Department of Conservation
Te Papa Atawhai

NIWA
Taihoro Nukurangi

Workshop on research needs for protected corals in New Zealand waters

Date: 12 October 2017

Time: 9:30 – 15:00

Place: Level 4 Conference Room, Conservation House, Department of Conservation, 18-32 Manners Street, Wellington

Workshop leaders: Freya Hjorvarsdottir (fhjorvarsdot@doc.govt.nz) and Di Tracey (di.tracey@niwa.co.nz)

Workshop facilitator: Kris Ramm (kramm@doc.govt.nz)

Rapporteur: Julia Gibson (jgibson@doc.govt.nz)

Attendance: Ian Angus, Freya Hjorvarsdottir, Julia Gibson, Kris Ramm, Shane Geange, Debbie Freeman (DOC), Di Tracey, Helen Bostock, Jaret Bilewitch, Owen Anderson, Ashley Rowden, Mark Morrison, Andrew Tait (NIWA), Simon Davy, Jonathan Gardner (VUW), Rich Ford, Lyndsey Holland, Malindi Gammon, Mary Livingston, Jen Matthews, Tiffany Bock (MPI), Geoff Tingley (GFL/DWG), Rob Tilney (C&A Ltd), Ray Wood (CRP), Mike Patrick (MERMAN Ltd), Pierre Tellier (MFE), Oliver Wilson (FINZ), David Aguirre, Libby Liggins (Massey Uni)

By-catch, identification & data sourced – Di Tracey, Sadie Mills, Kevin Mackay
Presentation on the work carried out by NIWA to identify protected deep-sea corals returned from commercial vessels by Government Observers. Originally the project was funded through CSP, then MPI, but now sits with CSP (three-year programme). Outlined was the work that has been undertaken to improve the accuracy of the samples collected and returned to NIWA, the methods used to identify the samples, where and how the data is stored, and application of the results e.g., data used for spatial distribution maps, pooled with other datasets for predictive modelling, contributes to describing BPA fauna.
Discussions:
It was highlighted that new species are still being identified by the visiting global taxonomic experts. A significant driver for this was that the vessels are still going to new areas and therefore encountering species that we haven't come across before. Further discussion occurred around the method of sample collection. Observer coverage is a key source of samples as well as biodiversity research voyages, in different areas. Discussion on the frequency of areas being re-visited, and samples collected again from these same areas, it was noted that this is difficult as reliable time series do not exist for most areas, but historic data from some areas can be used to determine this.
Protected coral distribution modelling – Owen Anderson, Sara Mikaloff-Fletcher, Helen Bostock, Dianne Tracey
An overview on recent research conducted in relation to the modelled distribution of protected corals in NZ and the methods used. Suitability and use of models and model variables was

described, as well as model development along the way.

Earth System Models - Sara Mikaloff-Fletcher, Helen Bostock, Owen Anderson, Dianne Tracey

Presented on the development of an algorithm that was used to estimate carbonate parameters from hydrographic data for the NZ region. The algorithm produced maps estimating the depth of the Aragonite and Calcite Saturation Horizons (ASH & CSH respectively). The depth of the saturation horizons were then used to predict the location of corals. Recent work has looked at how the saturation levels have changed in the last 20 years and how these types of models can be used to predict future distribution of coral species with respect to climate change.

In 2018 the next generation of IPCC models will be available, which will bring more opportunities for improved modelling.

Discussions:

Discussion centred around how accurate the models are at reproducing the current physical and biogeochemical status of the ocean. The model reliability was checked by comparing the outcomes with actual and historic data. This allows us to assess how reliable the models are at predicting the future biogeochemistry of the oceans.

The benthic habitat models can be run with combined data e.g., by the morphological groups (reef-like, tree-like, etc). The models are however more accurate when individual species are used. When multiple species are aggregated the model becomes less reliable due to variability in the environmental requirements between individual species. Additional layers such as for sediment will improve the models.

Discussion around the possibility to assess how many species we have good enough data to make predictions for and which species we are lacking data e.g., we only have data at the genus level for black corals and bubblegum corals, species level would be more ideal.

Will the location of refugia area for certain corals differ with changes in depths of saturations horizons? E.g., for the stony coral *Goniocorella dumosa* that occurs in shallower waters on the crest of the Chatham Rise.

Biology, age, and reproduction of corals – Di Tracey

Presentation on the biology - growth, growth rates and reproduction of deep-sea corals and the different methods used to age and assess growth rates for different species. The risk assessment highlighted how data poor our knowledge is on coral productivity, which related directly to recoverability of corals from disturbance, i.e., how long will it take certain species to recover from trawling impacts.

