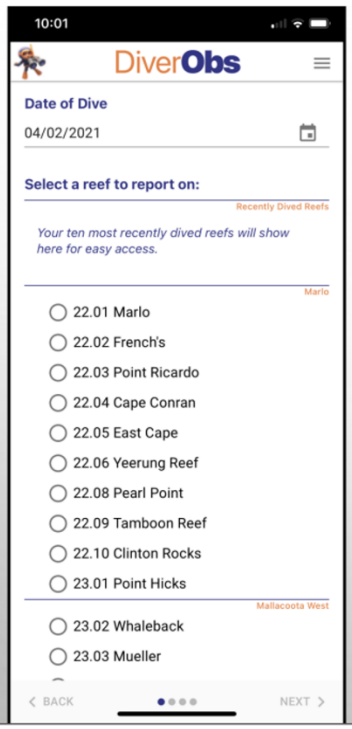
P5

Home Screen

- The Home screen is the first screen the diver sees upon subsequent use of the app.
- Instructions to the diver are provided underneath the calendar.
- The calendar can be scrolled to select the date to report on. Dates into the future are not able to be selected.
- This is the menu bar in the top right- hand corner that provides access to the settings, privacy policy and help screens.

P6

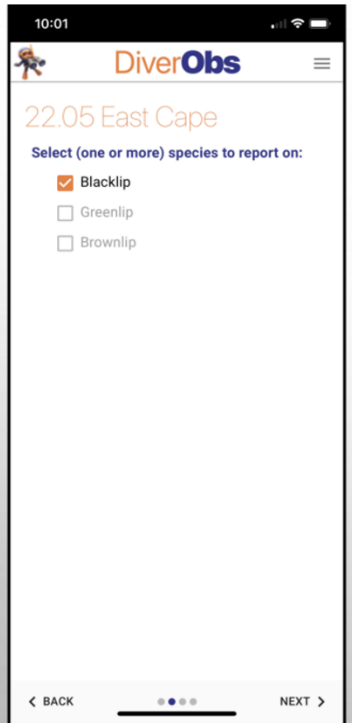
P7



Select Reef

- Date of Dive can be changed by tapping the calendar icon.
- The ten most recently dived reefs (for which a survey has been completed) are listed at the top. This will make it quicker to find & select favourite reefs.
- Reefs are grouped by SMU/SAU and listed geographically.
- You can only select one reef at a time.
- Complete the survey for the first reef you fished then start again from the Home screen to report on subsequent reefs.
- Tap BACK & NEXT to progress through the survey once required responses are made.
- To quit the survey at any time, Tap Menu>Home>Abandon.

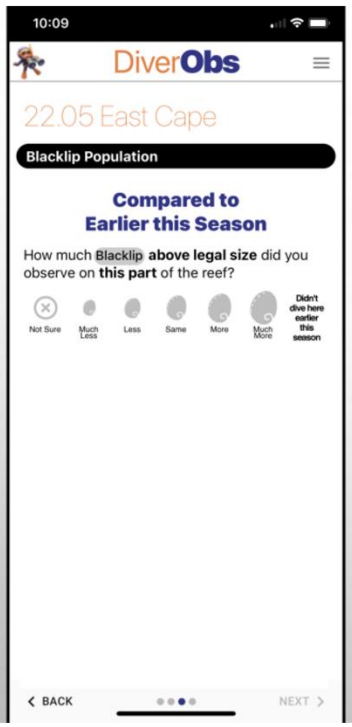
P8



Select Species

- This screen only appears if there is more than one species available for harvested from the selected reef in accordance with information provided by the industry organisation.
- You may select one or more species to report on.
- All survey questions will be repeated separately of each species selected.

P9



Compared to Earlier this Season

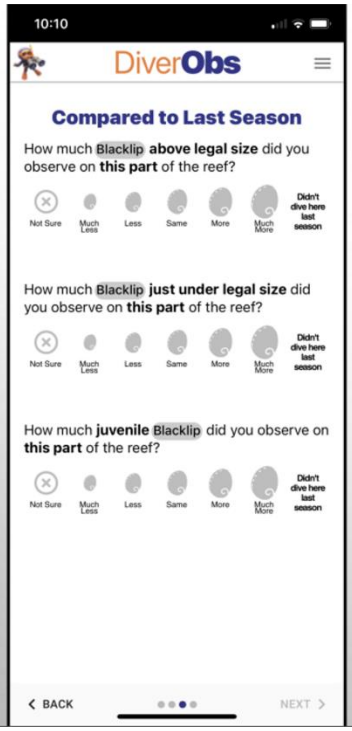
The survey asks you to compare your observations on this dive day to earlier time periods when you dived in the same area.

For example, if you observed more abalone on this dive day than you did during the comparison period, your response to the question should be more.

- **Earlier this season -** means earlier this fishing quota year.
- **Above legal size –** means above the legal size that applies to the reef area you dived.
- **This part of the reef** - means the same general area that you previously dived.
- Scroll-up to answer all survey questions.

  Note: The app does not have blank spaces; this is for demonstration purposes only.

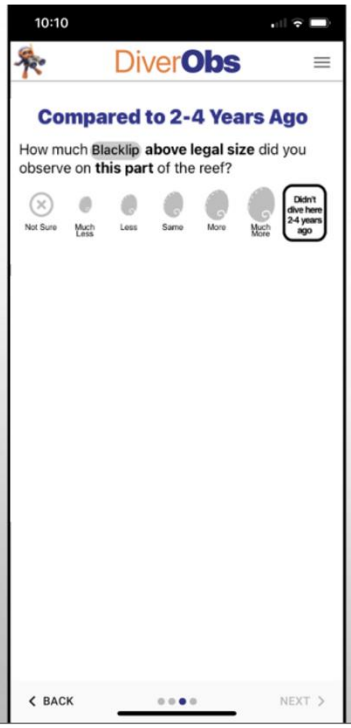
P10



Compared to Last Season

- **Last Season** - means the previous fishing quota year.
- **Just under legal size,** - means roughly 0-20 mm under the legal size, or the abalone you expect to come into the fishery in the next 1-2 years.
- **Juvenile** - means abalone more than 20 mm below the legal size.

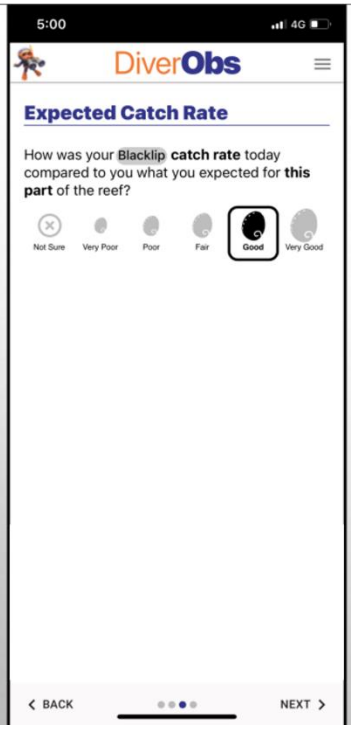
P11



Compared to 2-4 Years Ago

- **2-4 Years Ago,** means 2-4 fishing quota years before the current fishing quota year.
- This question is asking about the longer-term trend of abalone abundance.
- If you are operating in NSW or Victoria, you will just get one question about legal size abalone for the 2–4-year time period.
- If you are operating in SA or WA, you will see all three questions, above legal size, just under legal size and juveniles.

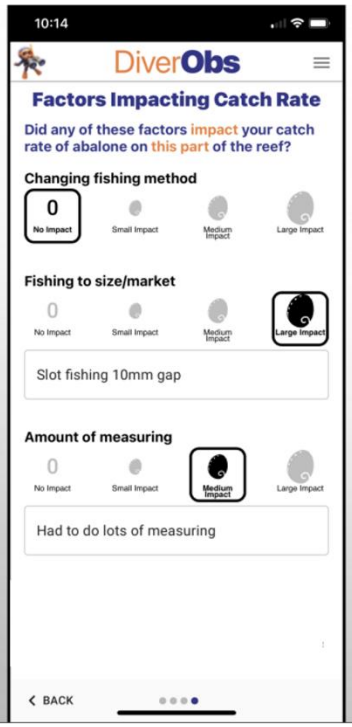
P12



Expected Catch Rate

- **Expected Catch Rate,** means the kg per hour you expected for the reef area given the time of year.
- This is a non-trend question.

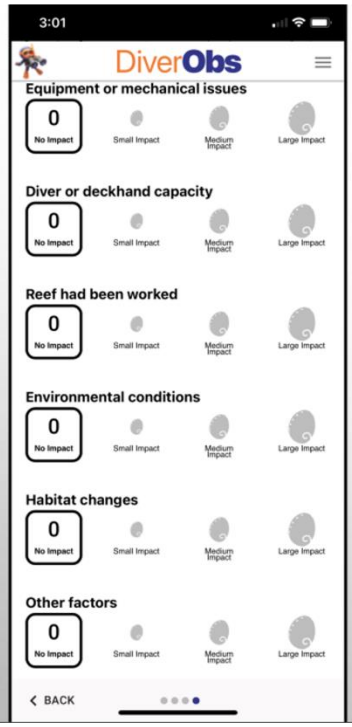
P13



Factors impacting catch rates

- What factors, other than stock abundance, had an impact on your catch rate and to what extent.
- The response defaults to 'No Impact'. If none of these factors had an impact on catch rates, the diver can simple scroll-up to the next questions.
- If 'Large impact' or 'Medium impact' is selected, a pop-up box appears asking for further typed explanation which is optional.

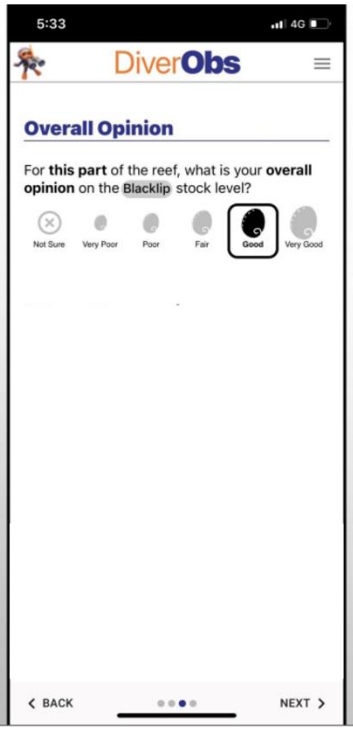
P14



Factors impacting catch rates – continued

- Here are more factors that may have impacted your catch rate.
- Use 'Other factors' to report on something not listed.
- Scroll-up to get to the next question.

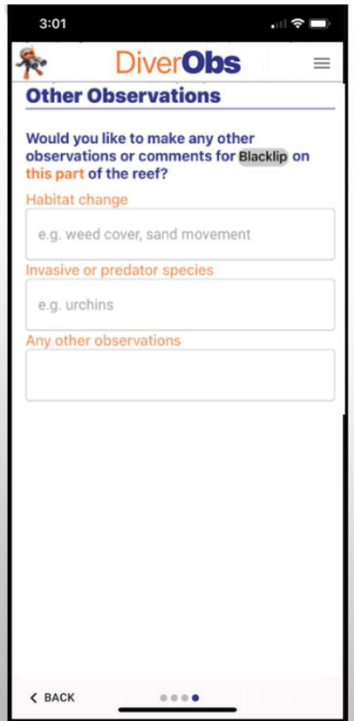
P15



Overall Opinion

- **Overall Opinion,** means your opinion on the current state of the abalone stocks.
- The Overall Opinion, is a non-trend question about the status of the abalone stocks.
- You may consider that the abalone abundance may be high or low, regardless of wether it is increasing or decreasing.

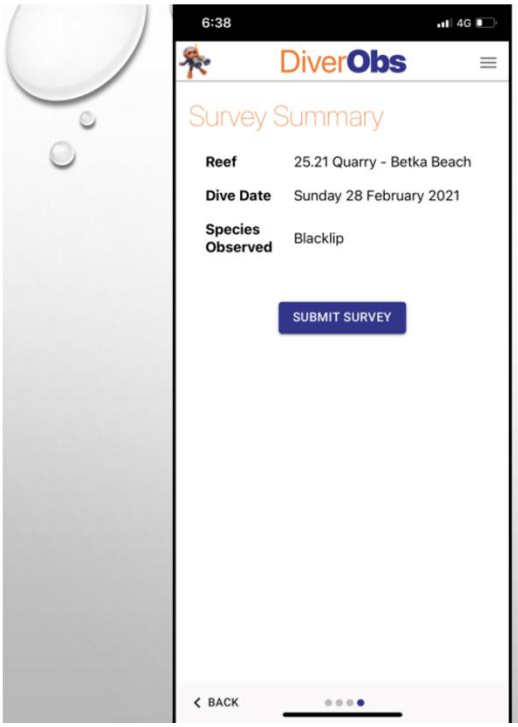
P16



Other Observations

- Selecting a text box, pops up the keyboard for long answer text comment.

