e-Fish Design Principles

FRDC

Submitted by

York Stanham
Business Analyst
M. 0422 826 050
E. york.stanham@mtpservices.com.au

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mtpservices.com.au

Contents

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1. Executive summary

This report details the first part of the 'Discovery' stage of the e-Fish project, providing context on the project, the interview methods, the intent of the interviews, the data received, and who was interviewed. A total of 55 users were interviewed across eight state and territory jurisdictions and three supporting agencies.

This report has produced detailed user personas typically seen at fisheries management agencies, research bodies, and industry. These personas are:

- Fisheries manager
- Data users
- IT specialist
- Data manager
- Third party users (CSIRO, ABARES, consultants)
- Traceability providers

The development of the user personas has highlighted **five** problem themes encountered by users of fisheries management agency data. These five problems themes are:

1. Data integrity
2. Data sharing
3. Siloed data
4. Data collection
5. System capabilities and support

This report has provided **five** design principles that aim to provide guidance for the design of a fisheries data architecture. These design principles have been developed to directly address the aforementioned problem themes. These five design principles are:

1. **Linked data** – Data sets are inherently linked and linked in way that allows ease of use.
2. **Modern data sharing** – Data sets should be exposed to external users through an easy to maintain and minimal touch solution such as application programming interfaces (APIs).
3. **Ensure data integrity** – Data is clean and validated with minimal errors. Data is stored according to predefined elements maintained in an agency or industry wide taxonomy.
4. **Standardised data collection** – Data is received in a uniform approach. Care is taken to not duplicate data where it is unnecessary to do so.
5. **System capability fit for purpose** – Implemented systems directly support various business outcomes of fisheries stakeholders

2. Scope

The e-Fish project is investigating a solution for how a fisheries management agency could improve the connectivity between data capture systems and allow insight into the interactions clients have with the agency.

Fisheries management agencies provide a range of services to their clients to pursue their legislative objectives. To support agency operations there is a need to be able to relate information received by an agency's systems and deliver a complete picture of client interactions. Due to the overlap between many fishery management agencies' services, a "tell us once" approach to information provision is also needed with changes made to one system reflected across the other interactions their clients have.

This e-fish project is sponsored by the Fisheries Research and Development Corporation (FRDC). The project's outputs are applicable to any fisheries management agency.

The first stage of the project, Discovery, will be the development and agreement on design principles for a fisheries management data architecture that meets user needs. These design principles aim to describe the ideal state of a fisheries management data architecture. This report is the delivery of those design principles. The second stage of Discovery will design and document an architecture based on the design principles.

In the next stage of the project, Alpha, a proof of concept prototype will be developed to test the practical application of the architecture design and record the findings. The designs and deliverables of the project will be widely available to the FRDC and Australian fisheries jurisdictions.

This report aims to provide the initial design principles to support the overall project objectives:

- Better meet the demands of the Australian community and fisheries stakeholders to readily access and use fisheries data.
- Provide opportunities for the digital transformation of fisheries data.
- Increase the opportunities for businesses to utilise fisheries data through enhancing its availability and power.
- Increase the cost effectiveness and efficiency of fisheries data capture and management.
- Better meet the demands of traceability schemes to aid market access for Australian seafood businesses.
- Provide greater access and linkages of fishery data without compromising data confidentiality and privacy obligations.

3. Stakeholder engagement

This Discovery phase of the e-Fish project has been undertaken through a large user engagement study. This user research was completed by conducting a number of one-on-one interviews either in person or on the phone. The interviewees were a mixture of users who filled one or more user personas across a range of fisheries jurisdictions and research bodies throughout Australia.

3.1 What we were trying to find out

3.1.1 Persona profiles

User persona profiles were developed in an effort to better categorise the typical data users of fisheries management agencies and associated research bodies. The development of user personas ensured the project had sufficient coverage for all data users. The user personas adopted for this report are:

- Fisheries manager
- Data users
- IT specialist
- Data manager
- Third party users (CSIRO, ABARES, consultants)
- Traceability providers

The researched aimed to collect information so that persona profiles could be developed (seen in section 4). These ensured the personas entire experience with the fisheries management systems was captured. These profiles aimed to capture the following information about each persona:

- Typical responsibilities
- Pain-points (problem themes) most often encountered
- Improvements that would facilitate more accurate and more timely completion of their responsibilities

