Final Report - FRDC Project 2009-088

Shark Futures

Sustainable Shark Fisheries – a National Research, Development and Extension Framework

Andy Bodsworth & Dr James Scandol

Australian Government

Fisheries Research and Development Corporation

Project No 2009/088

FRDC TRF Project 2009-088

Sustainable Shark Fisheries – a National Research, Development and Extension Framework

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Non Technical Summary

2009-088	Sustainable Shark Fisheries – a National Research, Development and Extension Framework

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OBJECTIVES:

1. Develop a national Research, Development and Extension (RD&E) Framework to underpin improved management outcomes for Australian commercial, recreational, and indigenous fisheries where shark species are caught.

Project Outcomes

The principal output from the project is a contemporary RD&E framework to target shark associated fisheries research to management priorities, generate RD&E efficiencies, and improve the return on investment of FRDC funding.

Outcomes from the project should be high value shark related RD&E that is closely aligned with Australia's current management priorities for fisheries that take or otherwise interact with sharks. Ultimately the framework is intended to promote RD&E activities that will underpin improved Ecologically Sustainable Development (ESD) outcomes for these shark associated fisheries.

NON TECHNICAL SUMMARY:

The populations of many shark species are inherently vulnerable to depletion from the impacts of fishing and other human activities. Combined with regulatory requirements for sustainable fisheries management, and strong government and public interest in the conservation and management of sharks, this vulnerability has led to increased management and research attention for shark species in recent years.

The Fisheries Research and Development Corporation (FRDC) have recognised the critical importance of effective and efficient RD&E for shark associated fisheries. Clearly defined RD&E, targeted to recognised shark management priorities, will not only improve the return on investment for public and fishing

industry funds, it is highly likely to drive substantial improvements in ESD performance for shark associated fisheries.

In conjunction with an Australian Government sponsored review of the effectiveness of *Australia's National Plan of Action for the Conservation and Management of Sharks* (Shark-plan 1), the FRDC commissioned development of a practical RD&E framework to guide development of highly targeted and relevant shark related RD&E proposals, and enable the corporation to evaluate those proposals in a transparent, rigorous and efficient way. The evaluation would then form the basis for prioritising proposals for FRDC funding.

This new FRDC RD&E Framework (Sharks), referred to as *Shark Futures*, provides clear guidance to RD&E providers about contemporary management priorities for sharks. It defines priority shark management themes, and then describes ten RD&E proposal attributes designed to focus RD&E proposals on high value activities. These are the sort of activities that can significantly improve ecological, economic, social and cultural outcomes for shark associated fisheries across Australia. The framework also has the potential to extend best practice shark RD&E into the region, and internationally.

Shark Futures is a stand-alone document designed as a *how to* guide for RD&E providers. It helps them develop proposals that are clearly targeted to current shark management priorities, and to clearly describe the potential value of their work. This in turn will enable FRDC to fund those proposals that are most likely to contribute to strong ESD outcomes for shark associated fisheries.

Key Words: sustainable fisheries; sharks; shark management; fisheries management; shark research; research, development, and extension; fisheries ESD outcomes.

Acknowledgements

Australian RD&E providers with an interest in shark conservation and management provided invaluable assistance in the development of Shark Futures. Fisheries managers and marine environment agency officials from all Australian jurisdictions also contributed valuable information, helping to develop and refine key aspects of the new framework.

The Oceania Chondrichthyan Society; and shark RD&E providers from James Cook University also enabled the project team to attend Sharks International at late notice, and facilitated valuable networking during the conference.

FRDC had the foresight to initiate the project and integrate it with the separate project (funded by the Australian Government) to review and re-develop Australia's NPOA Sharks. FRDC funded the development of the Shark Futures framework through their Tactical Research Fund and provided welcome assistance with meetings, project administration and support.

Finally, Dr James Scandol as co-investigator is thanked for his major contribution to this project; and his enthusiastic, objective, and insightful contributions to fisheries science and management more broadly over recent years.

Background

Many shark species[1] are recognised to be particularly vulnerable to depletion from fishing and other anthropogenic impacts. Their generally low productivity and slow growth also mean that population recovery time for depleted and less productive shark species can be very slow. Within Australia and internationally, there is increasing community, government, and fishing industry awareness about these issues.

These shark sustainability challenges emphasise the need for carefully defined Research Development and Extension (RD&E) priorities, and projects that can drive strong sustainability outcomes for shark associated fisheries.

Recognising this, the Fisheries Research and Development Corporation (FRDC) Board recommended that a Tactical Research Fund (TRF) project be commissioned to develop a national Shark RD&E framework. The framework is intended to:

- Clearly guide future FRDC investment in shark fisheries research;
- Be informed by an expert consultation (workshop) in conjunction with the June 2010 Sharks International conference in Cairns;

[1] The term "shark" refers to all species of chondrichthyes or cartilaginous fishes including (sharks, dogfish, sawfish, sawsharks, rays, skates, chimaeras etc.)

- Be informed by and benefit from the current evaluation of the effectiveness of Australia's NPOA Sharks (Shark-plan 1);
- Be consistent with RD&E themes developed as part of the new Australian NPOA Sharks (Shark-plan 2); and
- Be consistent with FRDC's National Fishing and Aquaculture RD&E Strategy, including the focus on national scale research, with regional scale development and extension.

The FRDC approached Zetafish Pty Ltd (James Scandol), and Cobalt Marine Resource Management Pty Ltd (Andy Bodsworth) to complete the project. This final project report provides an overview of the process, results, and key issues arising during the project.

Need

The biological and life history characteristics of many shark species, and their susceptibility to many fishing methods, has contributed to strong domestic and international concerns about shark sustainability (Bensley et al., 2010; FAO, 2000). In Australia, recent emphasis on ecological and ESD based fisheries risk assessments (Fletcher et al., 2002; Hobday et al., 2006: Scandol et al., 2010) has continued to demonstrate ongoing sustainability challenges for sharks caught in marine fisheries. Many of these species are now a high priority for research and management attention.

This, combined with their key ecological role, and an increasing community awareness and attention on the sustainability of shark fisheries; as well as the need for increasingly efficient use of fisheries research funding, demonstrates the need for effective and efficient RD&E targeted to management priorities. This need is relevant domestically and regionally, and at an operational and more strategic level.

There is also a requirement to co-ordinate FRDC investments in shark-associated fisheries RD&E with key national investments in infrastructure such as the IMOS Australian Acoustic Tagging and Monitoring System. The large distances moved by some sharks, and the widely dispersed nature of many shark populations, require cross-jurisdictional research and management responses. There is valuable leverage associated with the integrated application of some of these infrastructure developments.

Given constraints for fisheries RD&E funding, and an emphasis on funding RD&E for larger or more valuable commercial fisheries, shark associated RD&E must reflect management priorities and work to deliver practical cost-effective solutions to identified problems. Such projects must also demonstrate strong and relevant collaboration to generate efficiencies, promote knowledge transfer, and build technical and human capacity. Without these attributes, future shark-oriented RD&E will not achieve its potential to drive demonstrable improvements to ESD outcomes for these species, and the fisheries that interact with them.