P17



Submit

- Here is a brief summary of your survey.
- Tap SUBMIT SURVEY
- Your survey response is stored on your mobile device until phone service is established when it is then automatically uploaded to the DiverObs server.
- You will be taken back to the Home screen from where you can select another dive date or the same dive date to complete a survey for another day or reef.

Appendix 10

Data Collection Trial Plan

Release date

From 1st March 2021, the Diver Observation System will be ready to accept data reported by divers.

Trial Period

From 1st of January to 30th December 2021 data will be collected from divers during the 12-month trial period. The nominated representative of participating industry organisations will be provided with regular reports on diver participation. A six-month (interim) review of suitability and useability of the survey will be conducted. Towards the end of the trial period, the data will be analysed, and a summary (anonymised) report produced to aid in fishery assessment meetings.

For the best experience, please 'install' on your mobile device prior to first use

It is important to instruct Divers to 'Install' the DiverObs app on their mobile device on first use. Then to access the survey from the DiverObs icon on the device home screen thereafter.

1. Please delete any earlier trial versions of the DiverObs app or survey from your phone.

2. Tap on the url link in the SMS sent to you by your Executive Officer, or type the url: **obs.abdiver.link** into the **address bar** (not the search bar) of your web browser (Safari on Apple, Chrome for Android).

3. For iPhone or iPad.

    a. Follow the prompts to **+Add to Home Screen**, scroll-up to find the right option.
    b. Find the DiverObs icon on your device screen, re-position to your preferred location.
    c. Tap the DiverObs icon to open the app.
    d. Scroll-up to read and **ACCEPT** the terms and conditions.
    e. Enter your details on the settings page and tap **SAVE**.
    f. You are now ready to complete your first survey, or swipe up to close the app.
    g. Remember always tap on the DiverObs icon to complete a survey soon after every dive.

4. For Android
    a. Tap on the **'Add DiverObs to Home Screen'** banner at the bottom of the screen. You may need to scroll-down to make the banner appear.
    b. Tap **'Install'** on the pop-up.
    c. Scroll-up to read and **ACCEPT** the terms and conditions.
    d. Enter your details on the settings page then tap **SAVE**.
    e. You are now ready to complete your first survey, or close the app.
    f. Find the DiverObs icon on your device screen, re-position to your preferred location.
    g. Remember always tap on the DiverObs icon to complete a survey soon after every dive.

Diver Training & Support

- The DiverObs app has a help menu with support contact numbers and question guidance.
- The Executive officer is to be the Divers first point of contact for support.

Executive Officer Training & Support

- A User Guide is provided to assist EO's in providing training and support to their divers.
- Regular reports on participation will be provided to enable EOs to drive uptake during this early roll out phase.

- A monthly project update will be provided to the steering committee and industry EOs that includes participation rates across the participating jurisdictions.
- Instructions on how to access the Administration console to obtain reports, shall be provided once the console has been developed.
- For general support please contact John Minehan ph. 0409580782.
- For technical support please contact Duncan Worthington ph. 0431 755497

Database management

SLDigital is providing Database management, hosting and technical support to the project team.

Encouraging participation.

1. The DiverObs App is designed to be easy to access, intuitive to use and quick to complete the survey. The App has a distinctive logo to assist in identification, and promotion.

2. The onus is on the EO's of each industry organisation to drive diver participation in their fishery. The message to divers is that it is a means to have their say and strengthens diver input into the stock assessment process.

3. The DiverObs App allows divers to complete a survey for the current date or any date in the past, however they ought to be encouraged to make it part of their end of the day, post diving work practises.

4. Regular reminders (say monthly) via emails, newsletters, meetings or directly to divers to complete their DiverObs surveys is important to maintaining participation.

5. Educating License Owners about the project (the User Guide may assist) may encourage them to require their divers to complete DiverObs surveys.

6. Seeking to embed the consideration of the DiverObs survey reports into the stock assessment process, such that divers understand the importance of participation.

7. Pursuing key divers to participate and promote participation such that others may follow.

8. Through the (to be developed) Admin Portal, a 'Leader board' report shall be available for your fishery that shows which divers have submitted the greatest number of reports. This report could be used to develop an incentive / rewards scheme. Blacklip wetsuits have offered to supply discount vouchers for this purpose, but you may use any suppliers you choose.

Ownership & Responsibilities

- The ACV continues to develop the tools of the Diver Observation System on behalf of and for the benefit of participating industry organisations. These tools include the DiverObs app, DiverObs Admin Console and Database.
- The FRDC agreement provides that the ownership and responsible for maintenance of the Diver Observation System subject to the Privacy Act resides with the ACV. This is at least until the end of the FRDC agreement and until an alternative arrangement is determined by the project steering committee.
- DiverObs survey data is held securely and privately by the ACV. The data is only accessible to the contracted service provider (SLDigital) and an industry appointed database manager Dr. Duncan Worthington.
- The survey data is provided back to the nominated representative of participating industry organisations in accordance with a signed data release agreement.

Data Access

Survey data will be provided in reports and via the DiverObs Admin Console to the nominated representative of the abalone industry organisation as set out in the table below:

Jurisdiction	Industry Organisation	Person with Access Permission	Email address
NSW	Abalone Council of NSW	Mr. Duncan Worthington	duncan@ambrad.com.au
VIC Eastern Zone	EZAIA	Ms. Helen Jenkins	helen.jenkins202@outlook.com
VIC Central Zone	AVCZ	Mr. Josh Cahill	josh@abalonevictoria.com.au
VIC Western Zone	WADA	Mr. Harry Peters	wada@pipeline.com.au
SA Central Zone	CZAF	Mr. Michael Tokley	michael@strategicmc.com.au
SA Western Zone	AIASA	Dr. Nicole Hancox	eo@abalonesa.com.au
SA Southern Zone	SZAM	Mr. Arthur Martel	Tilanby6@bigpond.com
WA Area 3	AIAWA	Mr. Angus Callendar	eo@icu.org.au

Costs

Whilst the FRDC funding agreement is current (until 31st December 2021), all system development, database management, hosting, technical and user support costs are covered by the project budget. Prior to the conclusion of the project, a business model for the continuation of the DiverObs system beyond the life of the FRDC Agreement will be determined by the Steering committee. At this point in time, it is anticipated that the total running costs of the DiverObs system would be between $2,500 and $5,000 per year to be divided by the number of participating fisheries.

Documentation

1. ACV Data collection notice (DiverObs App) – required to be “Accepted” by the diver prior to completion of the first survey.

2. ACV Privacy Policy – available through settings in the DiverObs App or on the ACV website.

3. A Data Release Agreement shall be required to be signed by each industry organisation to accepts the terms of use of the DiverObs application and survey data, consistent with the collection notice, privacy policy and FRDC funding agreement.

4. DiverObs App User Guide (pdf) – aimed to assist EO’s to provide training & support to divers.

Review

At around 6 months into the Trial Period, an interim review of diver participation, useability of the mobile application, and technical functionality of the Diver Observation System shall be conducted.

Appendix 11

Survey data reporting extract

Diver Observations summary for EZ
obs.abdiver.link

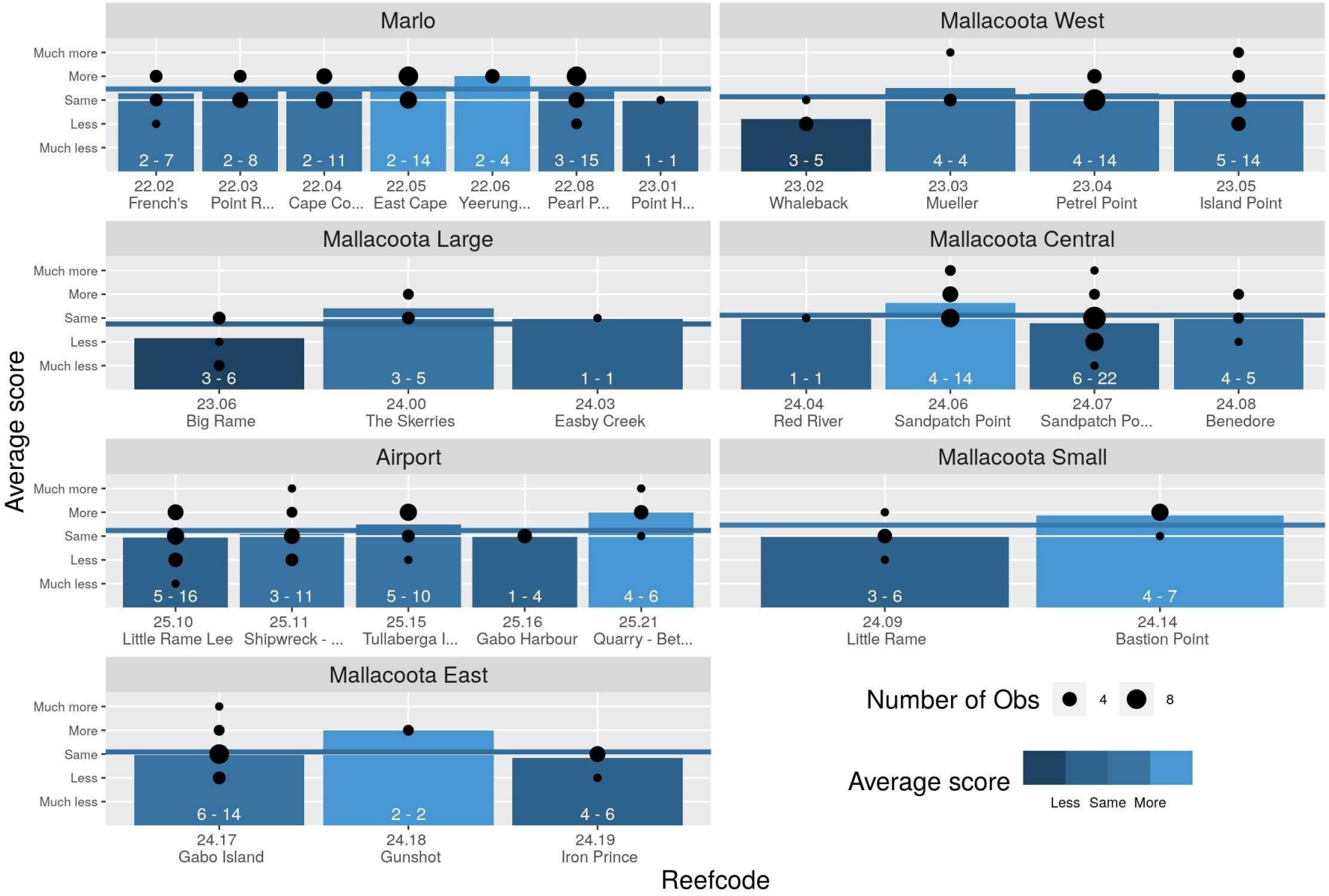
document produced at 10:10, 15 Nov 2021
with 285 surveys completed and last dive on 10 Nov 2021

Graphs are presented with de-identified raw survey data collected by the app and stored in the Project database.
White numbers at the base of bars in graphs show the number of unique divers and surveys completed for each reefcode.
For each SMU, an average score is shown by a blue horizontal line.
As more surveys are completed, trends will be presented through time, and a proportional-odds linear model will be used to standardise data.
A summary of the Survey App is included at the end of this document.
This html document can be printed to a paginated pdf by selecting Print in landscape from your browser.