3.1.2 Current data systems

The research conducted during the Discovery phase aimed to get a solid understanding of the typical data systems and collection methods employed across agencies. We aimed to determine:

- The strengths and weaknesses of the employed data collection methods
- How are paper-based forms used
- The data storage methods employed in difference agencies
- The types of technologies used to store and collect data
- The factors that affect the accuracy of the data
- The work that goes into upkeep and uplift of the data storage and collection systems

3.1.3 Data sharing and usage

The interviews aimed to determine how the received data is used and shared across and within agencies. This research asked each interviewer how they interact with the data in an effort to get a feel of:

- How the data is used
- What the data is used for
- How analysis of the data is performed
- The types of reporting that is developed as a result of the data analytics

As part of this process the method of data sharing was also explored. Data users rarely used a single source or collection of data, often collating numerous sources from within and sometimes across agencies. These interviews aimed to determine the following:

- When are data sharing activities triggered
- The physical process of data sharing
- Who is responsible for sourcing the requested data
- Who is responsible for sharing data

3.1.4 Challenges

The key component of this research was to determine the challenges faced by each persona when performing their daily tasks. Care was taken to determine any existing workarounds to problems. These main pain-points formed the problem themes explored in section 4 of this report. These problem themes were used to develop the design principles.

3.1.5 Suggestions for improvements

We asked each interviewee for their suggestions for improvements to any aspect of the system or process they interact with on a daily basis. These suggestions formed the foundation of what the design principles would look like in practice.

3.2 Our approach

3.2.1 Interviews (Australia-wide)

With guidance from AFMA and the e-Fish steering committee, we determined a list of target users from each user persona and jurisdiction.

Initially, interviews started with generic questions such as “which data systems do you interact with?” to begin the conversation. As the interview continued, we dived deeper towards ‘grey’ areas, edges cases and all information we saw as being crucial to the project and design principles.

3.2.2 Practical demonstrations (Canberra)

During the practical demonstration sessions, we asked users to show us how they use the different data systems and how they interact with the data in their day-to-day work.

Sometimes people will just accept a frustration as “the way the system works” and won’t mention it during an interview. This method was used to draw those frustrations out.

3.2.3 Workshop (Canberra)

A workshop was conducted in Canberra on July 22. This workshop was conducted with two aims:

1. Understand and gather information on any design principles that may not have been captured
2. Allow all jurisdictions to provide input and guidance on the design principles

This workshop was attended by representatives from all groups with the exception Tasmania and Victoria who were unable to attend. This workshop involved discussion all design principles in depth until a common view was achieved. This feedback has been included in these design principles.

3.3 Our questions

Each interview used a set of predefined questions to guide the direction of discussion. These questions were used as the skeleton with additional questions being asked to further unpack the uniqueness of each interviewee's role. The skeleton questions for each interview are:

- What is your position with the agency / research body?
- What roles do you typically perform on a day to day bases?
- How do you generally source the data you need to perform these roles?
- How do you generally share data with internally and externally to the agency / research body?
- What are some typical pain points you face in your day to day responsibilities?
- What would you implement to streamline and modernise your daily tasks?
- Have you seen any systems utilised in other agencies that might help you in your role?
- If you could change just one thing, what would you choose?

3.4 Scale of research

A total of eleven agencies were covered through the user interview stage. The interview and analysis totalled over 250 hours.

3.5 Interview breakdown

A total of 55 users were interviewed across eight state territory jurisdictions and three supporting agencies. Broken down by user persona:

- 31% were data users
- 20% were fisheries managers
- 20% were IT specialists
- 20% were data manager
- 9% were third party users
- 0% were traceability providers[1]

[1] Information was gathered via pre-existing material, webinars and email correspondence

4. Problem themes

The following problem themes are derived from analysis of data gathered through user research and engagement. The problem themes identify high-level groupings of the challenges faced by the users and the opportunities they identified.

4.1 How we defined the problem themes

We used an "open card sorting" method which provides a quick and efficient way to analyse interview data and look for common themes and insights.

We started by printing out all challenges and opportunities identified from our user research and engagement onto physical cards. Next, the cards were discussed individually and sorted into groups as common themes emerged. Finally, the themes were discussed, and groupings redefined to represent the final themes below.