Objectives

The objective for this project was to:

Develop a national Research, Development and Extension Framework to underpin improved management outcomes for Australian commercial, recreational, and indigenous fisheries where shark species are caught.

Methods

The project used a combination of methods to develop Shark Futures (figure 1).

Figure 1: Process to develop Shark Futures

The activities outlined above included less formal, albeit valuable, networking and liaison with Australian and international shark related RD&E providers, fisheries managers, and conservation agency staff

during *Sharks International* in Cairns (6-11 June 2010). This was followed by the project stakeholder workshop in Cairns (11 June 2010). The workshop engaged fisheries managers and research providers from most Australian jurisdictions in a process to further define and validate the shark management themes and RD&E proposal attributes (see agenda at Appendix 2). Workshop evaluation forms were completed by all attendees and reviewed by the project team to further refine the approach. Workshop feedback was, overall, very positive.

After the workshop the next version of proposed themes and attributes were circulated to all Australian fisheries management agencies and DEWHA for their consideration and comment (13-21 July 2010). The draft RD&E framework was then prepared and circulated to fisheries management agencies and RD&E providers nationally. Recipients were also asked to circulate to their professional networks to extend the reach of the consultation process (e.g. it was subsequently circulated amongst members of the Oceania Chondrichthyan Society). Valuable comments were received from a range of stakeholders and these were incorporated where appropriate.

The Commonwealth Fisheries Research Advisory Body (ComFRAB) also requested a presentation on the proposed RD&E framework, and the development of Australia's next NPOA Sharks (Shark-plan 2). This was provided by the Principal Investigator (PI) at the Australian Fisheries Management Authority (AFMA) in Canberra on 22 September 2010. It provided a valuable opportunity to extend information about the framework, and its future application, to a range of key stakeholders.

For the project team, attendance at *Sharks International*, including conference presentations, and the opportunity to network with Australian and international shark RD&E experts and fisheries management staff was also very valuable. Collectively this provided exposure to the very latest shark related research and management activities; and facilitated access to the very significant expertise and goodwill of Australia's shark science and management community.

Results & Discussion

Progress throughout the project was generally good. There were some minor delays during consultation processes due to late responses by some stakeholders (noting that deadlines for the project were also tight). In general, there was ongoing support for the development of the framework, and for the final product, as the project progressed. The majority of RD&E providers and fisheries managers recognised the substantial value that the framework could deliver to both RD&E planning and delivery; and ultimately to improved ESD outcomes for shark associated fisheries.

The themes and attributes developed for Shark Futures complement the inter-related strategic and business objectives for Australian primary industries RD&E more broadly, and also link closely with strategic fisheries research themes described in the FRDC's *Working Together: the National Fishing and Aquaculture RD&E Strategy 2010.*

Shark Futures Themes

The sustainable shark management themes used to guide the development and evaluation of projects under Shark Futures represent priority work areas for improved shark management. They were informed primarily by Australia's regulatory requirements for sustainable fisheries; the recent review and re-development of Australia's NPOA Sharks; and a review of recent shark related RD&E projects and contemporary shark and broader fisheries management initiatives in Australia and internationally.

The themes are described in figure 2 below, which also illustrates the central importance of stakeholder engagement in enabling effective and efficient RD&E for shark associated fisheries.

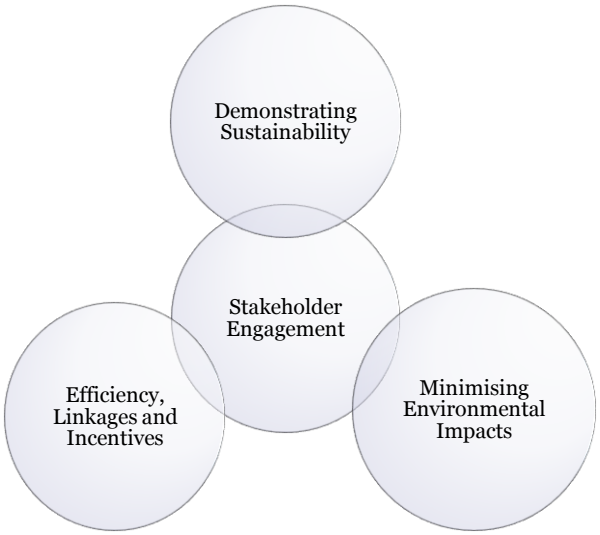

Figure 2: Themes for Shark Futures

The draft themes were presented at the Cairns shark RD&E workshop held immediately after the Sharks *International* conference. They were then finalised after a second broader round of consultation with key shark RD&E stakeholders. Despite some debate about the language used to describe the themes, there has been widespread stakeholder acceptance of their relevance and importance to contemporary best practice shark fisheries management.

Shark Futures Attributes

The attributes work to guide the development of high value shark related RD&E proposals. They do this by describing the most important characteristics of high value RD&E activities in a contemporary Australian fisheries and shark management context. They then encourage RD&E providers to clearly define how their proposed RD&E activities will efficiently deliver against those priorities.

In addition to targeting specific high value research areas and activities, the attributes also focus closely on improving RD&E and management capability at various scales; and leveraging off existing capabilities, and investments which have particular relevance for some shark species. These include substantial

national and regional infrastructure investments like the broader Integrated Marine Observing System (IMOS), and the Australian Tagging and Acoustic Monitoring System (ATAAMS).

Key issues arising from consultation on the proposed themes and attributes included:

- The nexus between the FRDC RD&E Framework Sharks (more fisheries focused) and more conservation focussed shark RD&E (which would also benefit from a more efficient RD&E framework);
- Concerns that high value single species research may be disadvantaged by the framework noting it has something of a focus on multi-species and cross jurisdictional RD&E and management;
- Desire by some agencies to include a greater level of detail and prescription for the themes and attributes of the framework
- Desire by some agencies for the FRDC Framework to support activities that might be better categorised as core management and research for those agencies (i.e. fisheries catch and effort data collection and verification, or basic biological work, or stock assessments for exploited species).

Road testing Shark Futures

A selection of recent shark related RD&E proposals were evaluated under the framework to test how it could work in practice. The PI and co-investigator separately evaluated each of four proposals against the ten attributes, allocating a score to each proposal as described in the framework. Although the total scores for each proposal varied, the order of merit (or relative value) of the four proposals was the same for both reviewers. In general, the framework worked well to identify the value that each proposal was likely to deliver against each of the attributes, and thus more broadly against national and more shark specific RD&E priorities.

To guard against the possibility of significant variation in reviewers' scores, and thus disagreement about the relative value of proposals, a decision rule to enable reconciliation of views was developed as follows:

> *If the two reviewers give an overall score for the same application that deviate by more than ±2, then the causes for this difference will be investigated and the reviewers asked to revise one or both of their assessments until this requirement is satisfied. The final score will be the average of the two reviewers' assessments.*

At FRDC's request the PI also met with shark related RD&E providers from the NSW Department of Industry and Investment at Cronulla Fisheries Research Centre to brief them on the new framework. This group then worked through a process to illustrate how future departmental research proposals might be developed and structured to align with the framework and improve the value derived from future research.