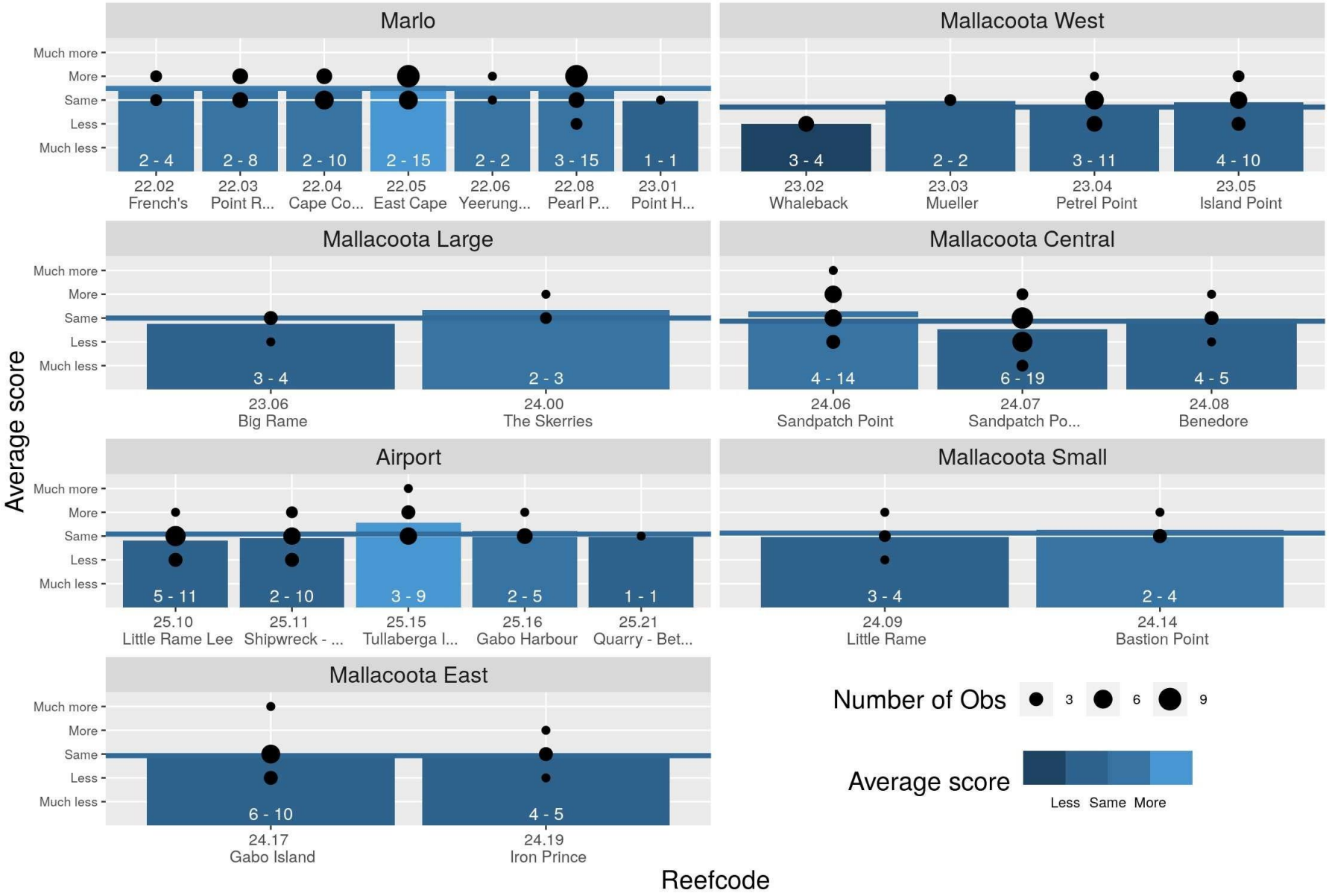
Prepared by ACV for FRDC 2019-038

Click here to go to obs.abdiver.link (http://obs.abdiver.link)