Discussions:

Under reproduction there was some discussion about what factors affect the dispersal of coral larvae including how long larvae are viable, whether the corals are brooders, or broadcast spawners, or does asexual budding exist. If they can disperse for many kilometres, they require suitable hard substrate to settle on. There are quite a few unknowns, particularly about larval settlement.

Molecular studies: Population genetic structure and connectivity – Jonathan Gardner, Malcolm Clark, Lyndsey Holland, Joanna Hamilton, Ashley Rowden, Di Tracey, Cong Zeng.

Part of a multi-year Vulnerable Marine Ecosystem (VME) project funded by Ministry of Business, Innovation and Employment (MBIE) and Ministry for Primary Industries (MPI) with the aim to identify population genetic structure, genetic hotspots, source and sink populations, and connectivity of VME (associated) taxa. Genetic stock and connectivity data to could be used to inform placement of new offshore Marine Protected Areas (MPAs).

Discussions:

Discussion around what role the life-history has in dispersal, and about the importance of filling that gap.

A query as to whether the effective population size is sensitive to sample size was addressed. Even though the method is susceptible to small sample sizes, a reasonable estimate can be obtained from 10-12 individuals. Different markers / analytical methods however are not comparable as results depend upon user-specified molecular evolutionary and reproductive (e.g. discrete generations) assumptions.

Ecology and connectivity of shallow reef building corals of the Rangitahua Kermadec Islands – Libby Liggins & David Aguirre

Presented on the shallow water corals in the Kermadec Islands area. Temporal changes in community composition, morphological divergence and genetic connectivity. Ongoing taxonomic and biodiversity work supported by New Zealand and Australian researchers.

Discussion

At the moment the work is limited because of limited samples from the region.

There is a need to compare species to look at overlap across factors such as depth.

Discussion around if the location of shallow water corals is all protected within reserves. In New Zealand all of the known locations are protected, but there is no formal study into distribution of shallow water corals, meaning that the gaps are still uncertain.

Ocean acidification & Mineralogy – Di Tracey, Malindi Gammon, Simon Davy, Helen Bostock

Ocean Acidification (OA) will impact both shallow and deep-sea coral communities, while those deep-sea stony corals abundant in depths shallower than 300-400 m could act as a refuge for corals in the face of climate change.

High latitude coral communities in the Kermadecs could act as a refuge for reef corals elsewhere in the face of climate change.

Assessed the potential impacts of OA on *Solenosmilia variabilis* (deep-sea stony coral). After a preliminary study on Chatham Rise samples, the research focussed on samples collected from theLouisville Ridge. These were kept alive for ~ 2 years. Growth rate and physiological processes were measured during the study. There was no detectable difference between the treatment and control colonies for growth & metabolic rates. However, there was more tissue loss in the treatment samples, which warrants further investigation to assess its long-term implications –i.e., tissue loss weakens skeleton, the reef matrix

OA also impacts capacity of shallow water corals to form a skeleton but at a cellular level impact mat be moderated.
Discussions:
There is a need to investigate the threshold of other coral groups to OA, as there will likely be a species difference. Discussion around the possibility that some parts of NZ will act as a refuge for corals and what the implications of that occurring would be. Shallow water corals from wider Pacific region settling in the New Zealand region, and deep-sea corals finding refuge on the top of the Chatham Rise.
The impact of trawl fisheries on deep-sea corals – Ashley Rowden, Malcolm Clark et al
Presented on the nature and extent of trawling impacts of corals, and if coral habitats and communities can recover. Some small and/or flexible coral species appear resilient to trawling damage, but most coral species have attributes that make them highly sensitive to impact, with low recovery ability.
The management of impacts on deep-sea corals – Ashley Rowden et al.
Presented on spatial management and its concepts, with examples of decision support tools. These tools provide a means to analyse data in an objective and transparent way that can benefit all stakeholders, necessary due to the competing spatial interests.
Discussions:
Although there are patterns of abundance, it's not clear what areas would be best to protect, which affect ecosystem function, or have an important role in connectivity between areas. General discussion around the need to set management objectives through which the various trade-offs can be assessed.
Inshore corals (biogenic habitats on New Zealand's continental shelf) – Mark Morrison, Emma Jones
Presented information on corals with a shallower distribution (less than 200 m). Surveys designed based on local knowledge on different habitats and associated unusual catches, and how the environment has changed over time. Fifty, mainly retired, trawl fishers were interviewed and the marking up of nautical charts were later digitised into GIS coverage. Many management issues apparent, including lost fishing gear and sedimentation from land.
Discussions:
Discussion around the sedimentation work and how there is more accurate data available on the dispersal of sedimentation around those areas. It was noted that more accurate sedimentation work is coming out soon. More knowledge and monitoring of our corals in shallower waters was discussed.