Benefits and Adoption

Benefits

Whilst not exhaustive, the following Australian fisheries were identified as potential beneficiaries from improved shark related RD&E activities:

Table 1: Beneficiary fisheries

Fisheries Management Jurisdiction	Fishery Name
Australian Government (commonwealth fisheries)	Torres Strait Prawn Fishery, Northern Prawn Fishery, Eastern Tuna and Billfish Fishery, Southern and Eastern Scalefish and Shark Fishery, Western Tuna and Billfish Fishery, Western Trawl Fisheries, Skipjack Tuna Fishery; recreational and charter fisheries under commonwealth jurisdiction
Queensland	Gulf of Carpentaria Inshore Finfish Fishery, East Coast Otter Trawl Fishery, Gulf of Carpentaria Finfish Trawl, Gulf of Carpentaria Line Fishery, River and Estuary Fishery, Coral Reef Finfish Fishery, Rocky Reef Fishery; recreational and charter fisheries
New South Wales	Ocean Trap and Line Fishery, Ocean Trawl Fishery, Estuary General Fishery; recreational and charter fisheries
Victoria	Bay and Inlet Fisheries, recreational and charter fisheries
Tasmania	Estuary General Fishery; recreational and charter fisheries
South Australia	Marine Scalefish Fishery, Prawn Trawl Fishery
Western Australia	Tropical Shark Fishery (North Coast), Shark Bay Prawn Fishery, Exmouth Gulf Prawn Fishery, Kimberley Prawn Fishery, Temperate Shark Fishery (Joint Authority Southern Demersal Gillnet and Longline), Tropical Shark Fishery (Joint Authority Northern), Temperate Shark Fishery (West Coast Demersal Gillnet and Longline), Northern Demersal Fishery, South Coast Trawl Fishery, Albrolhos Is and Mid West Trawl Fishery, Wet-line Fishery, Pilbara Fish Trawl Fishery
Northern Territory	Shark Fisheries and recreational and charter fisheries

Shark Futures was commissioned and designed to add value to shark associated RD&E, and thus improve the return on FRDC's investment. Principal benefits likely to accrue are:

- More efficient shark related RD&E for Australian fisheries (improved collaboration, leverage, knowledge transfer, competition, outcomes based)
- RD&E that is targeted to current fisheries management priorities for sharks and associated fisheries, and more clarity for RD&E providers about these priorities
- Alignment with Australia's next NPOA Sharks (Shark-plan 2) and regional extension of best practice RD&E planning and delivery

- Delineate RD&E areas most relevant to FRDC investment and those more suited to investment at an agency or jurisdictional level (i.e. agency core business like fishery observer programs)
- Improved ESD outcomes (ecological, economic, social, and cultural) for Australian fisheries that interact with sharks.

The potential for the framework to drive more collaborative development and delivery of RD&E activities, and the value from this, is significant. By enabling higher value RD&E proposals, and promoting core RD&E and management competencies relevant to sustainable shark fisheries (and fisheries management more broadly), the framework can add substantial value for FRDC and key shark fisheries and management stakeholders.

The framework is also likely to *raise the bar* with respect to the development and delivery of higher value RD&E activities. In the context of limited fisheries RD&E funding available for shark research, the framework should encourage more innovative proposals that clearly demonstrate value on several fronts. Those RD&E providers and agencies that collaborate with managers and other stakeholders, and within their own teams and business groups, to identify and target higher value areas are likely to be rewarded with funding. This has the potential to improve productivity with agency teams, and more broadly across the fisheries RD&E and management spectrum.

Adoption

Shark Futures will be used to guide development and evaluation of shark related proposals for the main FRDC funding round for 2010 (proposals due 1 November 2010) and thereafter. It will also be used for shark related Tactical Research Fund (TRF) proposals after 1 January 2011. To enable widespread adoption in the lead up to the 1 November 2010 round, the framework was widely circulated as a final draft, with a commitment from FRDC that the themes and attributes, and how they would be used to assess proposals, would not change in the lead up to the 2010 main round.

The framework has been designed for ease of use by RD&E providers. It provides clear guidance about how providers should develop and present their proposals; and how FRDC will then apply the framework to evaluate those proposals. The final framework will be widely circulated to fisheries management agencies, marine conservation agencies, and RD&E providers around Australia. It will also be provided to special interest groups like the Oceania Chondrichthyan Society (OCS) and the IUCN Shark Specialist Group (SSG) to broaden potential adoption regionally, and to aid extension. Shark Futures will be readily accessible via the FRDC website, with links to the framework available on key stakeholder websites (i.e. OCS, fishing industry peak bodies).

Further Development

Cobalt MRM will work with the FRDC early in 2011 to identify any areas where the framework and its application can be improved prior to the main funding round for 1 November 2011. As part of this process Cobalt will consult with selected key stakeholders to seek their views about how well the

process worked for the 1 November 2010 round. A brief evaluation report with relevant recommendations will be provided to the FRDC by 30 June 2011.

Planned Outcomes

Planned outcomes from the project were identified in the initial proposal as:

> *Delivery of a Research, Development and Extension (RD&E) Framework to guide FRDC's investment in shark fishery research… the framework will enable more effective and efficient RD&E activities to underpin positive management outcomes for Australian shark fisheries, and fisheries where sharks are taken as bycatch. It will link closely with Australia's next National Plan of Action for the Conservation and Management of Sharks (Sharkplan 2).*

The proposal also required that Shark Futures:

- Clearly guide future FRDC investment in shark fisheries research;
- Be informed by an expert consultation (workshop) in conjunction with the June 2010 Sharks International conference in Cairns;
- Identify the linkages between the RD&E priorities for shark-associated fisheries and other data collection opportunities (such as that presented by the Australian Acoustic Tagging and Monitoring System);
- Be informed by, and benefit from, the current evaluation of the effectiveness of Australia's NPOA Sharks (Sharkplan 1);
- Emphasise the need for multi-jurisdictional RD&E projects, particularly for species with widely distributed populations; Indicate that a balance of project-types will be required, including research that collects new observations, and others that make use of existing observations (or information streams, such as IMOS facilities and Blue-link), and;
- Be consistent with FRDC's most recent National Fishing and Aquaculture RD&E Strategy, including its focus on National R (Research) with Regional D&E (Development and Extension).

The primary project output (*Shark Futures*) was developed to deliver expressly against these design criteria. Much of the detail about how the framework will contribute to planned outcomes for the project is also contained within the framework which has been developed as a stand-alone document for use by RD&E providers and shark fisheries managers.

Ultimately, and with the commitment of Australia's shark research and management community, the framework is highly likely to improve ESD outcomes for Australian shark associated fisheries. In addition to ongoing fisheries RD&E program evaluation by FRDC, Shark Futures, by virtue of its association with Australia's next NPOA Sharks, will also be evaluated to determine to what extent it has contributed to improved ESD outcomes for these fisheries.

Conclusion

The FRDC has recognised the need for a more transparent, well defined, and efficient RD&E framework to guide its investment in sustainable shark related fisheries. By preparing a well defined project brief and capturing efficiencies available from alignment with the review of Shark-plan 1, and development of Shark-plan 2; and resourcing the project appropriately, the development of *Shark Futures* has been relatively smooth and efficient.