4.2 Problem themes

A total of 189 cards were sorted into 7 themes:

1. **Data integrity** – This theme captured pain-points around the accuracy and validity of the captured data
2. **Data sharing** – This theme captures pain-points around how data is shared within and across agencies.
3. **Siloed data** – This theme captures the challenges faced by all data users as a result of the soiled nature of data storage
4. **Data collection** – This theme captures the challenges faced by the conflicting nature of the different data collection methods.
5. **System capabilities and support** – This theme highlighted the issues and challenges faces by IT specialists in supporting the business outcomes of fishery management agencies.

Two themes from the card sorting activity, "Data Awareness" and "Culture", were considered outside the scope of the e-Fish Project. These themes are noted in Appendix C.

4.3 User personas and problem themes

Each user persona's challenges and opportunities for improvement have been classified under the five problem themes.

Tables 4.3.1 to 4.3.5 represent an overview of each user persona. These tables show that while the users require data sharing and use for different purposes, they also have a common need for improvements in similar areas (the problem themes).

4.3.1 Data manager

Description: Has detailed knowledge of how their organisation stores/shares their fishery data.

Typical responsibilities	The data manager looks after data control, from analysing and auditing data to policy management and integration projects. Typical responsibilities of a data manager: • Manages, manipulates, collates, formats data • Responds to data requests • Runs data audits and analysis • Manages physical and digital files
Problem themes	A data manager's challenges are categorised by the following problem themes: • **Data integrity** • **Data sharing** • **Siloed data** • **System capabilities and support**
Opportunities for improvement	Data managers identified the following key opportunities for improvement: • Standardise the way information is received (**Data integrity**) • Create definitions and standards for data (**Data integrity**) • Ensure the context of historical data is maintained (**Data integrity**) • Linking data sets to provide context (**Siloed data**) • Create a single source of truth for data (**Siloed data**) • Capitalise on systems and standards from other jurisdictions (**Systems capabilities and support**) • Create better integration across systems (**System capabilities and support**) • Allow for better accessibility to data for both fisheries staff and third party users (**Data sharing**)

4.3.2 Data user

Description: Is a compliance and monitoring officer, fisheries officer and/or licensing officer. Data users regularly uses fisheries data and have a good understanding its current limitations within their role.

Typical responsibilities	The data user is the most diverse of the personas explored in the Discovery phase. Data users exist both within agencies and external to the agencies collecting the data such as CSIRO and ABARES. Typical responsibilities of data users: • Investigates of allegations and enforces offence regulations • Monitors of fisher activities • Provides advice to fisheries officers and managers • Data analysis
Problem themes	A data user's challenges touch all five identified problem themes: • **Data integrity** • **Data sharing** • **Siloed data** • **Data collection** • **System capabilities and support**
Opportunities for improvement	Data users identified the following key opportunities for improvement: • Support for integration of catch and effort systems (**System capabilities and support**) • More investment in applications for electronic reporting (**System capabilities and support**) • Create a link between fisheries systems and compliance systems that supports sensitivity issues (**Linked data**) • Create a way to "paint the picture" all in one place (e.g. who is the skipper, what's the quota, what licences do they have) (**System capabilities and support** and **Linked data**) • Creating reporting capabilities within a UI (**System capabilities and support**) • Create links between data sets at the data level (**Linked data**) • Provide transparency and history of how data is collected, received, modified, etc (**Data sharing**) • Create automated alerts on certain conditions/triggers (**System capabilities and support**)

4.3.3 Third party user

Description: Receives data from fisheries organisations or directly from industry to support dedicated research projects.

Typical responsibilities	The third party users are external to the collection agencies and are often interested in more research-based outcomes such as stock assessments and trends within and across fisheries.
	Typical responsibilities of third party users:
	• Provides scientific support for management of fisheries
	• Conservation activities
	• Produces:
	  ○ Peer reviewed publications
	  ○ Conference reports
	  ○ Summaries for industry
	  ○ Reports for international fisheries
	  ○ Fishery status reports
	  ○ Import and export reports
	  ○ Gross value of fisheries production
	  ○ Stock assessments

Problem themes	A third party user's challenges are categorised by the following problem themes: • **Data integrity** • **Data sharing** • **Siloed data**
Opportunities for improvement	Third party users identified the following key opportunities for improvement: • Cleaned data is shared to third party users (**Data integrity** and **Data sharing**) • Data sets are linked before it is shared with third party users (**Siloed data**) • Links between data sets are shown in the data (**Siloed data**) • Direct access to data from all jurisdictions (**Data sharing**) • Use a standardised 'template' for sharing data sets (**Data integrity** and **Data sharing**) • Ongoing communication between the jurisdictions and third party users when making changes to data structures and fields (**Data integrity**) • Create the ability to query different data sets simultaneously (**Data sharing**) • Create the ability to detect errors in data sets (**Data integrity**) • Communication to third party users when there are changes made to data structures and fields (**Data sharing**)

4.3.4 Fisheries manager

Description: Understands the overall data needs of fisheries within their agency and how received data supports decision making.