Ecological risk assessment for deep-sea protected corals – Malcolm Clark, Di Tracey, Owen Anderson, Steve Parker
Presented on a preliminary Ecological Risk Assessment (ERA), which was carried out in order to: inform managers of the type of outputs such a risk assessment may produce identify major knowledge gaps that limit the ERA, and provides an indication of relative vulnerability of different corals relevant for developing management options to reduce impacts from trawling. The work was not intended to be a definitive ERA, but rather to investigate whether such approach could be carried out given the data available and whether it produced sensible results in terms of relative risk. Corals at high risk were identified.
Discussions:
The ERA looks at change in distribution patterns, not fishing impacts, as there is available information on fishing but not on the recoverability. Discussion about the possibility of using data such as growth rates from same or similar species from studies in other countries to feed into the NZ risk assessment. However, it was identified that that due to unique oceanographic conditions data aren't always comparable, species can be different. Note: Overseas biological data was considered in the RA and used as a guide to the general magnitude of age & growth.
Conservation status of corals – Debbie Freeman
Presented on the conservation status of corals and some of the major gaps. Threatened species described. Majority of marine invertebrates are data deficient, and many of them have not yet been assessed.
Discussions:
Discussion around how this could be best linked in with other coral work Discussion around the process of categorising corals, as the percentage of decline in three generations, will in many cases be over 70%, which puts a species in the Nationally Critical category. Conversation about the possibility of automating some of the assessment for the invertebrates, by linking it up to a database.

Biological Gaps			
Please identify as many research/knowledge gaps as you can	***What use would we have for this information, how would it benefit management***	***Group discussion during workshop***	***Comments sent in during review of document***
Improved understanding of adaptability.	*Identification of species that could potentially adapt to changes in the environment, which might support the identification of important areas for spatial management.*	- Models lack the basic understanding of the biology of species, need to include more complex information. -	- Need to include cumulative or multiple stressors and impacts.
Improved understanding of small effective population sizes.	*Identifies the constraints on the resilience of populations to impacts.*		
Improved understanding of taxonomy.	*To provide basic understanding about the components of coral biodiversity, which is necessary for effective decision-making about conservation and sustainable use.*		
Improved understanding of the barriers of gene flow.	*Could allow us to identify species that may better cope with environmental changes, and to recover from disturbances, and those that can't and are more vulnerable to extinction.*		
Improved understanding of contemporary vs historical structure.	*To identify trends over longer time series. To increase our knowledge on dispersal, connectivity, and genetic hotspots.* *Could benefit the identification of areas of high protection value.*	- We need to increase our understanding of change, evolution, adaptability, and plasticity of species.	- We need to consider the relative resolutions of different genetic markers, and assumptions and limitations of genetic analyses (and sample sized) when distinguishing contemporary and historical gene flow.
Improved understanding of productivity.	*To understand the potential resilience of corals to impacts.*		

	Main limiting factor identified in the ERA in relation to recovery ability.		
Improved understanding of age and growth, there is a lack of New Zealand specific parameters.	*Increased knowledge on the recoverability of species after disturbance.* *Could support prioritisation of areas/species to protect.*		
Improved understanding of the reproductive and dispersal capabilities.	*To understand if asexual budding is more or less common than sexual broadcast release, and determine how capable species are of long-distance dispersal. Increased understanding of dispersal will increase our knowledge of connectivity.* *Improved knowledge of coral fecundity could identify vulnerable/less resilient species.* *Could help to prioritise areas/habitats with low reproduction and dispersal for protection.*		*- Pelagic larval duration is used as a theoretical proxy for dispersal potential and longer PLD is assumed to correlate positively with dispersal distance, although this is not always the case. Such data are best coupled with genetic and/or hydrodynamic models if available.*
Work on larval biology & duration.	*To increase our knowledge of larval duration for broadcast spawners, how capable species are of long-distance dispersal, and at what depth the larvae move in the current. Increased understanding of dispersal will increase our knowledge of connectivity.* *Could help to prioritise areas/habitats with low reproduction and dispersal for protection.*		