Importantly there has been good stakeholder engagement throughout the project, and widespread recognition of the immediate and more strategic value of such a framework. These factors have been important in enlisting the considerable expertise and goodwill of the Australian shark management and research community. This is a good example of how close alignment of objectives, stakeholder values, and work processes can deliver effective results in an efficient way.

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Appendix 1 – Project Staff

Principal Investigator:	Andy Bodsworth, Director Cobalt Marine Resource Management Pty Ltd
Co-investigator:	Dr James Scandol, Director Zetafish Pty Ltd
FRDC:	Dr Carolyn Stewardson, Projects Manager (Research)
FRDC:	Crispian Ashby, Programs Manager

Shark Futures: an RD&E Framework for Sustainable Shark Fisheries

Overview for Principal Investigators

Principal investigators preparing proposals for FRDC funding to support shark-associated projects should review this Framework carefully. It provides information about nationally identified needs for research, development and extension (RDE) projects for shark-associated fisheries; and a set of *attributes* for shark related RDE that will be used by FRDC, in addition to their existing processes, to prioritise projects for funding. Shark-associated projects which do not address at least some of these attributes are unlikely to be funded by FRDC.

FRDC have commissioned this Framework to ensure that shark-associated fishery RDE proposals are highly relevant to recognised high priority shark specific RDE and management needs; and are very likely to represent strong value across the range of relevant shark specific RDE attributes, as well as the more generic FRDC funding criteria.

The attributes used in the Framework have been designed to reflect the more unique and important aspects of shark related RDE that need to be considered in FRDC funding proposals for the 1 November 2010 funding round and beyond. The attributes (page 29) are the central component of the RDE Framework (Sharks) and should be studied carefully. Examples of how these attributes should be integrated into a FRDC application are also provided (page 31).

To provide context and guidance about the type of projects that could be supported, three overarching shark associated research, development and extension themes have also been provided.

The requirements of this Framework are **in addition to** the requirements of current FRDC applications, including existing consultative processes and deadlines. This information is available from http://www.frdc.com.au/research/applying-for-funding.

After reading this Framework, principal investigators should review the "Checklist for Principal Investigators" (page 33) to clarify the requirements associated with submitting a suitable RDE proposal.

Introduction

Purpose of this Framework

Shark Futures has been developed to improve the *return on investment* for FRDC funds directed to shark associated RDE activities. These funds, sourced from the commercial fishing industry and the Australian government, are used to support activities that will further the achievement of Ecologically Sustainable Development (ESD) objectives for Australian fisheries that interact with sharks. The elements of effective RDE for sharks that combine to make up this *return on investment* are diverse. They are discussed in more detail throughout the Framework.

Scope of this Framework

The Framework provides guidance to research providers seeking FRDC funding support for projects directly relevant to sustainable fisheries management for chondrichthyans (hereafter sharks). The relevant fisheries may be commercial, recreational, or Indigenous; and the impacts on sharks can result from either target shark fisheries or byproduct/bycatch fisheries where sharks are taken, discarded, or released. Under the Framework, all of these fisheries are referred to as "shark-associated fisheries".

Fishery impacts on threatened, endangered or protected sharks (TEP species), and marine ecosystems (such as trophic effects), relevant to sharks are also recognised. RDE proposals associated with such fishery impacts could be supported under this framework.

Who should read this Framework

People or groups interested in submitting or supporting RDE proposals associated with sharks to the Australian Fisheries Research and Development Corporation (FRDC) in the 20011/12 round (full proposals due by 1 November 2010), and beyond. Although this document is structured assuming a full application will be submitted, the Framework is equally applicable to proposals under either the large or small FRDC Tactical Research Funds (TRF).

How can I use this Framework to improve my FRDC application?

This Framework is aligned with RDE themes and higher level research needs relevant to the development of Australia's next National Plan of Action for the Conservation and Management of Sharks (Shark-plan 2). Shark-plan 2 will provide an overarching shark conservation and management framework for all Australian fisheries that interact with shark species.

This Framework also describes priority attributes of RDE projects for shark-associated fisheries. These ten attributes have been developed from RDE gaps identified during the recent evaluation of Australia's first NPOA Sharks (Sharkplan 1); and after broader consultation with a range of Australian fisheries research providers and managers. A proposal under this Framework must clearly address these attributes (page 29). The usual characteristics of successful FRDC proposals (such as attractiveness and feasibility) remain highly relevant under this Framework.

A checklist is provided to enable you to test your proposal against the Framework requirements (page 33). If your RDE proposal does not address at least some of the attributes provided in this Framework then FRDC funding will not be provided.

How will this Framework be used by FRDC?

FRDC currently use three general criteria for assessing RDE applications. These are *attractiveness*; *feasibility*; and *other considerations* (see PP-02: Annual Competitive Round Procedure). The additional shark specific attributes developed for this Framework (page 29) are designed to complement the *attractiveness* criteria. Existing criteria for attractiveness include:

- relevance to R&D Themes
- stakeholder support
- likelihood of adoption
- value for money
- level of impact
- contribution to new knowledge
- linkages and collaboration
- consequences of not undertaking the research.

These criteria remain highly relevant to all proposals. Applicants should note that the specific attributes identified for the Shark Futures framework will be considered **in addition to** the existing criteria. For information, the FRDC's existing criteria for feasibility are:

- likelihood of success
- well defined planned outcomes
- outputs clearly defined and linked to planned outcomes
- objectives clear
- methodology sound
- track record of investigator
- capacity to deliver.

Regulation, Policy, and Planning for Sustainable Shark Fisheries

Fisheries and marine environmental management legislation across Australia is focused on Ecologically Sustainable Development (ESD) objectives, with some variation in interpretation across jurisdictions. Fisheries legislation for each jurisdiction, as well as the overarching fisheries and marine focused provisions of the Commonwealth's *Environment Protection and Biodiversity Conservation Act* 1999 (EPBC Act) are recognised as the primary drivers for improved shark conservation and management in Australia, particularly over the last decade. The Shark Futures framework recognises the critical importance of these primary regulatory frameworks, and subordinate legislation and policy.

At the international level, the United Nations' Food and Agriculture Organisation (FAO) has developed its International Plan of Action for the Conservation and Management of Sharks (IPOA Sharks); whilst also calling on member States to develop a National Plan of Action (NPOA) for the Conservation and Management of Sharks. Australia's first NPOA Sharks (Shark-plan 1), was introduced in 2004. A national

project to evaluate the effectiveness of Shark-plan 1, and develop its successor (Shark-plan 2) is currently in progress. Findings from the review of Shark-plan 1 have been used to inform development of this RDE Framework. Specifically the shark RDE themes for the Framework will complement the key RDE elements likely to be included in Shark-plan 2. These themes, discussed in more detail below (page 23), aggregate the range of contemporary and higher priority RDE and shark specific fisheries management challenges into logical groups.

The FRDC's strategic and business planning framework links directly to the overarching objectives of Australia's *Primary Industries and Energy Research and Development* (PIERD) *Act.* This in turn guides rural industry focused RDE through national research priorities. For Australian fisheries and aquaculture industries, the FRDC's *Working Together: the National Fishing and Aquaculture RDE Strategy 2010* (hereafter *Working Together*) provides Strategic Research Themes which overlay the shark focused RDE themes described in this Framework[2] (figure 1 below).

