Department of Primary Industries

NSW Lobster Industry Working Group meeting 16 May 2017 - Outcomes

OUT17/30755

Agenda Item	Summary and Outcome
1. Welcome, apologies and introductory remarks	Meeting start 08:30am Attendance: Noel Gogerly (Industry), Lee Monin (Industry), Daniel Stewart (Industry), Scott Westley (Industry), Peter Offner (Industry), Oly Wady (Recreational), Nicholas Giles (DPI Commercial Management), Geoff Liggins (DPI Science & Research), Andrew Field (DPI Compliance). Observers: Mark Horne Apologies: Ronald Nye (Indigenous)
2. Confirmation of final minutes of the previous meeting	The NSW Lobster Industry Working Group members confirmed the final draft minutes from the Lobster Industry Working Group meeting held on 2 August 2016 as being a true and accurate record of the meeting, with one clarification: Agenda item 4: Validation process – Options to enhance integrity – The item noted establishment of a project to examine weight differences between validated and final weights within the validation window. A formal research project is not established; however work has been conducted to assess weight changes across time and cooking method. Minor changes to lobster weights according to storage, transport, and processing are noted, and will be considered in any compliance investigation. During discussion several industry members offered assistance should product be further required. **Outcome** – Compliance to provide concise summary on background, what has been done, findings, and whether more formal analysis is recommended to be undertaken.
3. Lobster Industry Working Group membership update	The Lobster Industry Working Group was established in 2012. The Terms of Reference (ToR) underwent a three yearly review and were finalized in April 2016. Member positions are reappointed for three year terms on a rotational basis to maintain continuity of knowledge and issues. Two fisher member positions and the Recreational, Indigenous and Conservation positions underwent re-nomination and members were appointed in June 2016. No nomination was received for the Conservation member position and this remains vacant. A call for re-nomination of remaining three fisher member positions will be made towards the end of 2017. Current members and terms are provided below:

<table>
<tr><th>Agenda Item</th><th>Summary and Outcome</th></tr>
<tr><td></td><td>
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<tr><th>Member position</th><th>Member</th><th>Term expiry</th></tr>
<tr><td>Industry Region 1</td><td>Daniel Stewart</td><td>15 June 2019</td></tr>
<tr><td>Industry Region 2</td><td>Noel Gogerly</td><td>1 December 2017</td></tr>
<tr><td>Industry Region 3</td><td>Lee Monin</td><td>15 June 2019</td></tr>
<tr><td>Industry Region 4</td><td>Peter Offner</td><td>1 December 2017</td></tr>
<tr><td>Industry Region 5</td><td>Scott Westley</td><td>1 December 2017</td></tr>
<tr><td>Recreational Fishing</td><td>Oliver Wady</td><td>15 June 2019</td></tr>
<tr><td>Indigenous</td><td>Ronald Nye</td><td>15 June 2019</td></tr>
<tr><td>Conservation</td><td>Vacant</td><td>N/a</td></tr>
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Outcome – Noted.
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<tr><td>4. Update on the Total Allowable Catch Setting and Review Committee (TAC Committee) program for 2017/18</td><td>A public call for submissions on the 2017/18 TACC was advertised on 5 April 2017, and a further letter sent to all Lobster Fishery Shareholders notifying of the advertisement and the dates for the Industry and TAC meetings.

The Lobster Total Allowable Commercial Catch (TACC) meeting was held on the 17th of May 2017.

All members of the Working Group and a number of additional lobster shareholders attended the meeting. Overview presentations of the information submitted from the Department’s Management, Science & Research, and Compliance Units were provided for the TAC Committees deliberations on the 2017/18 TACC. The Department and industry members provided additional information in response to queries from the TAC Committee.

Outcome – For information. A Determination will be made by the Committee on the TACC for the 2017/18 fishing period.</td></tr>
<tr><td>5. Management charges for the 2017/18 financial</td><td>A draft budget was supplied to industry members for comment, including a proposed Management Charge of $57.09 per share. The proposed management charge is an increase of $1.77 per share from the previous year, attributable to CPI</td></tr>
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year	increase and redetermination of savings, carryover, and FRDC contribution components. **Outcome** – The draft budget was supported by the Working Group. The management charge is currently being finalised and invoices will be provided with normal payment terms.
6. Research progress update	Update and discussion on key research projects was given by Dr Geoff Liggins. **Outcome** – Noted and discussed by Working Group. A summary of key research projects is attached.
7. Tags for the 2017/18 fishing period	A total of 235,000 tags were ordered for the 2016/17 fishing period at a price of $165 + GST per thousand for the TACC of 160 tons. A tender process for a three year tag supply contract was conducted in early 2016. The successful tenderer was Mega Fortris Pty Ltd. The three year contract assists in reducing ongoing tag costs, provide certainty of supply and economy of scale efficiencies in pricing, and ensure consistent presentation of security seals. The contract is expected to save a minimum of $12,000 over the contract period. The tags for the 2017/18 fishing period will be blue with laser engraved black text and a red NSW waratah. As with previous fishing periods, fishers are encouraged to only request enough tags that they reasonably expect that they will require, and to return excess tags when they finish fishing in the fishing period. The number of tags required will vary according to the expected average size of lobsters, influenced largely by the time and area of fishing activity. The cost of tags is recovered from industry, and forms a component of the management charge. The Department minimises the cost (number of tags ordered) as much as possible, however relies on industry to assist so fishers do not hold tags that are not expected to be used, and which are only returned after the season finishes. **Outcome** – Noted and supported by the Working Group.
8. Management targets and economic analysis	The TAC Committee has recommended for a number of years that the collection of economic data is necessary to support the TACC setting process and ensure that TACC's are set that maximise returns from the fishery to both industry and the NSW community. The Committee has also recommended developing a harvest strategy with targets that will provide clarity and guidance on management decisions in relation to TACC setting, stock rebuilding and maximising harvest benefits. Current legislated management objectives, performance, indicators, and limit triggers established in the Fisheries Management (Lobster Share Management Plan) Regulation 2000 generally focus on rebuilding of a previously depleted