Typical responsibilities	The fisheries manager is responsible for the management of a fishery. This includes ensuring the economic viability and environmental sustainability of their fishery. Typical responsibilities of fisheries managers: • Oversees a variety of data collection • Reports on trends within fisheries • Ensures legislative objectives are met • Strategy development & implementation • Policy development & implementation • Advises, supports, reports to state and national groups
Problem themes	A fisheries manager' s challenges touch all five identified problem themes: • **Data integrity** • **Data sharing** • **Siloed data** • **Data collection** • **System capabilities and support**
Opportunities for improvement	Fisheries managers identified the following key opportunities for improvement: • Each agency holds their own data, and all agencies can access that data (**Data sharing**) • Build new systems with the requirement of good data architecture (**System capabilities and support**) • Share data linking solutions between agencies (**Data sharing**) • Expose more data and reduce red tape when sharing with other agencies (**Data sharing**) • Create a single source of truth for data (**System capabilities and support**) • Gain access to data held by other agencies (such as CSIRO) (**Data sharing**) • A modern data/information system that fully supports our ability to pursue our legislative objectives (**System capabilities and support**) • Ability to access and link all data types at the operational level/event level (**Siloed data**) • Ability to access the data quickly and intuitively (**System capabilities and support**) • Access to data in real-time, rather than submitting a request and waiting for a response (**System capabilities and support** and **Data sharing**) • Move paper-based reporting to digital (**System capabilities and support**) • Reduce dependence on certain staff within an agency by making data easier to access, use and understand (**System capabilities and support**) • Data is available from an easy to use UI (**System capabilities and support**) • Automate reports that are run frequently (**System capabilities and support**)

4.3.5 IT specialist

Description: Has detailed knowledge of the jurisdiction's IT architecture and security.

Typical responsibilities	The IT specialists ensure the IT systems and infrastructure of a fisheries agency are capable of meeting the desired business outcomes set forward by data users, data mangers, fishery managers, and third party users. Typical responsibilities of IT specialists: • Develops enhancements and bug fixes to applications • Manages and maintains applications • Imports data into databases • Manages databases • Manages data architecture • Manages infrastructure • Links data sets and creates custom queries on request • Project planning • Fulfils roadmap and strategy items • Develops data standards • Business and data analysis
Problem themes	An IT specialist's challenges are categorised by the following problem themes: • **Data integrity** • **Siloed data** • **Data collection** • **System capabilities and support**
Opportunities for improvement	IT specialists identified the following key opportunities for improvement: • Minimise downtime of systems during a release (**System capabilities and support**) • Create a linking framework between different data sets before it's inputted into the database (**Siloed data** and **System capabilities and support**) • Link data sets with overlapping information (e.g. ocean surface temperature is recorded in two separate databases) (**Siloed data** and **System capabilities and support**) • Create a single point where different data sets can be viewed together (**System capabilities and support**) • Create real-time alerts to staff for certain scenarios (e.g. "This vessel does not have a licence to fish in this area") (**System capabilities and support**) • Investigate the benefits of moving data storage to the cloud (**System capabilities and support**) • Create a single hosted platform (**System capabilities and support**) • Move to digital forms instead of paper for data integrity issues (**System capabilities and support** and **Data collection**) • Improve data quality through system validation (**Data integrity**)

4.3.6 Traceability provider

Description: Knows the current and future needs of data sharing from a traceability perspective.