Improved understanding and definition of what a coral 'population' is.	*Could help us understand the spatial extent of interbreeding units and define sources and sinks.* *Could help define management units.* *Could help us to consider and assess the effects of impacts both spatially and temporally.*		*- Management actions may consider the effects of impacts on population scale.* *- We need to consider impacts and management strategies for both small (i.e., geographically limited) and large (i.e., widespread) populations.* *- Emerging connectivity data indicate that metapopulation dynamics play a role in population sub-division (or homogenisation).*
Determine the coral mineralogy of more species and evidence for carbonate dissolution using tools like Scanning Electron Microscope.	*This will allow the identification of species that may be more resilient to changes in the environment such as decreasing pH, which might support the identification of important areas for spatial management.*		

Environmental Gaps

Please identify as many research/knowledge gaps as you can	***What use would we have for this information, how would it benefit management***	***Group discussion during workshop***	***Comments sent in during review of document***
Improved understanding of physical oceanography.	*Essential for understanding distribution and abundance patterns, resilience, adaptability, dispersal etc. to better inform the importance of certain environmental drivers of coral distribution and abundance for use in future models.*	- Needed to understand responses to environment and environmental stressors.	

Improved understanding of biogeochemical variation in explaining connectivity.	*To optimize management by incorporating landscape sensitivity and hydrological connectivity.*		
Improved understanding of the drivers of environment and ocean stressors (temperatures and chemistry).	*Necessary to understand past and current changes to help inform on policy relevant to future projections.*		
What habitat values/function does it support.	*To identify functional linkages and incorporate this information into sustainable management of resources supported by corals.*		

Spatial Gaps			
Please identify as many research/knowledge gaps as you can	***What use would we have for this information, how would it benefit management***	***Group discussion during workshop***	***Comments sent in during review of document***
Improved sampling effort in areas of New Zealand interest in the High Seas (SPRFMO) and Ross Sea (CCAMLR) coral identification and distribution.	*Important to know what species are in these regions. Being able to understand total species distribution and population structure rather than just what is in our EEZ will increase our knowledge on connectivity between habitats/populations.* *Will help to inform management plans.*		
Further understanding on distribution and abundance. Still a lot of 'holes' in the map. Limited sampling in some areas (>2000m and some BPAs).	*Difficult to manage the EEZ if there are still large gaps in the map because the information isn't available.* *Filling in these gaps will support spatial management of the New Zealand EEZ.*	- We need to know what's there, if we are going to try to manage it	

Identification of sources and sinks, and biodiversity/functional hotspots.	*To identify high value areas to support decision making in spatial management.*	- Monitoring takes a long time, we need to find a way to identify these areas and act now.	
Are patterns of structure and gene flow “universal”.	*Ensuring that research and management assumptions are appropriate and well informed.* *Ecosystem-based management would benefit from assessment of multiple species.*		*- To date, there are some inconsistencies in sample sizes, in molecular markers used and in how genetic analyses are conducted, making direct species-by-species comparisons difficult – yet based upon best available information, we already know that patterns of structure are not uniform across deep-sea corals in New Zealand* *- Understanding and translating gene flow patterns, especially if contrasting among species, into a management framework is challenging and needs addressing.*
Comparison of coral VME to other VME data such as that for sponges to identify overall vulnerable ecosystems.	*To be able to learn from and apply successful international regulation to protect vulnerable populations, communities, and habitats.*	- There are some biological givens, and we already know a lot about species tolerances. For example, certain fauna can only survive within certain oxygen levels, in particular temperature range, ocean chemistry, etc. By using basic biological principles, we can specify vulnerable ecosystems. - Interface between science, assumptions, management etc.	

Further genetic collections from sources not already explored.	*To provide basic understanding about the components of coral biodiversity, which is necessary for effective decision-making about conservation and sustainable use.*		
How effective are current seamount closures and BPAs for protecting deep water corals.	*Better understanding if these spatial management measures have been useful, and provide evidence that they may or may not require modifications (e.g., moving, expanding, additions).*	- Protected areas have less data as a lot of the data that we have comes from fisheries observers etc. How do we know that the protected areas are the most useful areas?	
Identification of the areas of highest protection value for deep water corals, given competing interests of fishing, future seabed mining, and effects of climate change/OA.	*Better understanding if these spatial management measures have been useful, and provide evidence that they may or may not require modifications (e.g., moving, expanding, additions).*	- How does the area of protected corals fit into other work, such as ecosystem based management.	
Improved understanding of colonisation and settlement patterns of larvae.	*To better understand nature and potential for recovery of populations in areas*		- Critical, more so than knowing about reproduction, but also more difficult. It requires time series in situ to see what is happening in the field.
Further connectivity work, including work on different species than has previously been done.	*This information is needed to be able to predict recovery.*		- What species are lacking that should be examined and why. Are there certain areas that need to be samples (so we don't assume the Challenger Plateau has the same patterns as the Chatham Rise). Spatial scale becomes important for most of these ecological and environmental elements.