A key concept for the National Strategy is: *"national research, regional adaptive development and local extension"*. To this end the FRDC encourages collaborative arrangements for planning, investment, and/or delivery of RDE consistent with habitat and species distributions, or for other specific issues where a national approach is relevant.

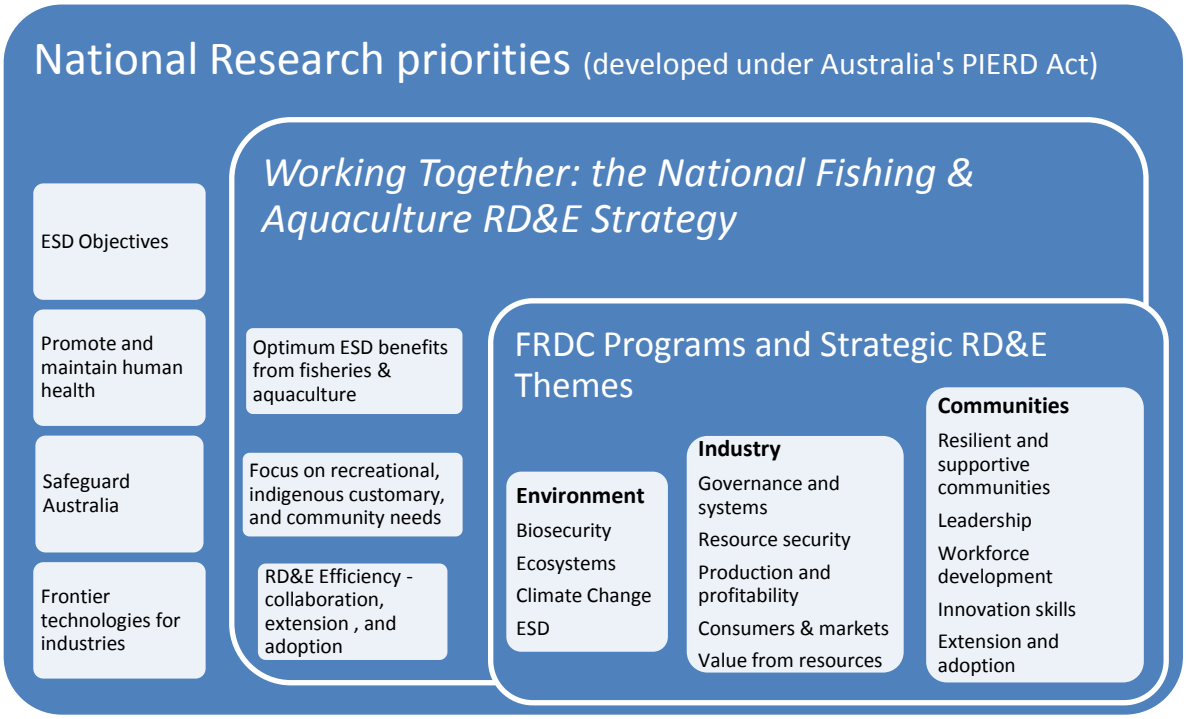

Figure 3: FRDC's strategic research planning structure

[2] Not all of the strategic RDE themes from the FRDC's National Strategy are directly relevant to Shark Futures. Not all of the strategic RDE themes from FRDC's National Strategy are directly relevant to this Framework (see: www.frdc.com.au/research/national-framework).

The Shark Futures framework explicitly encourages the development of RDE proposals for shark related fisheries that directly address previously identified priorities from fisheries specific or agency research plans, formal stakeholder consultative arrangements like Management Advisory Committees[3], marine Resource Assessment Groups; or RDE derived from formal fishery ecological, or ESD, risk assessment processes. In recognition of the large national investment in risk assessment work in recent years, and its primary relevance to shark species, additional commentary and guidance on the FRDC's interpretation of RDE proposals within the context of formal risk assessment processes is provided (page 30).

Whilst many of the RDE issues discussed in this framework reflect current and more operational management priorities for sharks there remains a key role for more strategic RDE activities. These can work to enable less reactive and more cost effective and efficient fisheries management in the medium to longer term.

Research, Development and Extension Themes for Australian Shark Fisheries

Background

Development of the RDE themes for Shark Futures has been informed primarily by current Australian fisheries and marine environment legislation and policy; the FAO guidelines for sustainable shark fisheries, and its IPOA Sharks; and Australia's 2004 NPOA Sharks (Shark-plan 1). The recent review of Shark-plan 1 has also enabled a more contemporary appreciation of the priority RDE needs likely to contribute to stronger management outcomes for shark related fisheries. Analysis of shark related RDE proposals received by FRDC over recent years, including their strengths and weaknesses, has also provided valuable insight.

Once these preliminary shark RDE themes were developed, the project team attended the *Sharks International* conference in Cairns hosted by James Cook University. They also facilitated an FRDC shark management and research workshop (Cairns, 11 June 2010) to further develop and test the proposed themes, and the preliminary attributes for the framework.

The findings from this scoping and validation of initial shark related fisheries RDE themes can be grouped into the following areas:

- ensuring established shark-associated fisheries, and any proposed new fisheries impacting on sharks, are ecologically sustainable, including improved bycatch management to mitigate incidental mortality;

[3] Such committees play a valuable role in assimilating stakeholder perspectives into management and RDE priorities for sharks. This collaborative approach is fundamentally important for effective and efficient shark management, including RDE processes.

- understanding and improving stakeholder engagement to facilitate more effective shark conservation and management (including compliance with management arrangements);
- understanding and applying economic factors that may enable improved ESD outcomes for shark-associated fisheries (e.g. optimum use of catch, economic incentives for and barriers to improved performance, ensuring appropriate management costs); and
- improving the quality, comparability and availability of catch and effort data for shark-associated fisheries, including collaborative research, data sharing, and an improved understanding of the cumulative impacts of fisheries on sharks.

The review of Shark-plan 1 also suggests that improved stakeholder engagement and empowerment (at both an international and domestic level) are key areas for improvement in the management of shark-associated fisheries. Rather than identifying a specific RDE theme covering engagement and empowerment (and potentially isolating stakeholder communication and engagement from research), the decision was taken to emphasise these aspects for mandatory consideration in proposals submitted under the Shark Futures framework.

RDE providers should use the standard FRDC application template to describe their extension strategy. If RDE providers do not have the requisite experience in this area, they should present clear strategies to manage this in their application. The groupings discussed above, and the central role of stakeholder engagement are illustrated in Figure 4 . Social research likely to lead to an improved understanding of stakeholder incentives, or improve communication strategies, is also relevant (see Theme 3 on page 26).

Readers should note that the text provided on the RDE themes (below) illustrates the scope of these themes. It is not intended as an endorsement (or otherwise) for particular projects.