Typical responsibilities	Traceability providers aim to trace a product from its origin to the point of sale, along with information about each transaction along this path. This traceability is used to ensure food safety, prove legality, and to verify sustainability. At a minimum, seafood traceability systems aim to achieve: • Allow the product to be traced from origin to point of sale • Ensure credible and transparent supply chain verification and auditing mechanisms are supported.
Problem themes	A traceability provider's challenges are categorised by the following problem themes: • **Data integrity** • **Data collection** • **Data sharing**
Opportunities for improvement	The following items have been identified as key opportunities for improvement: • Ability to easily obtain key data elements that assist in tracing and verifying product from fisheries management agencies through an API (**Data sharing**) • Move towards standardised data naming conventions (**Data integrity** and **Data collection**) • Adoption of authoritative sources (**Data integrity**) • Move towards digital recording, tracking and tracing of seafood in standard formats (**Data integrity** and **Data collection**) • A move towards independent verification and auditing (**Data integrity**)

5. Design principles

The following design principles are derived from the project brief and supported by the artefacts and data gathered through user research and engagement, including interviews and a workshop with key stakeholders.

1. **Linked data** – Data sets are inherently linked and linked in way that allows ease of use.
2. **Modern data sharing** – Data sets should be shared through an easy to maintain and minimal touch solution such as application programming interfaces (APIs).
3. **Ensure data integrity** – Data is clean and validated with minimal errors. Data is stored according to predefined elements maintained in an agency or industry wide taxonomy.
4. **Standardised data collection** – Data is received in a uniform approach. Care is taken to not duplicate data where it is unnecessary to do so.
5. **System capability fit for purpose** – Implemented systems directly support various business outcomes of fisheries stakeholders.

5.1 Linked Data

Guiding Principle #1:	**Linked data** – Data sets are inherently linked and linked in way that allows ease of use.
Context	Data is often stored in "silos" in many different formats and in numerous different locations. Internal and external data users are unsure where to find information and have low confidence in the reliability of information even if it is found. Data available to internal users, data managers, and fishery managers is often duplicated and unable to be used until manually linking, often in spreadsheets, has been completed. In some instances, the manual linking is limited to guess work based on dates, times, and GIS data rather than a common unique identifier. Based on the findings of the stakeholder interviews, a number of key challenges have emerged such as: • Reliably linking data sets that aim to capture the same or related data is often done based on a qualitative assessment. For example, linking electronic monitoring and log books, or linking VMS data with reported daily fishing log activities. • Manual linking of data from disparate data sources is a time consuming and expensive process that often constitutes a significant amount of the work undertaken by fisheries managers and scientists. • Manual linking of data often requires some massaging of data to produce a holistic picture. This massaging of data means the single point of truth is lost and also means agencies holding the original data are unable to reliably produce the same results and reports as those produced by some data users.

Design Principle in Practice

Structure	**People**	**Process**	**Technology**
All data sources are linked in some way, for example the trip ID or through another appropriate method. This link can be used to connect associated data before it is exposed to end users. This structure will allow the creation of data analysis dashboards for all data users.	Data users will be able to access and use data from a range of data streams seamlessly. This will reduce the large overhead when collecting and analysing data for research, compliance, and management purposes.	An agency or industry wide data strategy will provide the framework for how each data set should be linked. Once the initial upfront work has been conducted the day to day maintenance of the framework should be minimal. Documentation around which elements or methods are used to link	A recommendation for technology will be made however specific technology used to link data sets can vary and will therefore be decided by each individual agency. It must be noted that using an agency or industry wide approach to data storage and linking is likely to make linking easier.

		the data sets should be clear and explicit.	

5.2 Modern Data Sharing

Guiding Principle #2:	**Modern data sharing** – Data sets should be shared through an easy to maintain and minimal touch solution such as application programming interfaces (APIs).
Context	Fishery management data is shared frequently across agencies, scientific bodies, compliance and intelligence bodies, and also within agencies. However, there is no standard method for data sharing and in many cases no self-service option. Data is currently shared through the sending of spreadsheets (csv files) via emails, and copies of databases on DVD are mailed to the receiving party. The sharing of this data is often initiated through a request rather than a predefined agreement to send particular data at a particular frequency. Based on the findings of the stakeholder interviews, a number of key challenges have emerged such as: • The manual requesting and transmission of data often causes significant delays. There are often days between a request and receiving the data. • Duplication of data to share with external agencies causes a loss of the one source of truth. • Confidentiality and privacy obligations prohibits sharing of data across jurisdictions and to third parties.