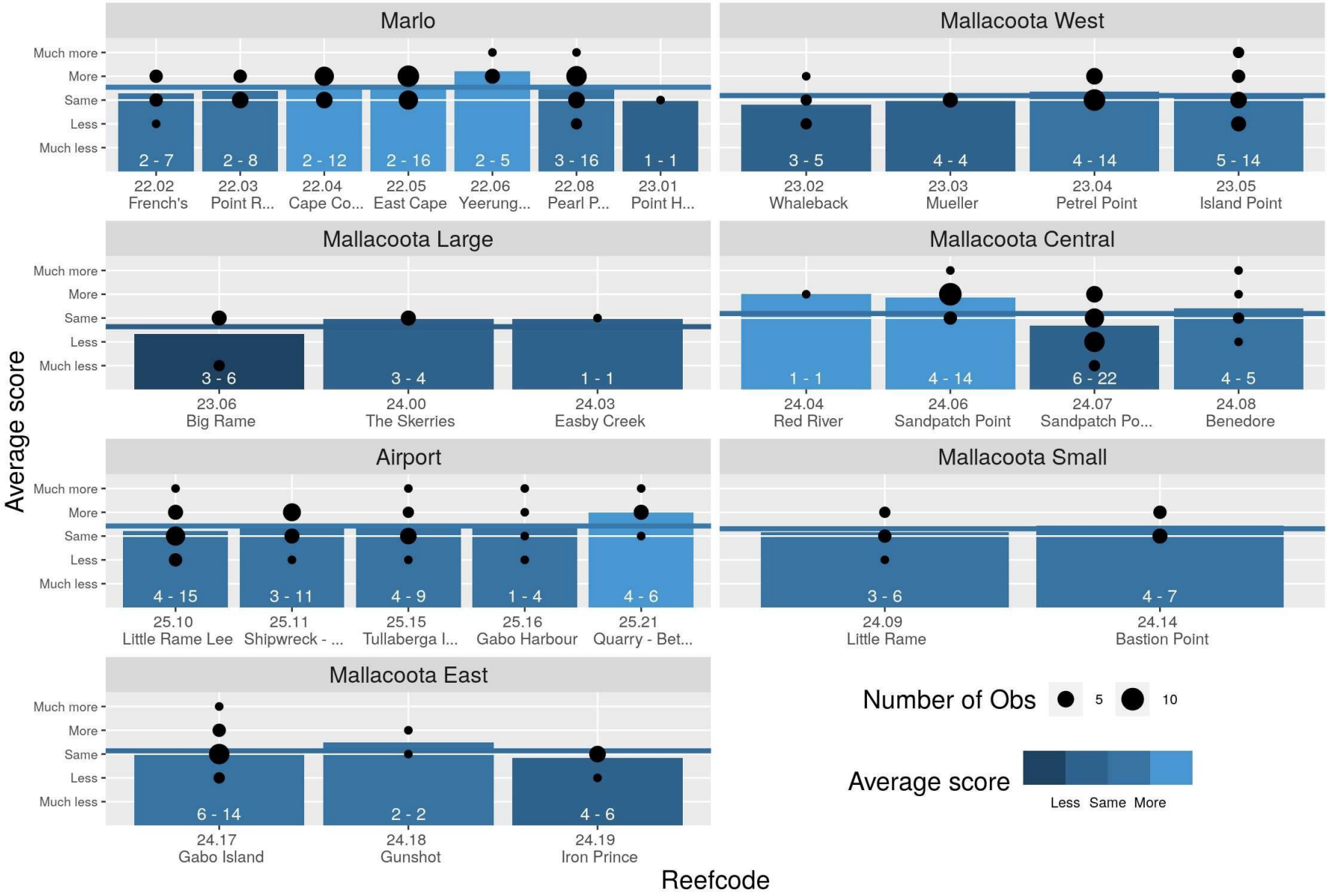
Legals compared to last year



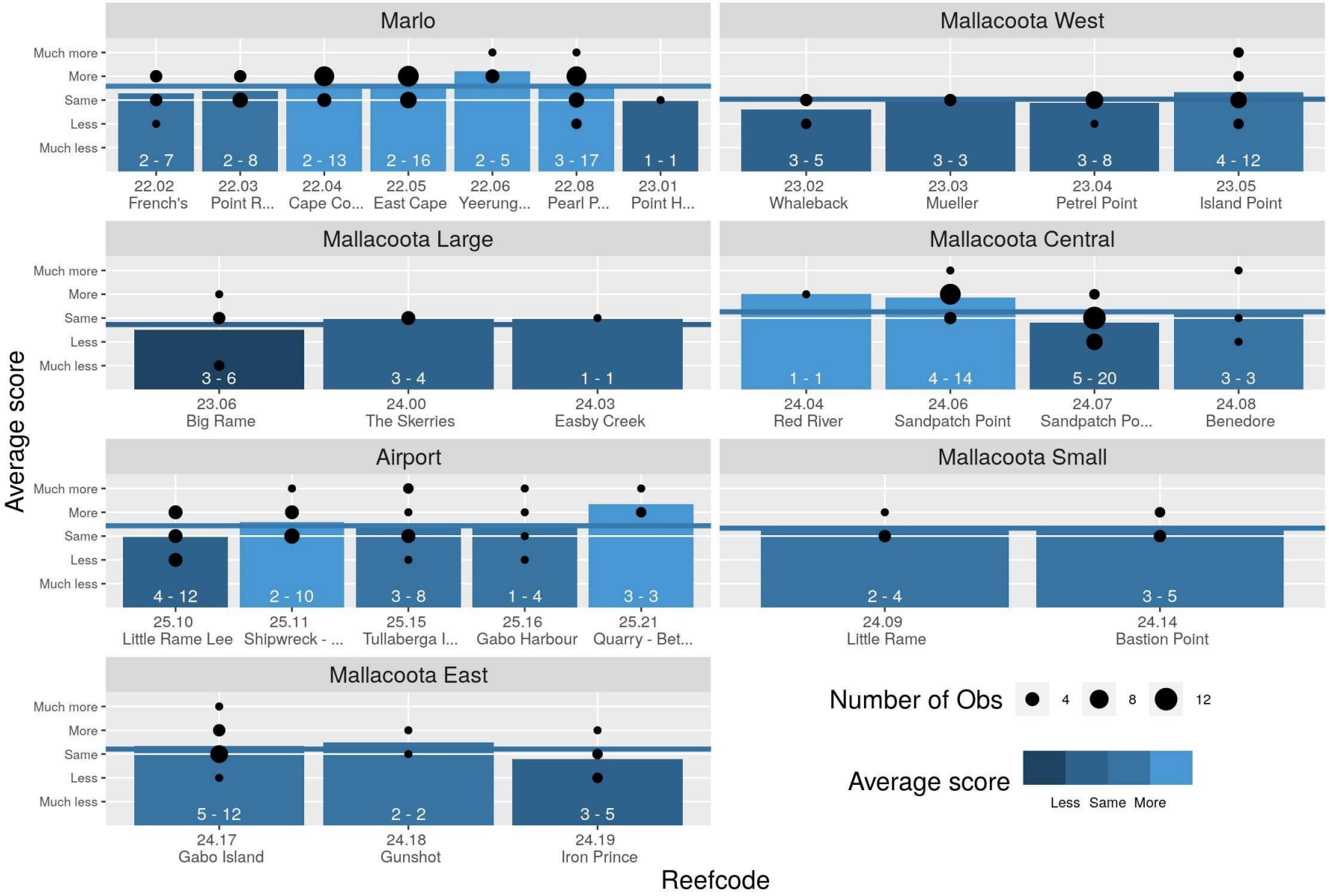
Legals compared to earlier this year



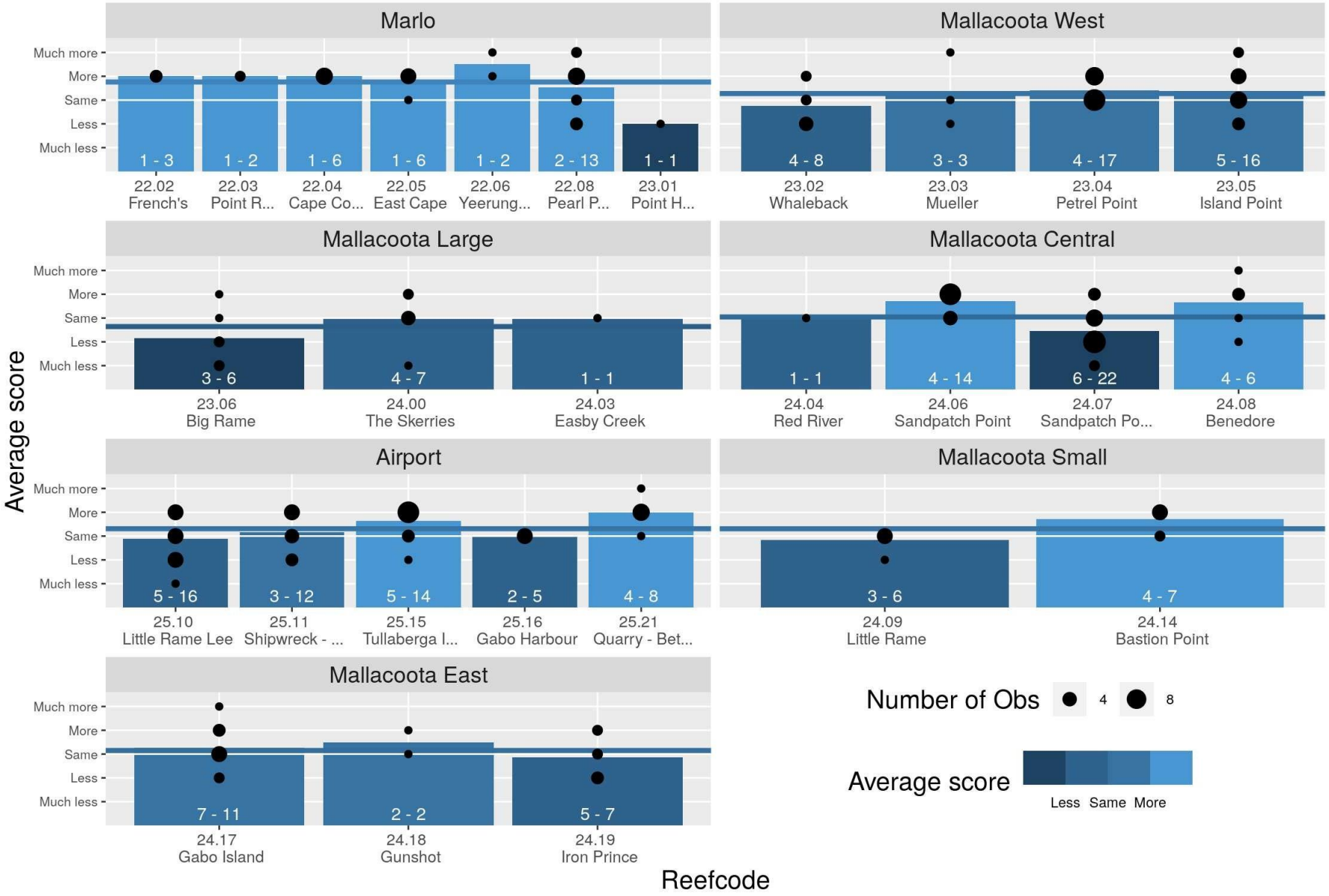
Unders compared to last year



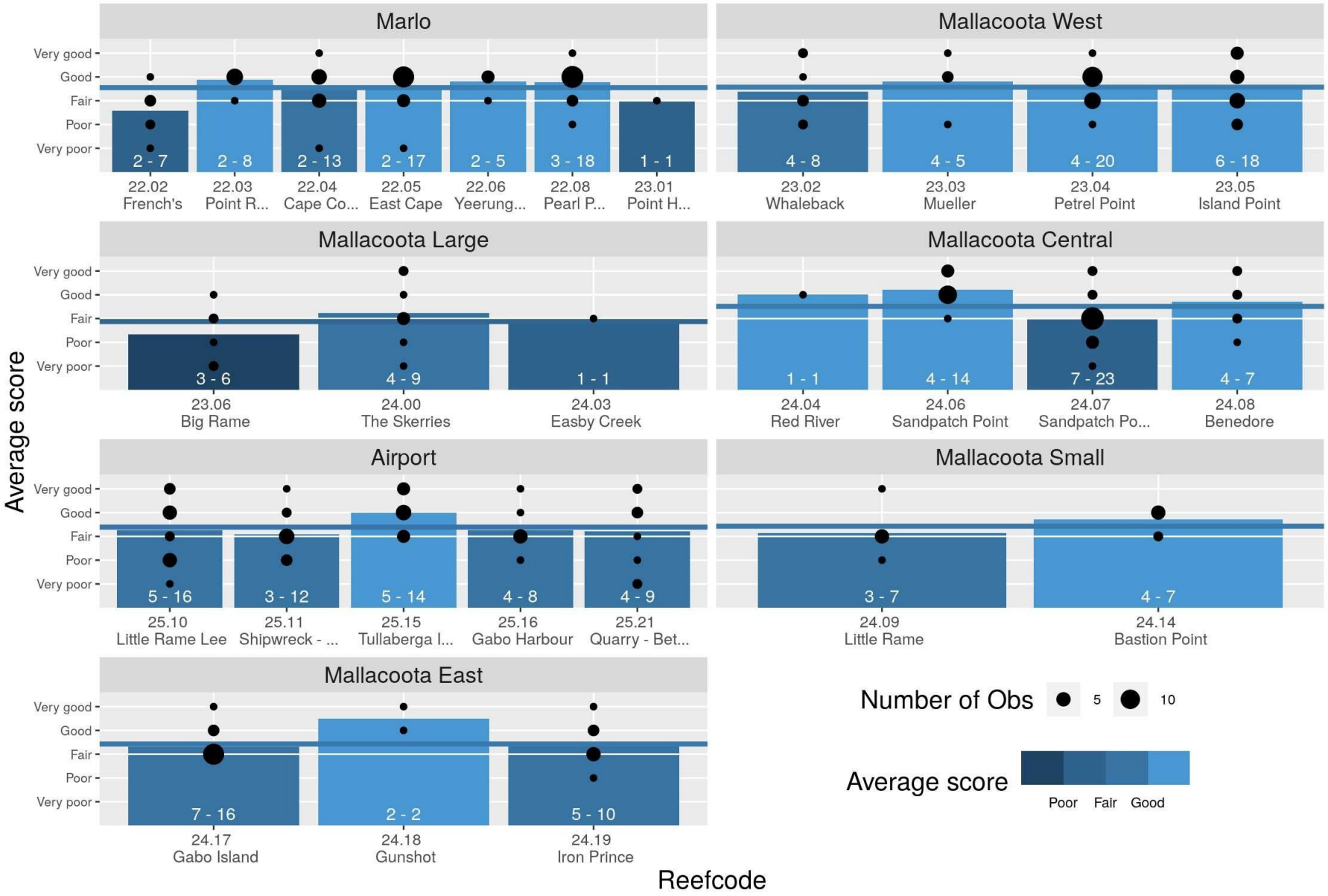
Juveniles compared to last year