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	lobster stock, provision of sound assessment data and process, promoting cost efficient management, and minimising offences in the fishery. The lobster stock is now thought to have recovered acceptably above the current reference point of 25% of the virgin spawning stock biomass as a result of a targeted management approach focusing on stock recovery. Existing biological reference points have supported the assessment, recovery, and development of the fishery to date, however now provide limited capacity to determine the strategy to be applied to broad stock management and the TACC setting process. Whilst quantitative stock assessment information is readily available, it is recognised that collecting additional baseline information (particularly economic data), engagement with industry on potential future management strategies and decision frameworks, and further development of the assessment model are key elements beneficial to development of a robust harvest strategy. Discussion with industry on the need for future target reference points and the potential for increasing economic yield of the stock has continued. The Working Group has indicated support for assessment of alternate reference points for fishery targets and yield, including assessment of economic analysis and/or harvest strategy mechanisms, however further discussion on potential benefits and management options is needed. The Department is assessing potential for a bio-economic strategy project for the lobster fishery to identify options to inform economic analysis and development of revised reference points under a harvest strategy. **Outcome** – Noted and discussed. The Working Group will be further engaged as information becomes available.
9. Online systems update	Development and staged implementation of the online quota and catch and effort reporting and business transaction system is continuing, with 436 registered users of FisherDirect and 36 registered users of FisherMobile. A consultation paper on proposed quota reporting arrangements for the lobster fishery was distributed to all shareholders and nominated fishers in April 2017. It is proposed to commence online quota reporting in December 2017. A presentation and demonstration of the FishOnline and FisherMobile system were provided for discussion. The application as presented for lobster fishery functionality was the 'test' administrative system that is used for training and testing purposes, and is subject to final development of functionality.

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	Presenting system function provided a useful forum for feedback whilst using the actual application. Consultation responses will assist in final development of online reporting arrangements. **Outcome** – The Working Group discussed reporting structure during the presentation. The Working Group supported the concept of online reporting, however raised a number of suggestions and concerns about the current reporting structure. **Motion**: Move that 'estimated weight' and 'estimated numbers' be removed from the pre-land report, as it is of no value. DPI notes that the primary purpose of providing estimated weight is support the integrity of quota arrangements by assisting Compliance Officers in conducting and prioritising quality inspections by having reported data on relative lobster numbers and weights. As presented, functionality to provide reporting of tag numbers on the pre-land report is not completed. Comments will be considered in final development of functionality. **Motion**: Move that the 'pre-land' report be renamed to a 'landing' report. DPI notes that the pre-landing report was developed with the intention of being completed at sea to provide Compliance Officers notice of fishers' intention to land to assist conducting quality inspections. Industry has previously raised concerns on the practicality of this and benefit in light of quota controls in the lobster fishery. Whilst reporting intention to land provides some compliance benefit, the Department proposes to require completion of the pre-land report before moving from the landing point similar to the integrity of current logbook procedures. Re-naming the report will be considered in final development. **Motion**: Support that any rock lobster boat makes a pre-fish report before undertaking lobster fishing. The Working Group supported that a pre-fish report be introduced in addition to the pre-land and post-land reports. Discussion centred on when the report may be required to be completed, which could be either before going to sea, or before conducting lobster fishing (i.e. setting, retrieving, or checking lobster traps, retrieving penned lobsters etc). DPI notes that a pre-fish report could be introduced. Best practice options on when the report may be completed will be considered for subsequent advice. **Motion**: Online reporting (as currently developed) does not satisfy the level of information and integrity of the current logbook system. Implementing online reporting in its current form is rejected. The concept of online reporting is supported. DPI noted that consultation regarding online reporting is not complete, and the meeting was an important step in determining final system development and design. The feedback of the Working Group will be considered regarding final