Design Principle in Practice

Structure	**People**	**Process**	**Technology**
All data should be shared internally and externally via a uniform method. This method should utilise a modern sharing framework such as application programming interfaces (APIs). This will allow each agency to hold their own data but also make it available for consumption across the agency and across different agencies, by scientific bodies, and by industry.	A modern data sharing method will reduce the reliance on database managers to manually export and share the data. Making data instantly accessible is likely to reduce the delay associated with the current transfer methods. This is likely to hasten decision making and report production.	APIs will need to be built on top of existing solutions or heavily considered when building new solutions. Once these are developed in accordance with the business purpose, external and internal users will be able to interface with the API. These may be used to develop data analytics solutions or imported into COTS applications such as	A modern standard such as REST API reporting should be made available across the agency reporting streams. These APIs should be exposed to relevant external agencies to consume. It is likely that the capability to internally consume API responses will also be required for reciprocated data transfers.

		Power BI for data analysis.	Care must be taken to ensure APIs access is controlled and confidentiality and privacy obligations are met.

5.3 Ensure Data Integrity

Guiding Principle #3:	**Ensure data integrity** – Data is accurate and validated with minimal errors. Data is stored according to elements maintained in an agency or industry wide taxonomy.
Context	Data is often received in a way to suits the particular data collection stream (e.g. log books or VMS) without considering the wider use of data collection and use within a fisheries agency. This often leads to duplication of data within siloed systems; often with different naming conventions, methods of collection, historically significance, validation, and accuracy. Based on the findings of the stakeholder interviews, a number of key challenges have emerged such as: • The diversity of data collection methods and validation across systems leads to significant resources dedicated to cleaning and processing of the collated data before any meaning can be drawn. • Users are often not aware of the accuracy of the data. This, in combination with data cleaning leads to insufficient evidence to make decisions. • Siloed data from different, unique collection methods does not allow agencies to establish one source of truth across all systems. This leads to difficulties and inaccuracies in determining stock assessments and collection of accurate compliance data.

Design Principle in Practice

Structure	**People**	**Process**	**Technology**
All data should be received in a uniform method. This method should utilise a standard reporting taxonomy. Two such examples are the SBR AU Taxonomy used across multiple Australian Government organisations, and the Fisheries Language for	This process will require the establishment of a taxonomy and data collection working group. This process will require an agency wide approach to uniform data collection and validation.	All new data collection methods must conform to existing agency standards and predefined process. Each data element must be one that already exists in the taxonomy or added to the taxonomy through a thorough, predefined process such as that of the SBR AU Taxonomy.	A modern standard such as API reporting should be made available across the agency reporting streams. Fields within each API should be drawn from a predefined taxonomy. Data validation should be included as a key

Universal Exchange (FLUX). Care must be taken to not over validate inputs because this may lead to users not using the system due to increase difficulty or unintentionally decrease the usefulness of the received data.			component of the API methods.

5.4 Standardised Data Collection

Guiding Principle #4:	**Standardised data collection** – Data is received in a uniform approach. Care is taken to not duplicate data where it is unnecessary to do so.
Context	Data is currently received through a variety of methods including paper-based landing report forms, paper-based observer records, electronic reporting of log books, video capturing and annotations, and VMS GIS data. These methods often differ in accuracy and how quickly the data reaches the agency. A significant portion of this received data is used to verify and validate the primary data. This primary data includes the log books and landing reports; secondary data includes VMS, electronic monitoring, and fish receiver landing reports. Based on the findings of the stakeholder interviews, a number of key challenges have emerged such as: • Difficulties in collating and comparing primary and secondary data sources due to the different collection methods. Additionally, there is often a significant delay between each data source reaching the agency. • Data users and fisheries managers often have difficulty comparing the primary and secondary data due to irregular collection and data storage formats. • Data is often received and stored in silos despite being linked. This creates a significant overhead to link, clean, and process the data before any meaning can be drawn.

Design Principle in Practice

Structure	**People**	**Process**	**Technology**
Much like in 5.3, all data should be received via a uniform method. Each collection method will be designed within the	A move towards a standard data collection method will require significant buy in from agencies, and people	A standardised data collection method will need to be determined from the ground up. This will include analysing the	A modern standard such as API reporting should be made available across the agency reporting streams.

context of the overall data collection and use goals of the agency.	responsible for inputting data. A standardised data collection only has value when all parties participate. This approach is likely to move all reporters to electronic reporting.	business requirements across all domains within a fisheries agency. Once reporting methods are created (APIs and front-end software) then all future reporting will come through these pathways.	Agencies will need to develop or outsource front-end UIs to accompany these APIs. Agencies will need to determine a suitable data storage method that collates data received across streams.