Improved understanding on the role of life-history variation, physical oceanography, ABNJ and biogeochemical variation in explaining connectivity.	To be able to determine appropriate spatial and temporal scales for management and recovery of impacted areas.		- Needs to be a lot more specific to guide research to produce something useful for management. The obvious thing is a five-year plan.
Further information about the link between shallow and deep-water corals. For example, regarding shelf break areas etc.	*To be able to differentiate management measures between areas that require different protection.*	- Inshore corals need more samples.	

Modelling Gaps			
Please identify as many research/knowledge gaps as you can	***What use would we have for this information, how would it benefit management***	***Group discussion during workshop***	***Comments sent in during review of document***
Improved prediction of future refugia for both deep water and shallow water species.	*Identification of priority areas for spatial management.*	- Suitable future habitat does not necessarily indicate that corals will be coming back to those areas. Are there any settlement cues that we can use? Absence/presence of physical disturbance in the areas, dispersal distances, presence of con-specifics etc. o Connectivity will be an important variable here, as well as a huge mathematical challenge.	
Better estimates of model uncertainty.	*Allows us to make more accurate decisions and trade-offs in spatial management.*		

Models that estimate abundance in addition to presence absence.	*To allow the estimation of biomass as well as distribution. This could support work in identifying high value areas, or species that have a greater need for protection.*	- Models are based on presence-absence and not more quantitative abundance or biomass.	
The use of models to work out what biological variables are the key drivers of coral community composition, density, and "health".	*In order to prioritise research projects so that the key environmental data are collected.*	- There is a need to refine models so they can include this more complex information.	
Incorporation of refined and updated predictions of future ocean climate from new Earth System Models.	*Updated model will enable spatial planning software's to utilise predicted future distributions and aid in re-prioritizing areas for protection.*	- We need to use more relevant timelines than 2100, perhaps a gradient of change expected over time.	
Identification of the linkages of gene flow to physical flow.	*To improve understanding of connectivity the therefore resilience of populations to disruption.*		*- We need to understand and incorporate physical (and gene) flow variation between sites to reflect coral distribution and connectivity by depth.*
Updated risk assessment with updated information, perhaps including parameters from the same coral species from other countries.	*To give us more accurate estimates to assess risk to coral species.*	- Do we first need to focus on our lack of biology knowledge in order to draw an assessment of risk? Is there anything in the science that would help to narrow the focus to certain species?	
More accurate models, that also include shallow water corals.	*Improve predictive power and priorities management strategies.*		
Models with more accurate inclusion of data	*Improve prediction power and priorities management strategies.*		

on biology of corals, and adaptive capacity.			

Threat & Pressure Gaps			
Please identify as many research/knowledge gaps as you can	***What use would we have for this information, how would it benefit management***	***Group discussion during workshop***	***Comments sent in during review of document***
Investigation of ocean acidification impacts for deep and shallow water corals in the region, their dissolution and resilience.	*To identify possible refugia areas and identify species that are more likely to withstand the changes in the environment.*	- Oxygen levels and their impact on corals are not currently well known, future levels and their impact poorly understood.	
Further experiments to understand the sensitivity of deep-sea corals to climate change, and if there is potential for acclimation.	*To provide more policy relevant projections, not just end-of-century to help management – e.g. we could protect any areas of potential refugia.*		
Further investigation into the impacts of trawling on ecosystem function/services (e.g. carbon cycling, habitat provision for juveniles, fish etc.) provided by deep water coral/reefs.	*Better understand the wider impact on corals and associated communities, and be able to consider these impacts when designing management measures.*		-This is the type of broad gap that can then start to be better filled by smaller projects that all contribute to a better feel for what goods and services are provided (e.g. fish association with corals based on seafloor imagery as a discrete study).
Further investigation into the impacts of seabed mining on ecosystem function/services provided by deep water coral/reefs.	*Better understand the wider impact on corals and associated communities, and be able to consider these impacts when designing management measures.*		
Improved understanding on how long recovery from	*Better understanding on how long spatial closures may need to be in*		