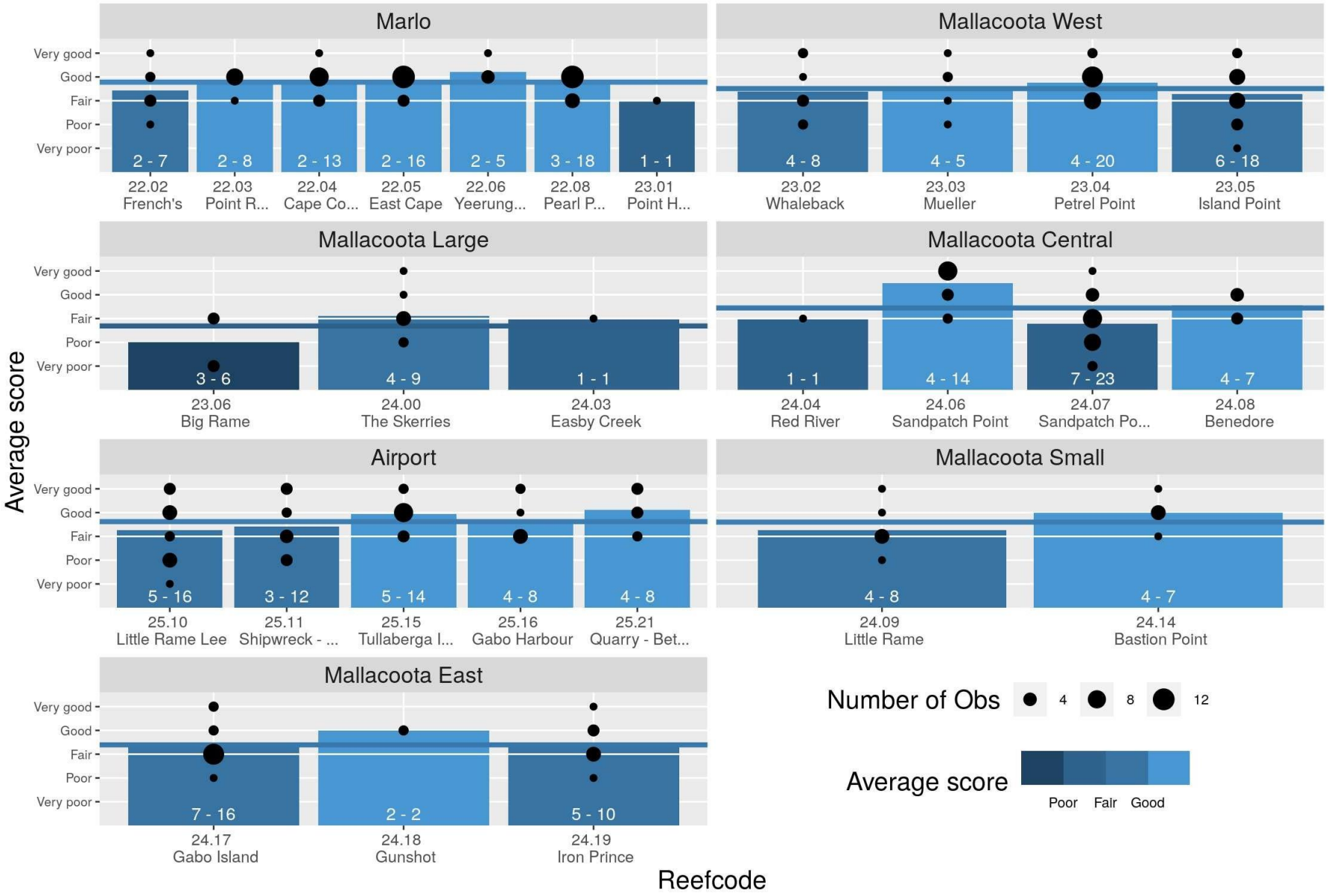
Legals compared to 2-4 years ago



Catch rate compared to expected



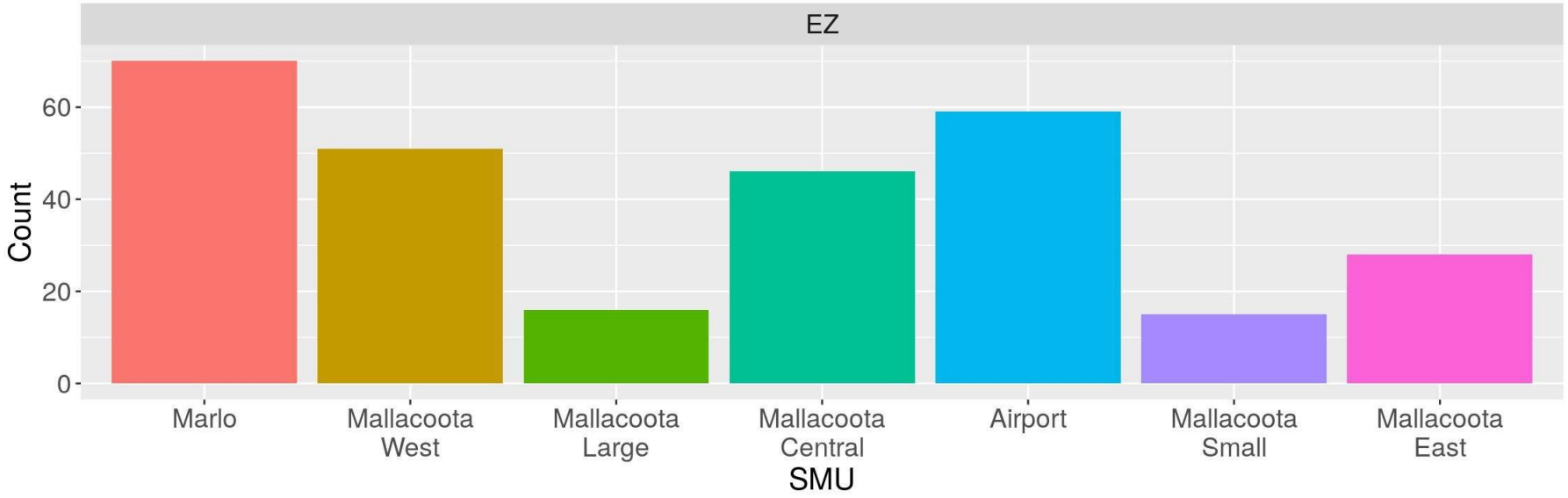
Overall opinion



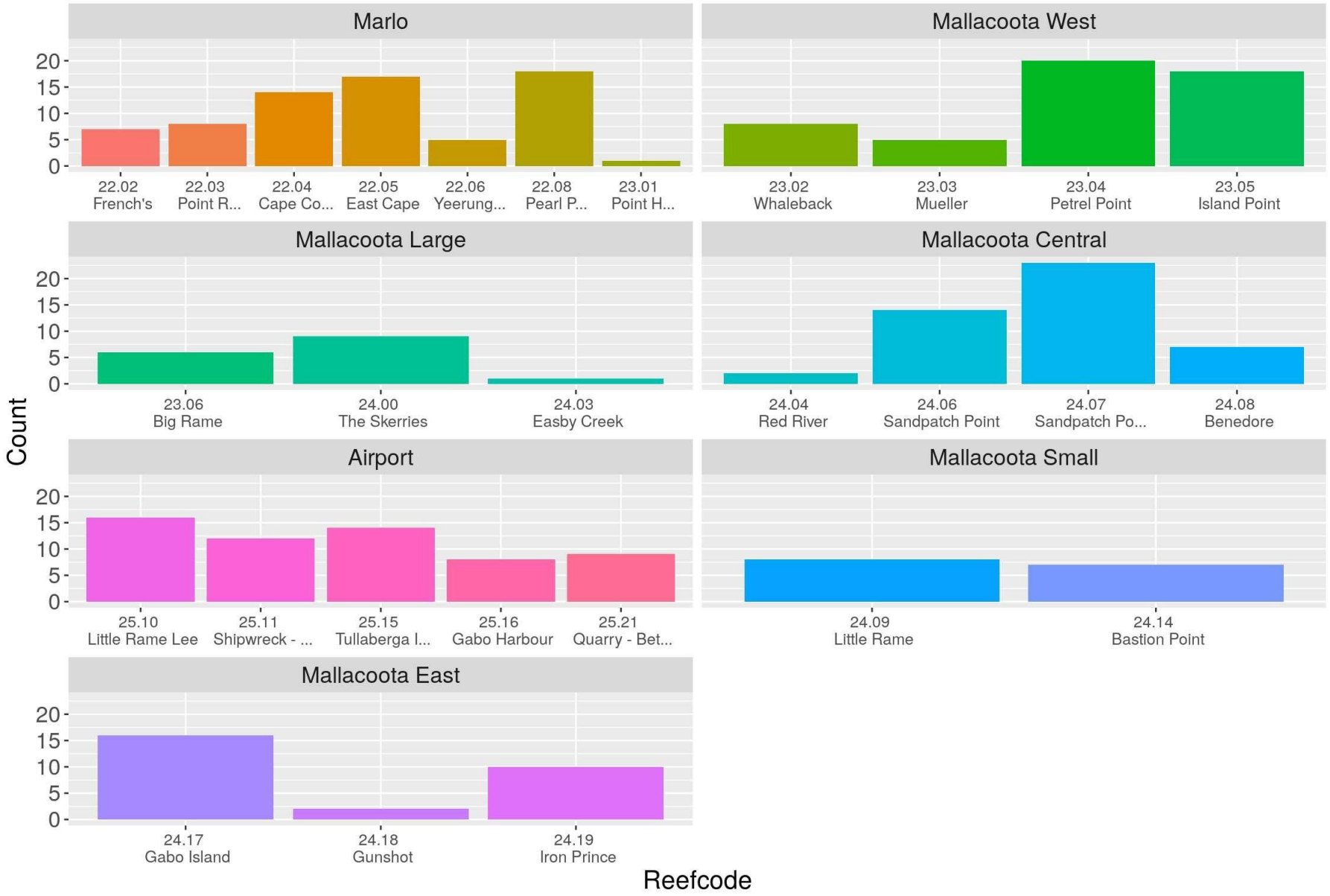
Diver Observations at the scale of SMU
obs.abdiver.link

SMU graphs of stock observations and impacts on fishing.