5.5 System Capability Fit for Purpose

Guiding Principle #5:	**System capability fit for purpose** – Implemented systems directly support various business outcomes of fisheries stakeholders
Context	The goal of a fishery management system is to support the management of fisheries. The business needs for fishery management agencies is often changing to adapt to new legislation, new fishing methods, and new scientific research methods. However, agency infrastructure and software systems are in a constant state of catch up. Agency infrastructure and software systems have been created in a reactionary way; often in small bespoke parts using outdated technologies. Based on the findings of the stakeholder interviews, a number of key challenges have emerged such as: • Uplift of the system functionality to meet the evolving business needs is often slow; leading to quicker ad-hoc solutions that become the status quo. • Ad-hoc solutions are often poorly integrated further exacerbating the siloed data problem. • Current system designs do not facility the access and sharing of data in an easy and quick way; this is often done manually. • Over time many systems have become unsustainable from a support and enhancement standpoint. • The conglomeration of small bespoke applications causes significant overhead when updating and releasing new features. This often includes large downtime because modular releases can often not be performed.

Design Principle in Practice

Structure	**People**	**Process**	**Technology**
Systems are defined to meet current but also future business needs. Future business needs will often be unknown, so care must be taken to	The design, maintenance, and uplift of the system must meet the changing business requirements.	Maintenance and design of systems if often more efficient and more accurate when a cross functional team is responsible for delivery.	Current systems are built on old, clunky, and often over powered systems. Lightweight, modular, systems such as cloud-based applications will

modularise applications such that new business needs can easily be meet without the need for a full takedown of a system.	This means business must work closely with the development team. Frequent conversation between product owners and business analysts will help ensure this.	In practice this means a strong integration between the business and IT side such as is typically seen in agile development teams.	better support rapid development that can better keep up with evolving business requirements.

6. Glossary of terms

Term	Description
Alpha stage	Alpha is the experimental stage of a project. It's an opportunity to use prototypes to work out the right thing to build
API	Application programming interface
REST	Representational state transfer – A type of web service
COTS	Commercial off the shelf
Discovery stage	The initial stage of a project, aimed to get a deep understanding of the problems users are trying to solve
EM	Electronic monitoring
FLUX	The Fisheries Language for Universal Exchange
PowerBI	A business analytics service by Microsoft
RFID	Radio-frequency identification, commonly used on credit/bank cards
SBR AU	Standard Business Reporting
VMS	Vessel monitoring system

7. Appendices

Appendix A – Stakeholder engagement

Name	Date	Interview type	Location	Position/Branch	User Persona
Stephen Mayfield & Angelo Tsolos	27/6/19	Phone call	PIRSA (Fisheries, South Australia)	Science Leader, Fisheries; Sub-Program Leader, Molluscan Fisheries (Stephen)	Data User (Stephen) Data Manager (Angelo)
Genevieve Phillips	9/7/19	Phone call	Queensland	Fisheries Resource Officer	Data Manager
Sharna Rainer	25/6/19	Phone call	Fisheries, Tasmania	Senior Officer, Licensing and Operations	Data Manager
Véronique Vanderklift	30/5/19	Phone call	Fisheries, Western Australia	Research Data Manager	Data Manager
Timothy Green	29/5/19	Email	Fisheries, Western Australia	Manager Compliance Statistics & Systems	Data Manager
Mark Cliff	5/6/19	Phone call	Fisheries, Western Australia	Principle Management Officer, Entitlement Monitoring	Data Manager
Joel Shirlow	31/5/19	Phone call	Fisheries, Western Australia	Licensing, Regional Services	Data Manager
Stephanie Nicoloff & Aline Salas	30/5/19	Phone call	Fisheries, Western Australia	Vessel Monitoring System Manger (job sharing)	Data Manager
Nadia Engstrom	24/5/19	Phone call	Agriculture and Fisheries, Queensland	Fisheries Resource Officer	Data Manager
David Makin	17/7/19	Phone Call	NSW Fisheries	Fisheries Manager	Data User
Lucas Sumpter	10/7/19	Phone call	Queensland	Compliance	Data User
Denise Garcia	27/6/19	Phone Call	Fisheries, Tasmania	Senior Officer Fisheries Monitoring	Data User
Sebastian Lambert	21/6/19	Phone call	PIRSA (Fisheries, South Australia)	Manager Intelligence & Strategic Support	Data User