trawling impacts and seabed mining take, and if communities recover to previous state.	*place, and if recovered areas will provide similar ecosystem function/services.*		
Improved understanding on what facilitates the recovery of corals/habitat after trawling and seabed mining.	*Better understanding if there are any management measures that can be taken to improve recovery rate.*		
What stressors and threats do these habitats and areas face (both repeated single stressors, and cumulative and multiple stressors).	*To identify all threats that these habitats and areas face for further assessment of risk.*		
What management approaches can we adopt to reduce/mitigate these stressors, and perhaps even enhance productivity.	*To inform a diverse and effective suite of management approaches.*		
Further information on affected and 'unaffected' areas from anthropogenic pressures	*To increase our understanding on these risks.*		
In which regions/areas are we seeing the most rapid change, or which ecosystems.	*To help us identify possible refugia areas and aid in spatial management of these areas.*	- Where are the hotspots of rapid change, which ecosystems etc. would we expect to see? Could use predictive models, but we don't' necessarily have enough temporal data. - We could use multiple models, but each model can giver different results so we must be careful with the conclusions drawn.	

		- Biggest gradient changes in the fronts, places with slow change could be looked at as refugia.	
Monitoring for changes in different areas, both in relation to larvae settlement and climate change.	*Improve the understanding of resilience and recoverability to better inform management approaches.*	- National monitoring strategy, could be very useful in the future. - Where would we look to sample/focus on. - We need to take action now, by directing the research we have already towards management decisions, some immediate protection and long-term objectives to build upon.	

Data, management & communicating science			
Please identify as many research/knowledge gaps as you can	***What use would we have for this information, how would it benefit management***	***Group discussion during workshop***	***Comments sent in during review of document***
Incorporate new variables, records and methods.	*Ensure that the data architecture is adequate to facilitate relevant analysis.*		
More robust image database storage system used for the observer collected digital images.	*For efficiencies and consistency of the image identification, which will help inform management decisions.*		
Important to refine what is accepted as "robust" science when sample sizes are often small and spatial coverage may be poor.	*To ensure that management is informed by appropriate science.*		
Improved understanding of *Areas Beyond National Jurisdiction* (ABNJ).	*Ensures that and research and management decisions take into account whole populations rather than being made at an EEZ or regional level.*		

	This also ensures a degree of consistency on coral management within and adjacent to the EEZ.		
Selection (e.g. SNPs – seascape genomics).	*To better understand the processes shaping the genetic structure of corals and the appropriate spatial management scales of coral taxa.*		
How to best link in with other coral work, including approaches to assessing risk to corals.	*To minimize duplication in research and maximize the outcomes of research projects.*		
Identifying and accessing relevant information sources; data consolidation.	*To have an easy and accessible way of reviewing existing information.*		
Management discussion on what these gaps, or this information, means to us and to the management of the activities/species etc.	*To help us make more informed management decisions that both benefit the protection of these areas as well as the sustainable use of resources that are linked to them.*		
Identification of new ways to communicate this science and knowledge to the public, and/or other platforms – data platform?	*To get the public more involved and interested in the protection of coral species.*	- There is a potential to incorporate this into the Sustainable Seas project – which looks at how people value things etc. - We need to be able to inform the society about the consequences of the management decisions. - We also need to meet international obligation with communicating our science. - We need to filter both up data and information for management purposes and for education, turn data into something more tangible.	

More coordination of existing coral research/projects.	*Minimize duplication and create synergies.*	- There is a lot of small projects and we need to find a way to share this information to be able to coordinate. One place to look for what data exists is a workshop like this.	
We need to identify the difference of legislative. balance between inshore and offshore areas.	*To be able to better manage both shallow and deep-sea corals.*	- Creates problems for management. - Some species that exist over these barriers which have to be considered.	
We need to define specific management goals for deep-sea corals in New Zealand. Specific management objectives are ill-defined and poorly outlined, so it remains unclear what we're trying to achieve in terms of management with the data that we have (e.g, 10% spatial coverage? consider the CBD etc.).	*To use data available so far to, for example, derive management actions in line with NZs national and with international agreements to which NZ is a signatory.*		- Requires explicit management objectives, against which protective efforts can be measured, i.e. we need to define management targets. - May include development of a data portal /repository so that relevant managers could access useful data. - Requires cross-agency collaboration (DoC, MPI, MfE, MFAT).