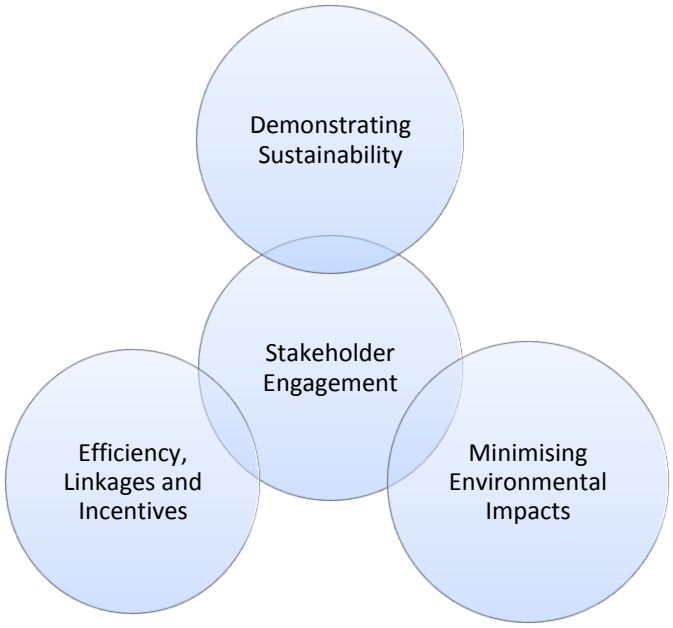

Figure 4 The research, development and extension themes presented in this framework.

Theme 1 - Demonstrating Sustainability: Evidence-Based and Low Risk Management for Shark-Associated Fisheries

The challenges associated with evidence-based fisheries management are particularly acute with shark-associated fisheries. The widely dispersed nature of many shark populations, coupled with low growth rates, late maturity, and generally low fecundity requires careful consideration of the available fisheries management tools. Robust performance management should underpin existing management arrangements, or any new approaches that are proposed. This theme has two primary and interdependent components: understanding the biological production of species or species groups and managing this against fisheries management reference points; and improving risk management for shark-associated fisheries.

The inherent vulnerability of many shark species to fishing pressure coupled with a paucity of species specific knowledge highlights the relevance of precautionary management strategies. Similarly many shark species play a key ecological role and knowledge about the likely consequences of existing harvest levels on ecosystem function are not well understood.

There will be occasions where the costs of obtaining the evidence necessary to justify existing or higher exploitation rates will be prohibitively expensive, particularly for lower value species, or bycatch issues in smaller fisheries. In such circumstances it may be more appropriate to manage in the face of this uncertainty by taking more precautionary management decisions (i.e. reducing exploitation rates, or using spatial management to protect high value areas).

Understanding and Managing Production

Understanding the productive capacity of shark populations and their resilience to fishing pressure, and managing exploitation rates within these limits requires approaches such as: better data and methods to estimate biological reference points and current exploitation rates and population status; development and implementation of more sensitive, specific and cost-effective indicators; development of effective harvest control rules; assessing and managing cumulative impacts on shark populations; and management strategies to improve outcomes for widely dispersed multi-species populations across jurisdictions. Understanding and using information from tagging programs (including conventional and acoustic tags) to improve the sustainability of shark fisheries would also fall within this RDE theme. Other examples include evidence-based strategies to rebuild and recover over-exploited shark populations. Where information costs are prohibitive relative to fishery values, the development of more precautionary management strategies is likely to be appropriate.

In some circumstances proposals that improve knowledge about the effectiveness of management responses for the recovery of shark species listed under the EPBC Act may also warrant some level of funding from the FRDC.

Improving Risk Management

Risk management provides a framework to improve management outcomes for fisheries where there is ongoing uncertainty about the likelihood or consequences of various human-caused impacts. RDE

providers should look to leverage the results of existing risk assessments and could consider proposals (for example) that:

- reduce the likelihood of unwanted outcomes;
- provide effective management options for fisheries with compromised catch estimates and/or species identification;
- clarify and/or improve the use of precautionary management strategies in shark-associated fisheries;
- reconcile the costs and benefits of exploitation, including the risks, with the costs of management;
- evaluate and if necessary improve the effectiveness of anti-shark finning measures used in fisheries;
- propose new low-cost methods for managing species complexes; or develop and implement the use of "indicator species" in shark-associated fisheries.

Risks may also be clarified by research that reduces the uncertainty around the consequences or likelihood of various impacts. Further comment on links between the Shark Futures framework and established risk assessment processes are provided on page 30.

Theme 2 - Minimising Environmental Impacts in Shark-Associated Fisheries with Technology and Fisher Behaviour

In shark-associated fisheries, there will inevitably be some unwanted interactions with sharks (e.g. catches that exceed bycatch limits; catch at sizes outside minimum or maximum legal lengths; or interactions with threatened, endangered or protected species). In some cases, particularly for TEP species, these interactions may have serious ramifications for the viability of a fishery. RDE proposals that aim to mitigate the environmental impacts of these interactions by improving gear selectivity to reduce bycatch; or by using knowledge of shark and/or fisher behaviour to avoid or minimise unwanted interactions would fit into this theme.

If sharks are likely to be discarded, then RDE proposals that develop and implement strategies to mitigate discard mortality would also be highly valued. This could include Codes of Practice for handling shark bycatch, or experiments or surveys to improve the management of unintended mortality.

Theme 3 – Improving Systems of Management and Research for Shark-Associated Fisheries

The final theme takes a broad interpretation of *management systems* to bring together the remaining project types within the Framework. There are three components to this theme.

Improving the Efficiency of Fisheries and their Management

Economic drivers play a fundamental role in shark conservation and management. Projects that improve the utilisation of shark products, or develop substitutes for shark products, have the potential to improve the efficiency of shark-fisheries or reduce environmental impacts. Improved estimates of the

use and non-use values of sharks will also help to optimise the value derived from these species. RDE projects on governance arrangements for shark-associated fisheries and studies that further our understanding of best mixture of output and input controls for shark-associated fisheries may also be beneficial. Finally, improved estimates of the costs associated with managing sustainable shark fisheries and novel economic analyses (e.g. risk-cost-benefit analyses) may be valuable.

Research, Development and Extension Linkages

Significant numbers of RDE projects for sharks and shark-associated fisheries are underway in Australia and internationally. Although fisheries are broadly recognised as the dominant impact on shark populations, fisheries focused research and development organisations (such as the FRDC) will only be able to resource a subset of higher priority shark RDE projects.

Within the linkages component of this theme, FRDC recognises that increased collaboration with universities, industry, government, and non-government organisations will provide important RDE efficiencies, and opportunities to better understand and manage shark-associated fisheries. Although this approach may not always be relevant to a particular RDE proposal, there is significant scope for new and more cooperative strategies that leverage RDE expertise from multiple sectors to support sustainable shark management.

Stakeholder Incentives

Understanding the incentives driving individual decision-making and managing these to improve outcomes is a key challenge for fisheries management. RDE providers with expertise in this area should consider projects that achieve this goal. Given that many decisions taken for shark-associated fisheries will reflect underlying value-based tradeoffs (e.g. between production and biodiversity), then new strategies to improve stakeholder engagement, and decision making processes, may be valuable.

Principal investigators will be asked to indicate a theme into which their proposal belongs (see page 33). This indicated theme will only be used for *classification purposes* and will not affect the consideration or ranking of the proposal.