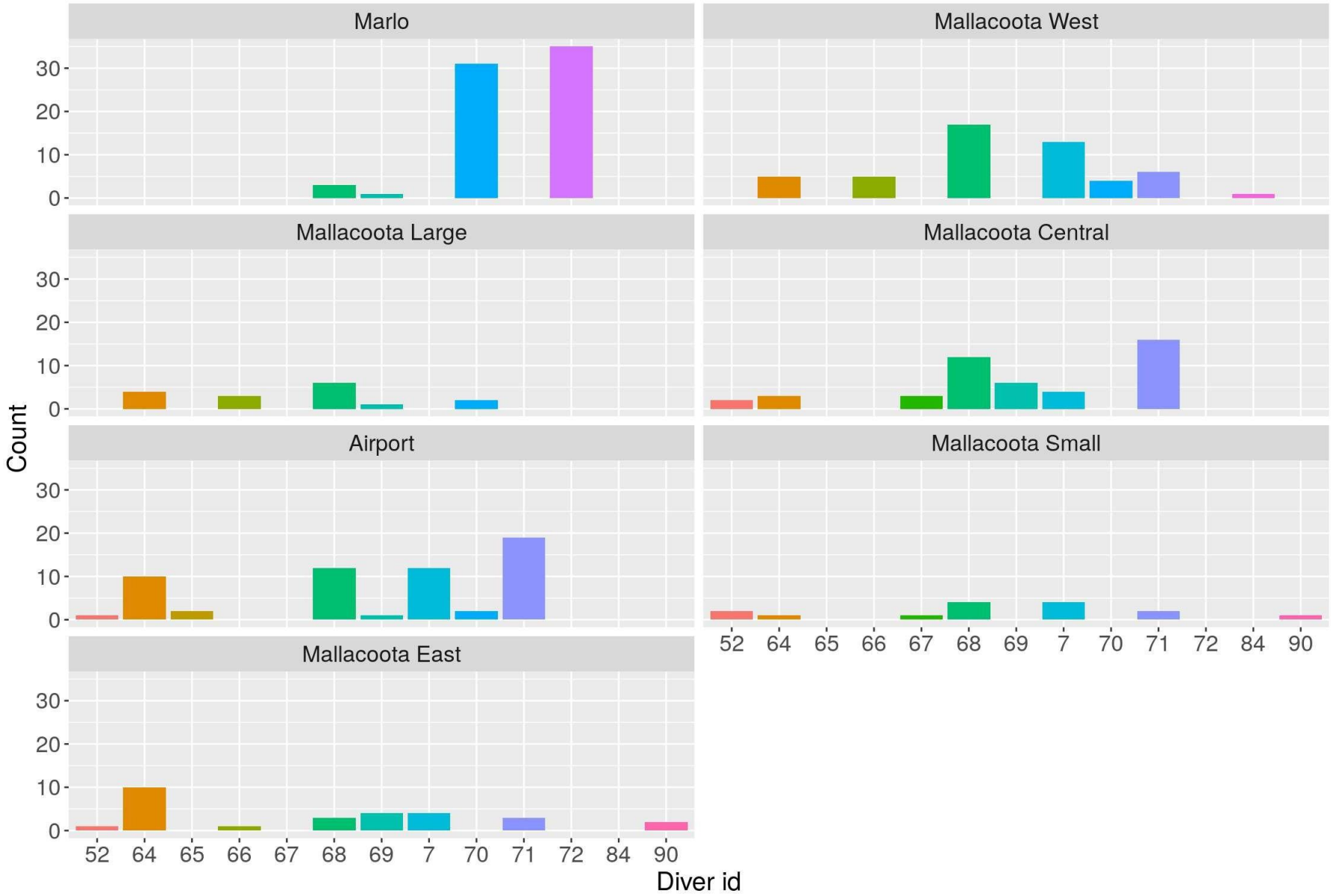
SMU observations

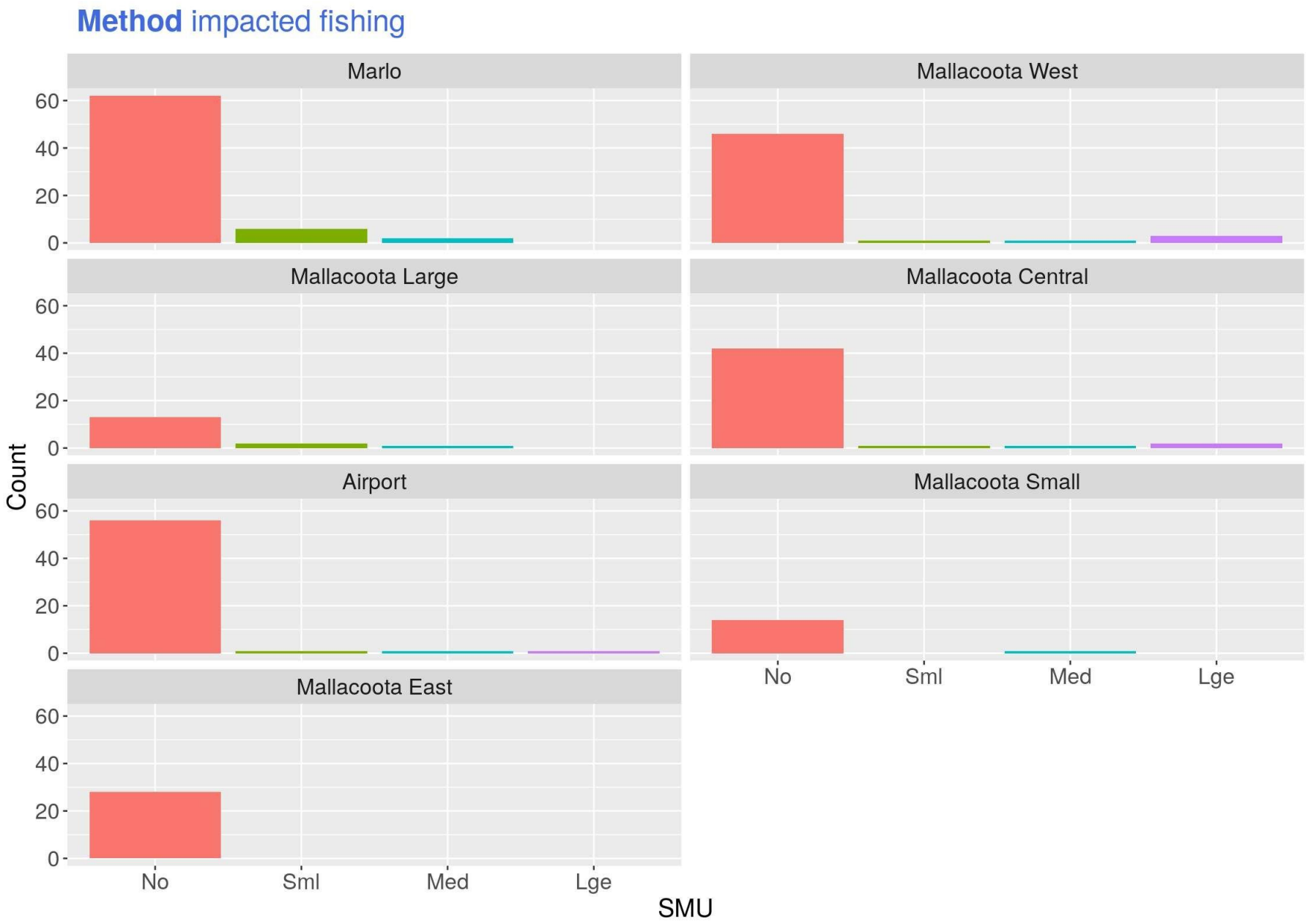


Reefcode observations

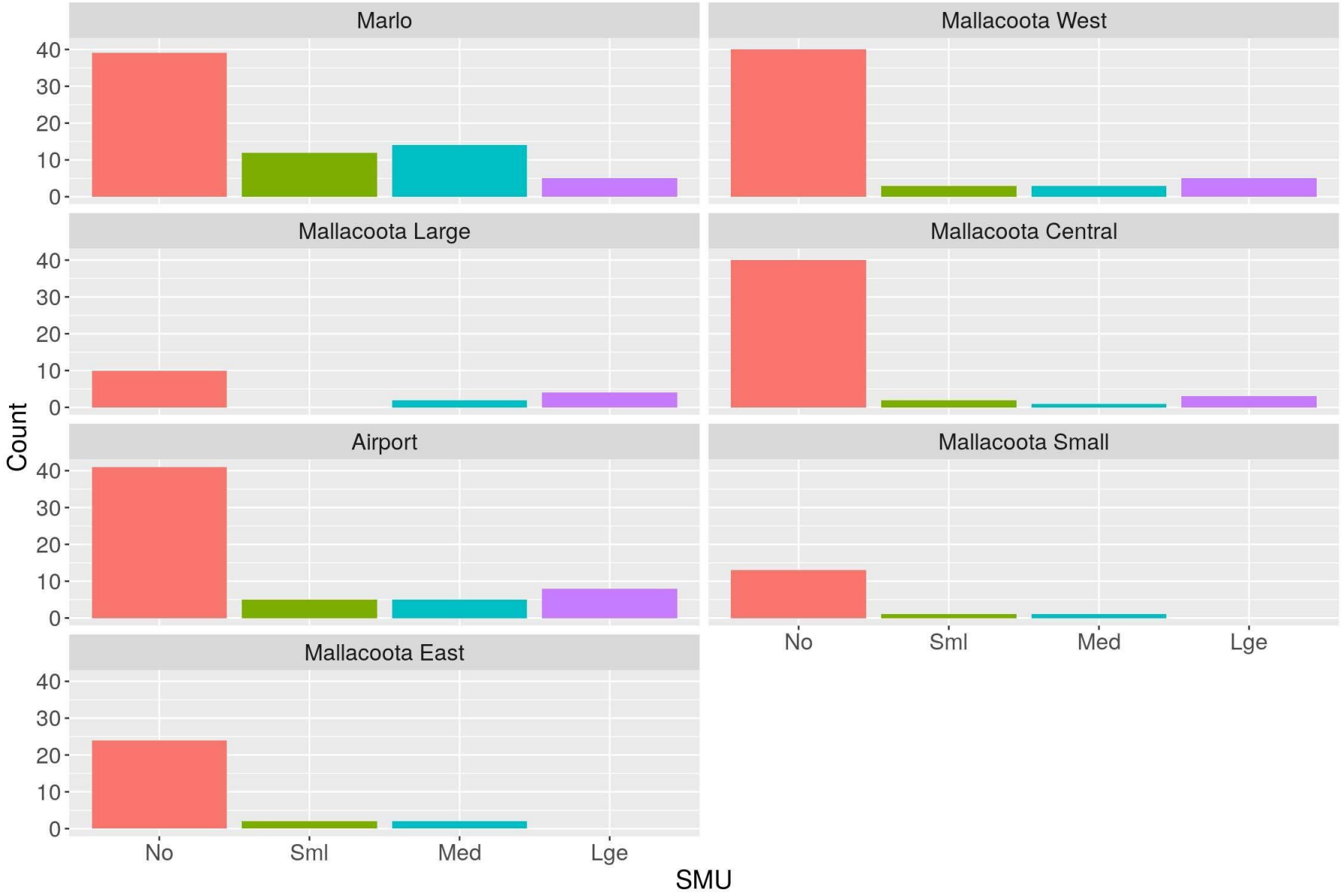


Diver observations

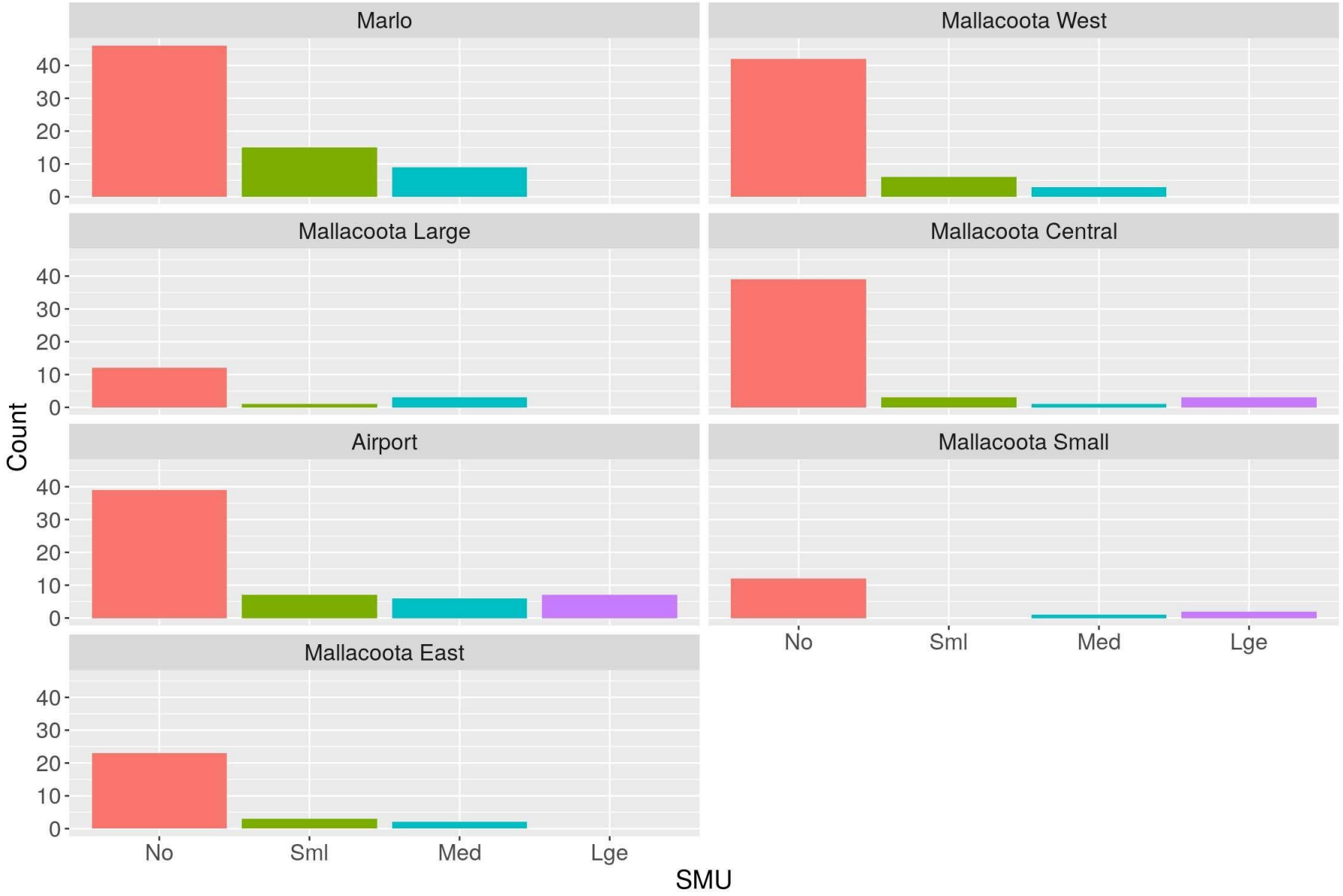



Method impacted fishing
Marlo
Mallacoota West
Mallacoota Large
Mallacoota Central
Airport
Mallacoota Small
Mallacoota East
Count
0
20
40
60
No
Sml
Med
Lge
SMU