Simon Conron	17/6/19	Phone call	Victorian Fisheries Authority	Senior Scientist	Data User
Ashley Mooney	15/5/19	In-person	AFMA, Canberra	Senior Intelligence Analyst, Fisheries Operations Branch	Data User
Dr Shane Penny	6/6/19	Phone call	Fisheries, Northern Territory	Senior Research Scientist	Data User
Cheryl May	30/5/19	Phone call	Fisheries, Western Australia	Prosecutions System Support Officer	Data User
Jeremy Thuell	22/5/19	Phone call	AFMA, Canberra	Intelligence Analyst, Fisheries Operations Branch	Data User
Karina Hall	21/5/19	Phone Call	NSW Fisheries	Stock Assessment Scientist	Data User
James Parkinson	24/6/19	Phone call	Fisheries, Tasmania	Manger, crustaceans fishery	Fisheries Manager
Blake Taylor	18/6/19	Phone call	Fisheries, Northern Territory	Aquatic Resource Manager	Fisheries Manager
Toby Jeavons	17/6/19	Phone call	Victorian Fisheries Authority	Manager of Rock Lobster and Giant Crab Fishery	Fisheries Manager
Don Bromhead	23/5/19	Phone call	AFMA, Canberra	Manager of Tuna and International Fisheries	Fisheries Manager
Daniel Corrie	16/5/19	Phone call	AFMA, Lakes Entrance (NSW)	Manager of Coral Sea Fisheries	Fisheries Manager
Andrew Powell	15/5/19	In-person	AFMA, Canberra	Manager of Regulatory Improvement and External Services	Fisheries Manager
Dallas D'Silva	12/6/19	Phone call	Victorian Fisheries Authority	Director, Fisheries Policy, Management, Science and Lisensing	Fisheries Manager
Steven Matthews	12/6/19	Phone call	Fisheries, Northern Territory	Program Leader, Research and Field Operations	Fisheries Manager
Tim Nicolas	30/5/19	Phone call	Fisheries, Western Australia	Manger of Aquatic Resource Management	Fisheries Manager
Natalie Rivero	16/5/19	In-person	AFMA, Canberra	Regulatory Improvement and External Services	Fisheries Manager
Callum Tyle	18/6/19	In-person	AFMA, Canberra	Data Architect	IT Specialist

John Garvey	18/5/19	In-person	AFMA, Canberra	Data Manager	IT Specialist
Nirmala Yeruva	15/5/19	In-person	AFMA, Canberra	Apps team manager	IT Specialist
David Newton	17/5/19	In-person	AFMA, Canberra	Senior Network Engineer	IT Specialist
Alex Kay & Malcom Evans	6/6/19	Phone call	Fisheries, Western Australia	Manager ICT Strategy & Architecture (Alex), Enterprise Architect (Malcom)	IT Specialist
Trevor Guy	6/6/19	Phone call	Fisheries, Northern Territory	Business Analyst	IT Specialist
Karen Evans	17/6/19	Phone call	CSIRO, Tasmania	Principle Research Scientist	Third Party User
Patty Hobsbawn	6/6/19	Phone call	ABARES, Canberra	Fisheries Data Manager	Third Party User
Robert Curtotti	12/6/19	Phone call	ABARES, Canberra	Manager, Fisheries Economics	Third Party User
Dr Paul Burch	23/5/19	Phone call	CSIRO, Tasmania	Research Scientist, Temperate Population Dynamics	Third Party User
Ian Knuckey	20/5/19	Phone call	Fishwell Consulting, Victoria	Director	Third Party User
Western Australia group call	29/5/19	Group phone call	Fisheries, Western Australia	Various	Various

Appendix B – Problem themes out of scope

Culture

Fisheries managers, data users, and third party users all highlighted data issues that stem from a cultural standpoint.

Some interviewees highlighted that some people could intentionally report incorrectly to gain an advantage.

Data Awareness

Fisheries managers, IT specialists, and data users all expressed that some received data is not being used because users are not aware the data even exists.

These interviewees expressed that this is likely due to the complex and irregular nature of data collection and storage.