Key Project Attributes for the Shark Futures Framework

Proposals submitted under Shark Futures will be evaluated using the usual FRDC criteria for determining funding (FRDC generic evaluation criteria) for main-round and Tactical Research Fund (TRF) applications, as well as the more shark specific attributes described below. The attributes were developed largely on the basis of feedback from FRDC staff, the review of Shark-plan 1, consultation at the *Sharks International* FRDC workshop, and additional consultation with Australian shark RDE providers and fishery managers.

The attributes have been designed to delineate key, and somewhat unique, aspects of shark related RDE for shark-associated fisheries in Australia. They are intended to drive the development of high priority and high value RDE without stifling the innovation, creativity and expertise of research providers.

Feedback from research providers and fisheries managers will enable refinement of the attributes and the Shark Futures framework over time.

A review of the attributes will indicate that projects based on: existing and authoritative risk based management priorities; recognise and cater for widely dispersed shark populations involving multiple species (where appropriate); and, generate solutions which can be applied across multiple sectors and multiple jurisdictions, are likely to have significant value against FRDC's objectives. This type of project is therefore more likely to be supported than projects that don't meet these criteria.

Each attribute is identified with a code (e.g. SHK03) which should be cross referenced in your FRDC application (the steps to follow are fully described on page 31). The attributes are **not** presented in order of priority. Not all attributes need be described in your application, although proposals that do not capture a substantial number of these attributes are unlikely to be successful.

Attributes

SHK01 The proposal addresses a shark related RDE priority previously identified in a fisheries management plan, fishery or fisheries research plan, management advisory committee recommendation, a recovery plan, outlook report, or a similar authoritative document. RDE outcomes that directly support conditions or recommendations for EPBC Act Wildlife Trade Operations, or priorities associated with international obligations (such as those identified by RFMOs and endorsed by Australia) are also relevant. Proposals should provide full details of any previously identified priority RDE outcomes that will be achieved by the project, and an indication of the relative authority of these documents.

SHK02 The proposal has been prepared in response to an existing ecological or ESD risk assessment, or stock assessment.; Furthermore, planned outcomes for the project will increase the likelihood of a fishery achieving its management objectives (additional details of how RDE projects might be applied to reduce such risks is provided on page 30).

SHK03 The proposal recognises and addresses the multi-species nature of impacts from some shark-associated fisheries. RDE proposals that aim to achieve positive outcomes for multiple shark species simultaneously are encouraged.

SHK04 The proposal recognises the widely dispersed nature, and movement patterns of some sharks, and develops a suitable cross-jurisdictional collaboration for research and the consideration of associated management options.

SHK05 The proposal promotes collaboration between researchers, managers and stakeholders, and develops inter-disciplinary solutions (that include biological, economic and social dimensions) for shark-specific issues.

SHK06 The proposal generates outcomes which can be readily adopted by the target stakeholder groups, and describes an adoption pathway.

SHK07 The proposal is very likely to generate practical solutions which have implementation costs commensurate with the value[4] of the fishery or fisheries.

SHK08 The proposal leverages existing Australian and international investments in technology and expertise.

SHK09 Planned outcomes from the proposal will benefit a shark-associated fishery or fisheries with significant production, participation and/or cultural values.

[4] Value may be monetary, social, political, biodiversity related, etc.

SHK10 The proposal recognises the cumulative impacts on many shark populations and develops multi-sector research, development and extension solutions likely to improve management outcomes.

Additional Notes on Linkages to Ecological Risk Assessments (SHK02)

Australian governments and many commercial fisheries have made very significant investments in ecological or ESD focused risk assessments for shark-associated fisheries. Some of these have flowed through to fishery management plans/policies and/or research priorities to improve ESD performance of fisheries.

RDE providers should understand how the ecological or ESD risk assessment relevant to their proposal has been developed and applied. If addressing attribute SHK02, the proponent should clearly indicate how their RDE activities will reduce the level of risk against management objectives (i.e. objectives related to biological, economic, and/or social dimensions of a fishery). There are two general strategies that can be used to reduce environmental risks.

1. Management options that reduce the likelihood of an undesirable outcome by applying additional controls to the source of an impact (e.g. reductions in catch, by-catch reduction devices, spatial or temporal closures). Within this approach, there are two distinct tactics to reduce this likelihood. Firstly, the frequency of an event can be reduced (e.g. less fishing effort), or, secondly, the impact per event can be reduced (e.g. implementation of by-catch reduction devices). Both strategies can be applied simultaneously if required (see Guideline G18 in Scandol *et al*. 2009).
2. The second strategy is more abstract and usually more difficult to justify. Most risk assessments done in Australia include a precautionary interpretation of uncertainty. In such cases, if a particular parameter was uncertain, then risk assessors used a value of that parameter that generated the higher, but still plausible, estimate of risk. For example, if only a range of fecundities for a species was known, then the lower estimate was assumed in the risk assessment. A strategy that potentially reduces risk is to do research to clarify the value of that parameter. Researchers should not, however, assume that all research results in a reduction of risk. In many cases there will be other parameters (such as recruitment or movement) which dominate the uncertainty within the risk assessment. The likely contribution of the proposed research to reducing risks needs to be considered in a comprehensive manner (see Guideline G11 in Scandol *et al*. 2009).

The linkage between your proposal and any cited risk assessment should be described when responding to attribute (SHK02).

Using this Framework with your Application

(also see FRDC fishnet-for-applicants)

Text to address the Framework attributes should be included in the **Methods** section of an FRDC application. The text associated with the attributes should be identified by the heading *"Response to Attributes within the Shark Futures RDE Framework".*

The length of this response should be less than 1000 words. This text can cross-reference other parts of the application as required (and vice versa). Table 2 includes example text to illustrate how a proposal might address the attributes.

Multiple attributes can be referenced with a single justification if appropriate. However, applicants should assist reviewers by being as clear as possible. The order in which the attributes are addressed is unimportant and all attributes will be given the same weight (see page 32). If an attribute is deliberately not being addressed in your application, please make this explicit (e.g. "Attribute SHK03 is not relevant to this application as it is only associated with a single species").

Table 2 Examples of text to link aspects of a proposal to an attribute.

Attribute	Example Text
SHK01	The planned outcomes of this project meet research priority #2 in the jurisdiction's fisheries research priority list, and Condition 3 of the WTO for this fishery (SHK01).
SHK02	The ecological risk assessments for both fisheries state that the risk associated with these three species is very high due to uncertainty about the magnitude of this source of mortality. Outcomes from this research will clarify (and very likely reduce) this risk by reducing the uncertainty associated with the likelihood of this impact (SHK02).
SHK03	The research outputs of this proposal can be applied to any species of large pelagic shark and will be particularly valuable to multi-species shark fisheries where there will likely be ongoing uncertainty about the species composition of harvested sharks (SHK03).
SHK04	This collaboration between our agencies will ensure a consistent management approach to these species of shark in this region. Previous approaches have been compromised because of the wide-ranging nature of these populations and divergent management strategies used across jurisdictions (SHK04).
SHK05	This project will develop new linkages between the university, fisheries management agency and industry (SHK05).
SHK06	Industry has agreed (see letter of support) to use this device on at least 80% of the fleet should the project outcomes be as planned (SHK06).
SHK07	The long-term application of the outcomes of this proposed

	approach is estimated to cost only $50 000/year, which is less than 0.5% of the GVP of the fishery (SHK07).
SHK08	The project will make extensive use of the Integrated Marine Observing System. Co-investigator, Dr X, has a full awareness of the performance of these devices in such a difficult environment. (SHK08).
SHK09	The primary beneficiary of planned outcomes from this project is the X fishery with a GVP of $20 million and direct employment of around 2000 people. Adoption of this technology is likely to reduce shark bycatch by more than 3000 sharks per year (SHK09).
SHK10	These species of shark are harvested by the commercial, recreational and Indigenous sectors. Application of this novel management approach should achieve a significant and proportional reduction in fishing mortality from all three sectors (SHK10).