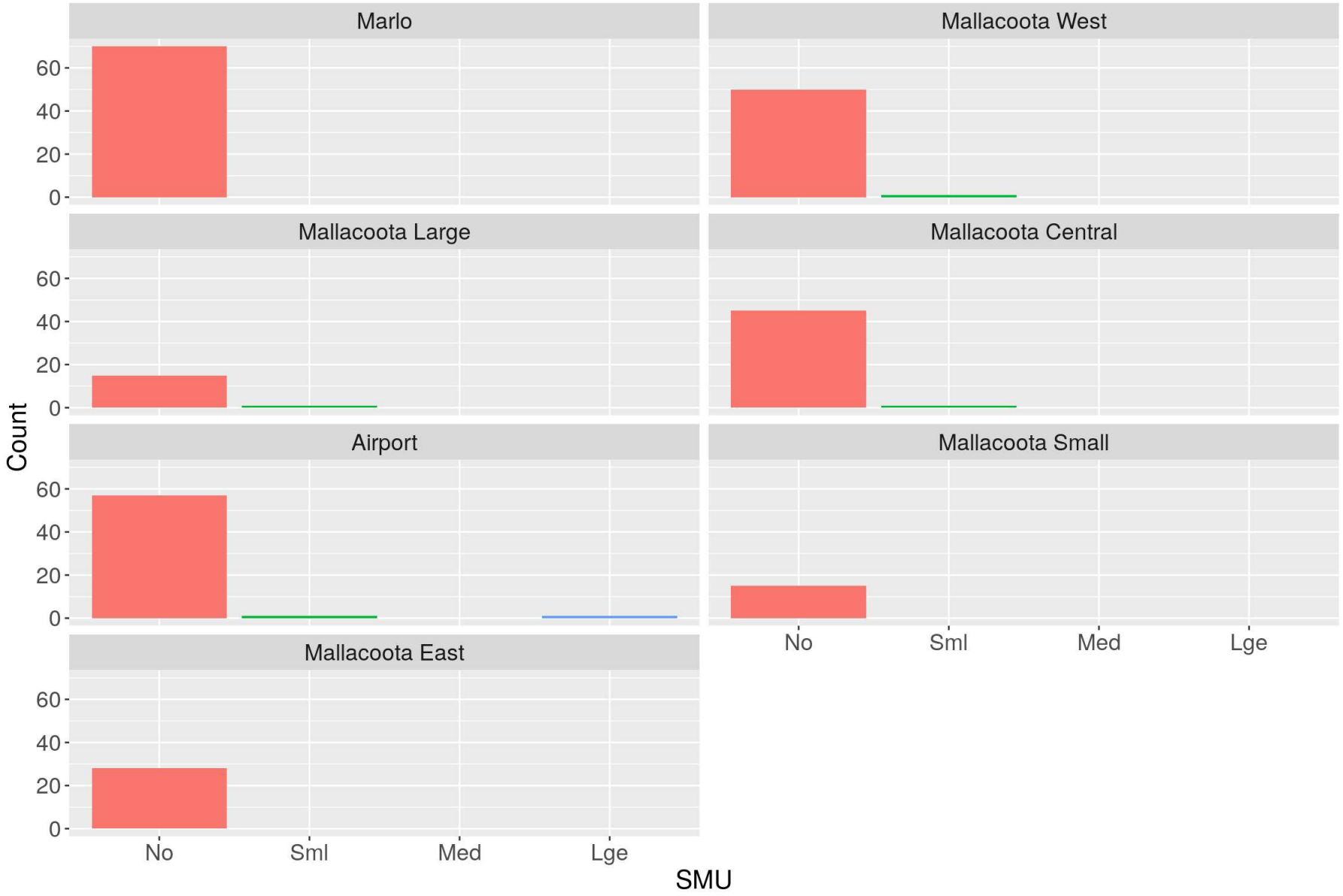
Demand impacted fishing



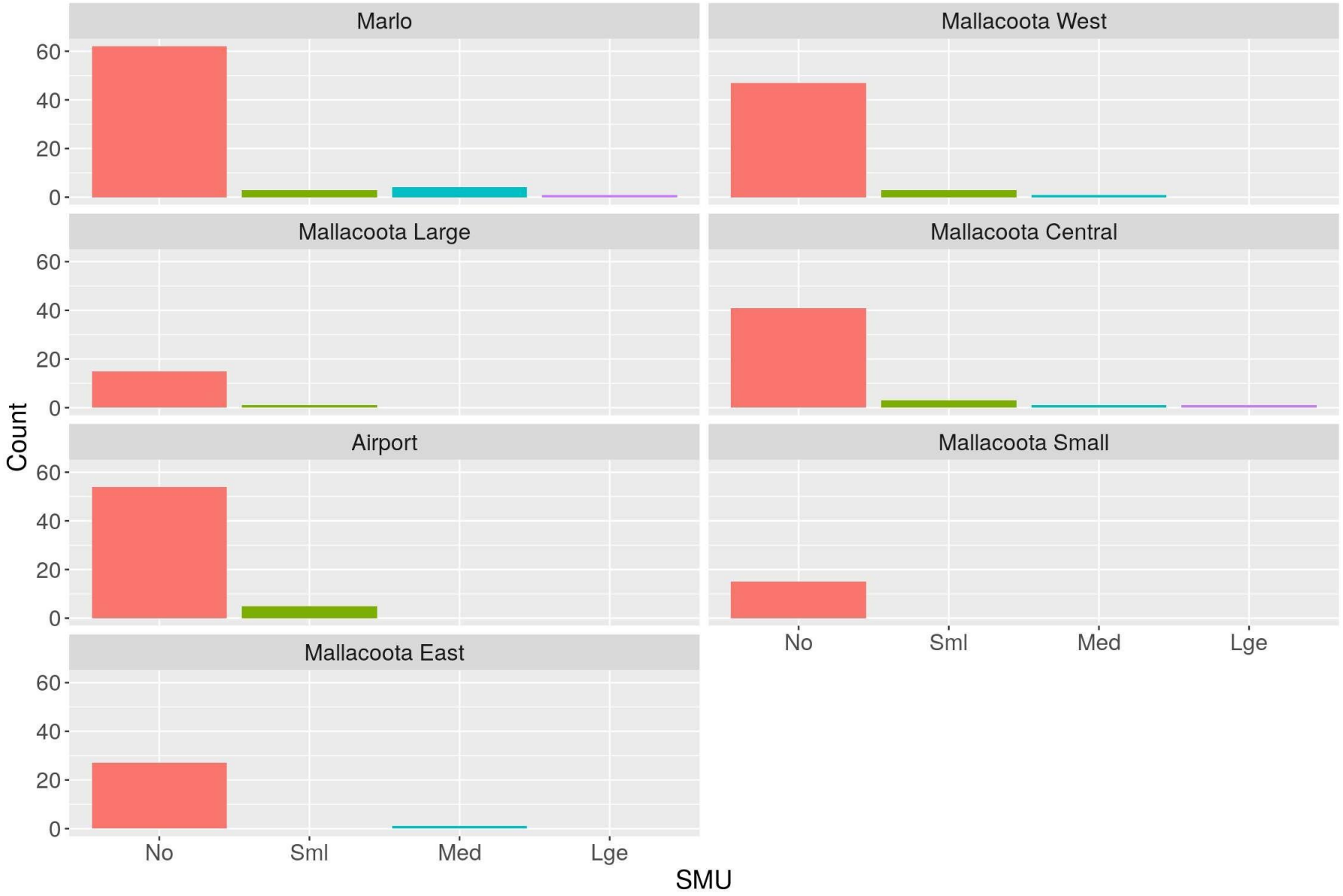
Measure impacted fishing



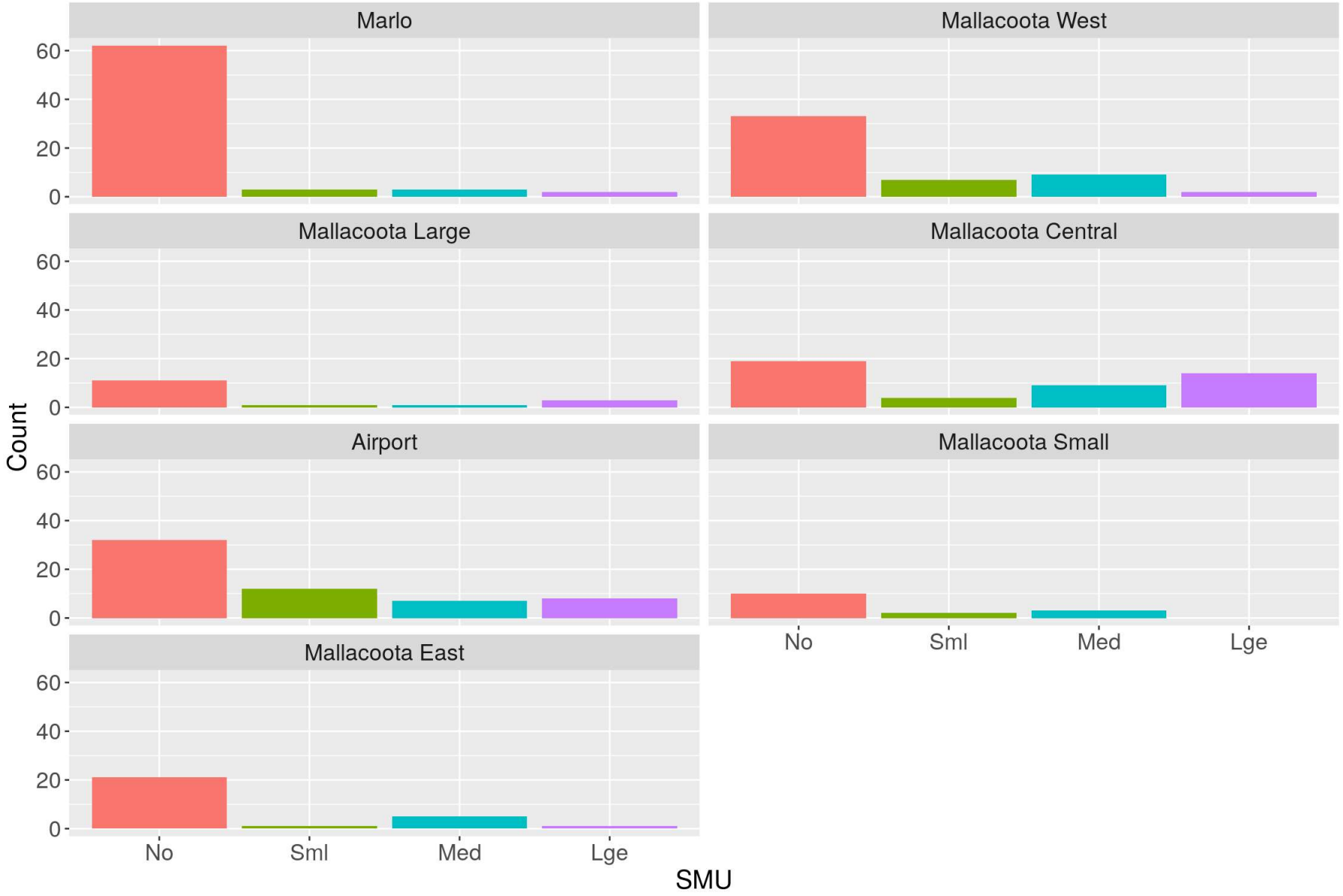
Equipment impacted fishing



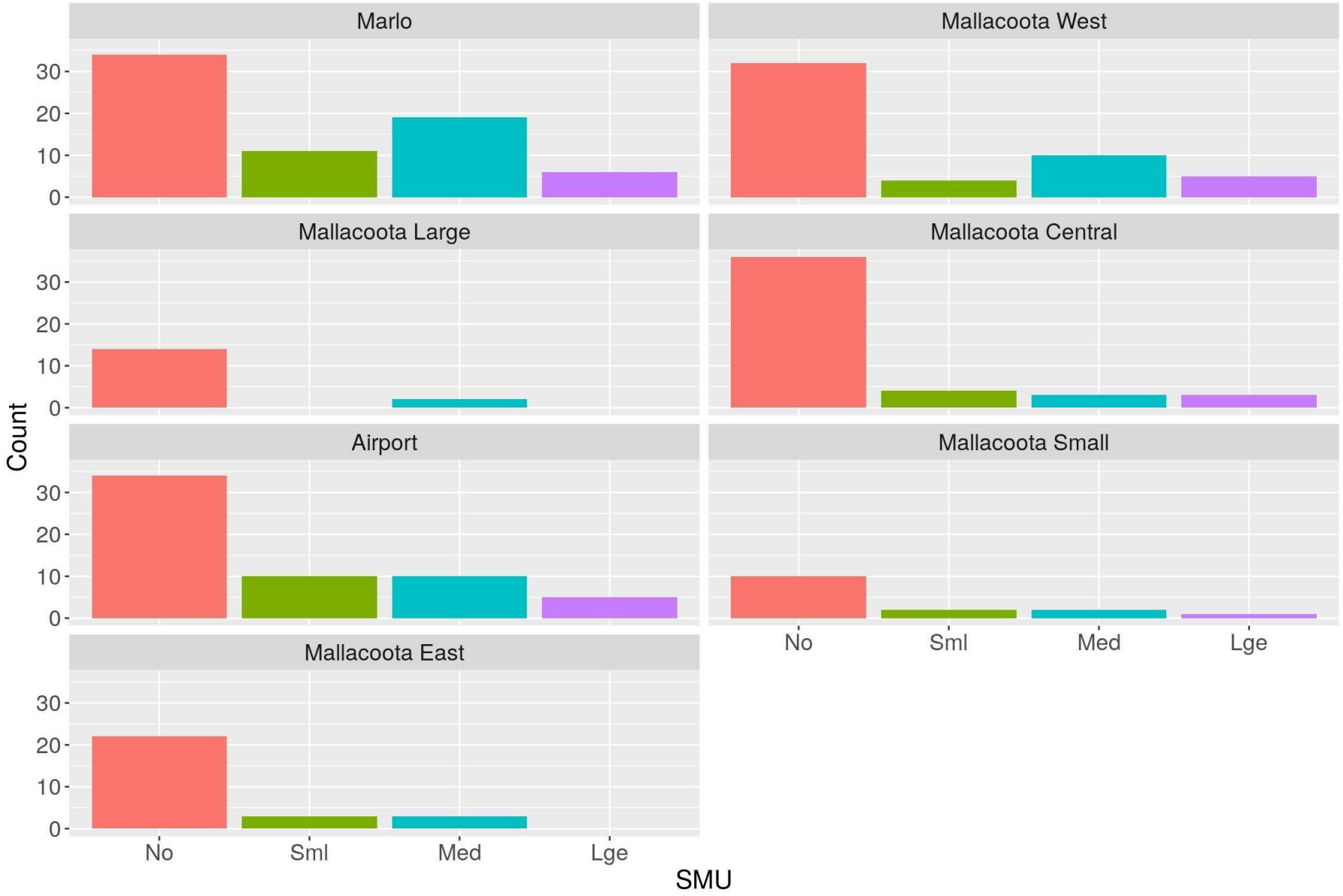
Ability impacted fishing



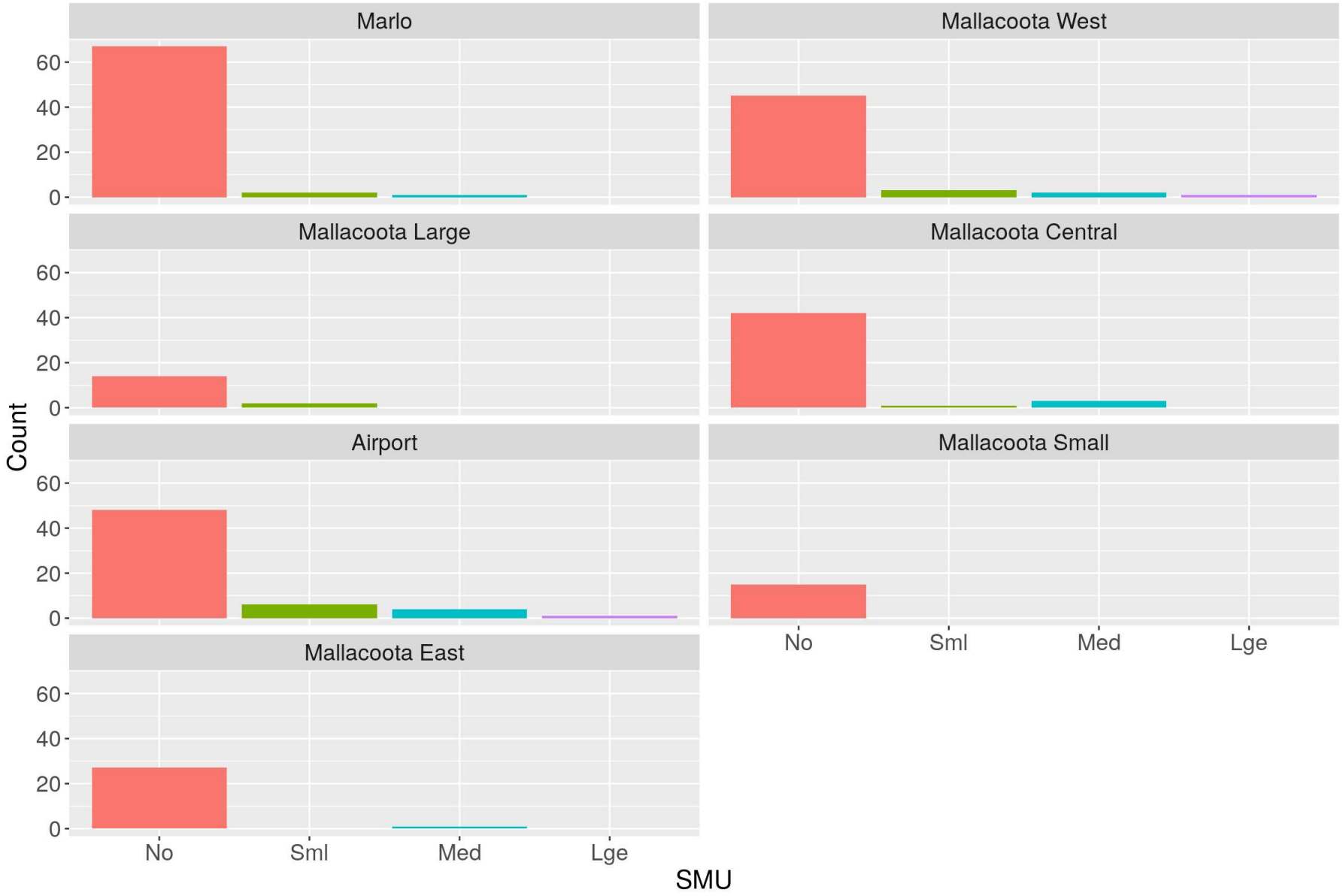
Worked impacted fishing



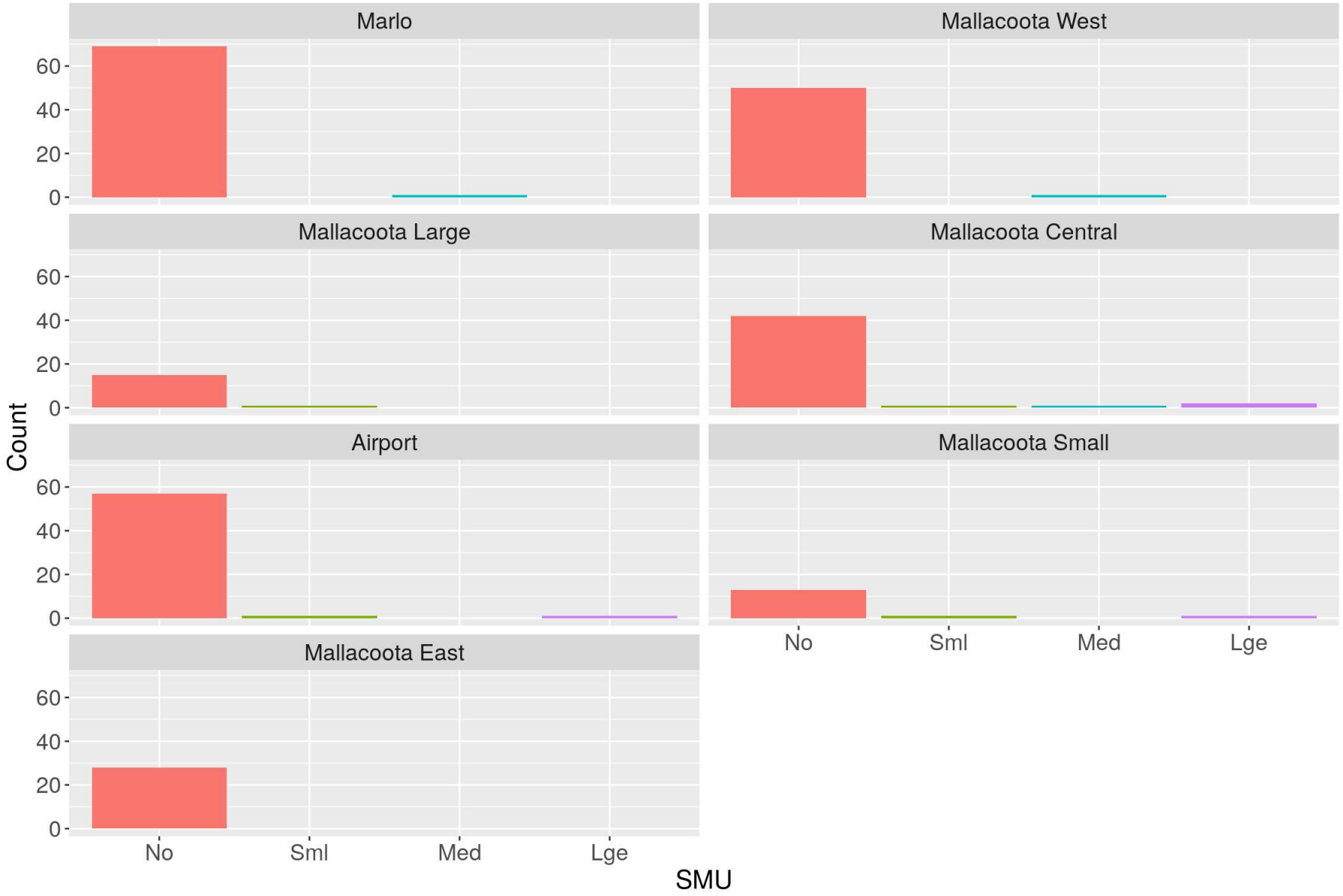
Conditions impacted fishing



Habitat impacted fishing



Other impacted fishing

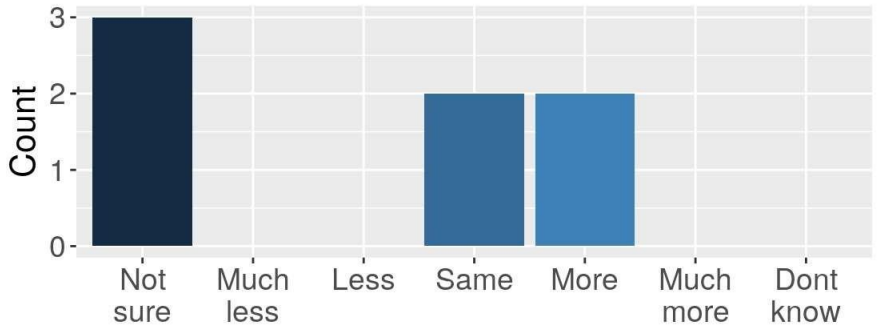


Diver Observations by Reefcode
obs.abdiver.link

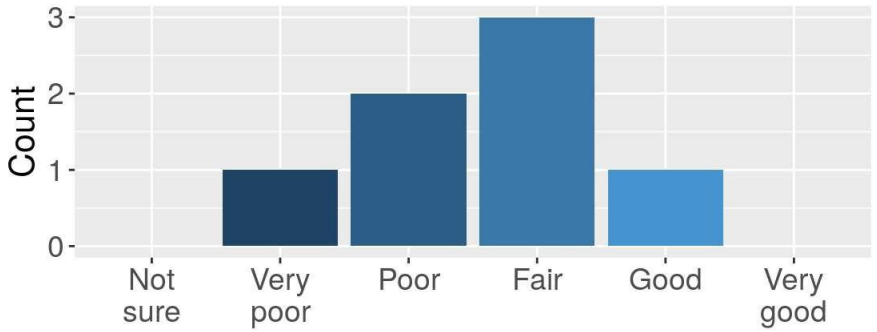
Reefcode graphs and their comments are available
on consecutive pages for each Reefcode.

Marlo, 22.02, French's

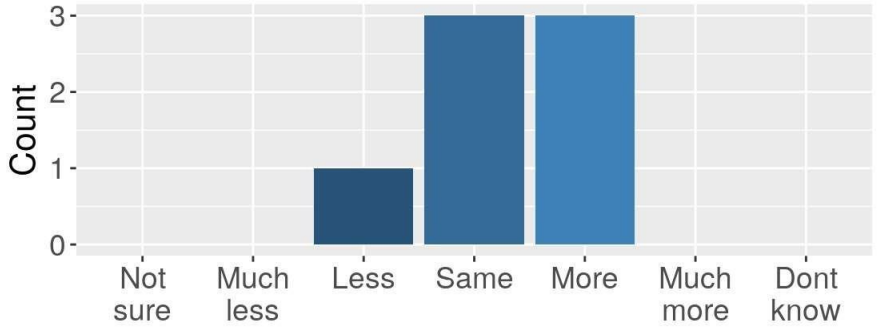
Legals compared to earlier this year



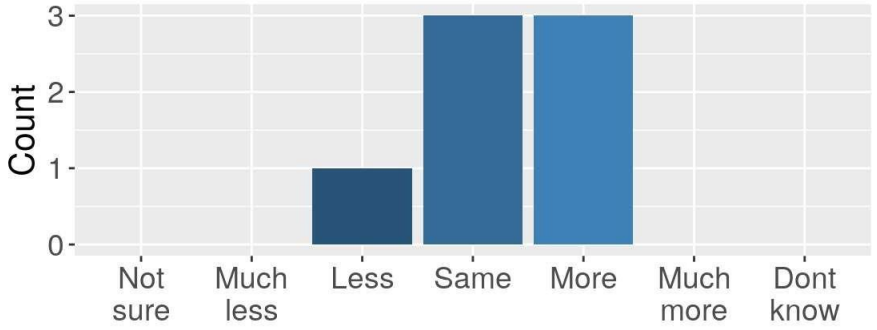
Catch rate compared to expected



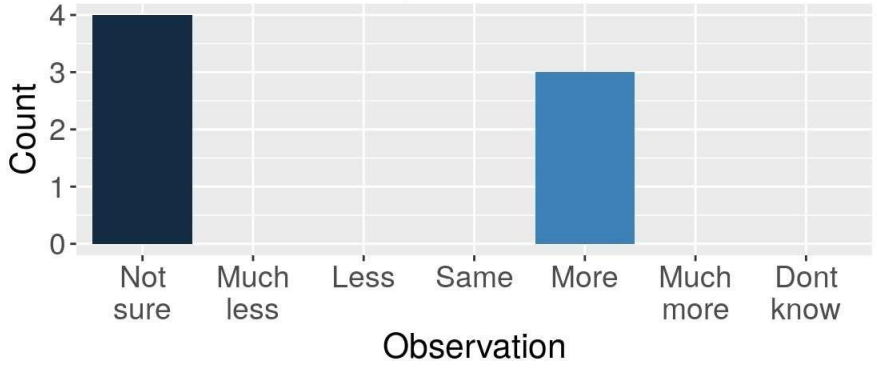
Legals compared to last year



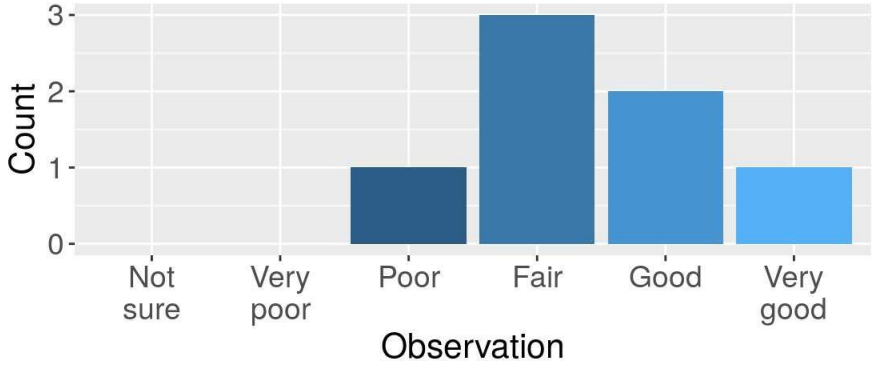
Unders compared to last year



Legals compared to compared to 2-4 years ago



Overall opinion



Marlo, 22.02, French’s

Date	ID	Comment
2021-10-14	70	Abs right on border line of live size class. - Significantly more abalone than previous few years
2021-08-22	72	Some small pockets of black urchins on this part of the reef - Bottom in good health and some good juvenile stock coming through
2021-07-13	70	Strong current
2021-07-09	70	Fishing. 400 gram plus - Size fishing - Dirty
2021-07-09	72	Very swelly very poor vis
2021-04-29	72	Weed was pretty thick but much better reef for abbs to swim over
2021-04-28	72	Fishing to live market - Weed cover was thick - Seemed to be less abbs than usual on this part of the reef It may have been worked late last season

Appendix 12

Example of linking diver observations with other data sources

This is an example of linking diver observations recorded after one day fishing with GPS logger data showing the part of a reef fished. Reef and depth are estimated from a LIDAR dataset, while different coloured GPS points are associated with different divers with their observations and comments in the same colour (e.g., red points are associated with red observations and comments). In this example, different observations of abalone populations are made by three divers on three fishing days from June to August 2021 and can be explained by observing different parts of the reef, demonstrating the importance of within reef variation.