How will FRDC use the proponents' response against the attributes?

FRDC will apply the following process to applications submitted under the Shark Futures RDE framework. Please also recall that your application will also be evaluated via the usual decision-making and review processes used by FRDC.

After the applications for a particular round have been received, those with the text "Shark Futures:" included as a prefix to the **Title** of the application will be considered in accordance with this Framework.

The text justifying the linkage of the project to the attributes will be evaluated by two independent reviewers. Each reviewer will score the application with respect to the 10 attributes into four categories:

Null — The application does not address the attribute at all (which may be deliberate).

Low — The application is a minimal response to the attribute (e.g. in SHK09, a claim that a commercial fishery of 10 tonnes is significant, would likely receive this score).

Moderate — The application is an intermediate response to the attribute (e.g. a project that had support from only the commercial sector and not the recreational sector would likely receive this score for SHK06).

High — The application is a near complete response to the attribute (e.g. a proposal that addresses issues with all species of chondrichthyan impacted by a particular fishery would likely receive this score for SHK03).

The codes (Null, Low, Moderate, High) are then mapped to the utility values (0,1/3, 2/3, 1) and then summed over all 10 attributes. This gives each application an overall score between 0 and 10.

If the two reviewers give an overall score for the same application that deviate by more than ±2, then the causes for this difference will be investigated and the reviewers asked to revise one or both of their assessments until this requirement is satisfied. The final score will be the average of the two reviewers' assessments.

This final score will then be considered along with the usual FRDC project criteria of attractiveness, feasibility and other considerations.

Checklist for Principal Investigators

Table 3 Checklist for Principal Investigators

Item	☑
Is your proposal associated with sharks or shark-associated fisheries? (if no, this framework is not relevant to your application)	☐
Have you undertaken the usual consultation processes required for a FRDC application?	☐
Have you included the phrase "Shark Futures:" as a prefix to the **Title** of your application to ensure that the project is evaluated accordingly? For example "*Shark Futures: New methods to estimate the fishing mortality rate of the mid-shelf catshark*"	☐
Have you indicated which of the Shark Futures themes the project best aligns within the **Needs** section of the FRDC application? Please include a single sentence paragraph "This project should be considered within Theme 1 - Demonstrating Sustainability: Evidence-Based and Low Risk Management for Shark-Associated Fisheries". See page 23 for a description of the RDE themes for this Framework.	☐
Have you read and understood the Shark Futures *attributes* that will be used to justify support (or otherwise) for your proposal?	☐
Have you included text which justifies which attributes your proposal addresses and clearly cross-references the attribute codes (SHK01 to SHK10) in your text (see example text on page 31)? This justification should be no longer than 1000 words and must be located in the **Methods** section of the FRDC proposal.	☐

Cited guidelines on risk management from Scandol et al, 2009.

Guideline G11 *– Recognise how risk assessments can be used to prioritise research. In particular, where potential outcomes are high risk because of an uncertain likelihood, research can be used to clarify the risk.*

Assuming a precautionary interpretation of uncertainty, some outcomes will be high risk because of an uncertain likelihood. Directed research can often reduce this uncertainty and clarify the estimated likelihood and risk. Note that research could actually increase the calculated level of risk in cases where the original estimate of the likelihood of a consequence was too small.

Guideline G18 *- Risk management is usually carried out by reducing the likelihood of an undesirable outcome.*
The likelihood of an undesirable outcome can be reduced by applying additional controls to the source of an impact (*e.g.* reductions in catch, by-catch reduction devices, spatial or temporal closures). Within these options, there are two distinct strategies to reduce this likelihood. Firstly, the frequency of an event can be reduced (*e.g.* less fishing effort), or, secondly, the impact per event can be reduced (*e.g.* implementation of by-catch reduction devices). Both strategies can be applied simultaneously if required. These strategies are also the primary risk management approaches used in engineering and occupational health and safety.

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Appendix 3 – Cairns Shark RD&E Workshop Agenda

SESSION 1:	**Introduction and project objectives**	**Objective**
	• Background to development of FRDC's RD&E Framework (Sharks), introduction to Agenda, and desired workshop outcomes • Brief overview of ESD/Management perspectives for sustainable shark fisheries (commercial, recreational and indigenous; including fisheries where sharks are target, by-product, and/or bycatch)	Provide information about the RD&E Framework (Sharks) project including scope and context of the project; overview preliminary findings about shark research issues/challenges from the current NPOA Sharks review. Recognise wide ranging movement patterns for some shark sp, multiple/cumulative threats/impacts & hence value of cross jurisdictional research, and management collaboration. Outline the scope of the project for the RD&E Framework (Sharks).
SESSION 2:	**Identifying RD&E themes for sustainable shark associated fisheries?**	**Objective**
	Lubricate our thoughts… • What makes a "model" RD&E project for shark associated fisheries in Australia or internationally? • Choose an example presented or otherwise discussed at Sharks International, or one that occurs to you	To benefit from the knowledge and experience of key shark researchers and managers attending Sharks International to inform development of the themes used within FRDC's National RD&E Framework (Sharks) • Note importance of research and management focus on risks and priorities, as well as more outcome focused RD&E and management.
	Developing appropriate RD&E Themes • Facilitated discussion around suggested key RD&E themes • Gap analysis of suggested themes (what have we missed?)	
	What are the challenges for sustainable shark fisheries? • Are there unique or otherwise special considerations for effective and efficient RD&E projects to support sustainable shark fisheries in Australia? • How do we better connect shark management and shark research?	
SESSION 3:	**Prioritisation of RD&E proposals for shark associated fisheries**	**Objective**
	• Present and discuss preliminary RD&E project attributes to be used for prioritisation (once a shark RD&E proposal is developed and is consistent with the agreed shark RD&E themes, what attributes will be most valued by FRDC and its key stakeholders)	To provide participants with an opportunity to contribute to and understand the attributes of RD&E proposals likely to be used by FRDC to rank proposals.
SESSION 4:	**Alternative Shark RD&E funding sources and synergies** **Concluding discussion & workshop evaluation**	**Objective**

	• Discuss non FRDC funding options and opportunities for synergies • Concluding remarks from participants • Complete a brief workshop evaluation sheet	Collate key sources; are there opportunities to improve co-ordination and RD&E synergies across funding sources and fishery/non fishery related research? Provide participants with an opportunity for concluding points/remarks Was the workshop well run and valuable against stated objectives?