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	reporting structure and implementation timing. **Outcome** – Consultation responses from the working group, shareholders and CommFish NSW are recognised. To provide for the benefits of real time quota functionality, for December 2017 the post-land report will be introduced to report validated weight only. Current logbooks will still be used to report additional information as per current arrangements. The Lobster Industry Working Group will be engaged to obtain further feedback on system function to inform final implementation arrangements.
10. Administrative sanction review	A range of administrative procedures are or may be triggered following offences, including share forfeiture, restrictions on nomination, and commercial fishing licence and/or endorsement suspension, refusal, or cancellation. A review of existing sanction provisions in NSW and other jurisdictions is underway, with a view to developing a revised demerit and/or sanction scheme in consultation with relevant industry sectors to apply across all NSW commercial fisheries. A new scheme is anticipated to be implemented by the end of 2018. **Outcome** – Noted and discussed.
11. Reporting of quota and share trading price	Average quota and share trading prices are key economic indicators used to track changes in the lobster fishery over time. Reporting of price is not compulsory, however is strongly encouraged by the Department and the TAC Committee to support the TAC assessment process and track changes in fishery values over time. In the 2016/17 fishing period, a significant fall in the number of trades reporting price for both shares and quota is evident. **Outcome** – Noted by the Working Group. The Working Group supported the importance of reporting price information for share and quota trades. • Members to discuss and encourage fishers in their region to report price. • DPI to contact recent share trades not reporting price to request price information.
12. Danish seine trawling	Shareholders on the mid-north coast have raised concern regarding the operation of two Danish seine vessels working between Port Macquarie and Newcastle. **Outcome** – Noted and discussed. One Danish seine vessel is known to be working, whilst another associated vessel is known to be otter trawling. Danish seine operations have been subject to review, including a report published and available at http://www.dpi.nsw.gov.au/__data/assets/pdf_file/0005/631355/Danish-seining-in-NSW.pdf The report and independent

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	observer program coverage identify low relative risk for habitat impact and by-product retention. No permits or authorization are provided to work in areas in contravention of Marine Park zoning and regulation. Relevant issues have been referred to Compliance, and the observer program leader will contact the shareholders to further discuss concerns regarding habitat impacts or interaction with the lobster fishery.
13. Shareholder letter submission to Working Group	A shareholder has submitted a letter to the Working Group for consideration of issues raised. **Outcome** – Fisher members to consider issues raised and prepare response.
14. Advent Energy Seismic survey proposal update	Advent Energy Pty Ltd holds an exploration permit for a Petroleum exploration Permit for waters of the offshore Sydney Basin (PEP11), and has proposed to seek approval for a 2D seismic survey in an area south east of Newcastle. NSW DPI has provided factual submission on commercial fishing and contemporary research on potential impacts of seismic surveys in relation to the proposal. Advent Energy proposed a stakeholder meeting with commercial fishers at Newcastle on 25/5/2017. **Outcome** – Consultation meeting noted. Lobster, Ocean Trap & Line and Ocean Trawl fishers were emailed meeting notice on 16 May 2017. Advent Energy has now lodged an Environmental Plan. The National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA) will provide notice of a decision anticipated for 3/8/17.
15. Retaining lobsters taken in demersal fish traps	Retaining lobsters taken in demersal fish traps is not currently permitted. Retention of lobsters is prohibited under Cl7A of the Fisheries Management (Ocean Trap and Line Share Management Plan) Regulation 2006, which relates to the fish trap itself. **Outcome** – The principle of allowing retention of lobsters taken in fish traps as long as relevant endorsements and quota are available is supported by DPI. Further investigation will be conducted into legal issues surrounding the interaction of authority under respective endorsements.
16. Vessel Monitoring	Industry has raised potential use of Vessel Monitoring Systems (VMS) for the Lobster Fishery to promote voluntary compliance and assist compliance investigations. **Outcome** – Discussed. DPI to provide out of session advice on options and potential costs for consideration. Options include 'real time' systems similar to existing VMS operation, or units which may allow on demand downloading of track information (noting that many plotters provide this function). Potential safety benefits were raised by the Working Group in

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	addition to compliance benefits.
17. Other business	Working Group members raised additional issues as other business: • Review of the *Fisheries Management (Lobster Share Management Plan) Regulation 2000* (the Plan). **Outcome** – The Plan is subject to ongoing review and a number of amendments have been made to date. The Plan is structured at recovering the lobster fishery, primarily focused on a spawning biomass reference objective. As confidence in the recovery of the fishery to above the reference point has increased in recent years, discussion with the Working Group has included the need to revise existing reference points to determine new management targets for the fishery (Refer Agenda item 8). Review of the Plan will be incorporated into strategy to consider economic priorities for industry and the fishery and development of a formal Harvest Strategy. • Maximum shareholding amendment. **Outcome** – Review of the maximum shareholding has been discussed in recent Working Group meetings (refer previous outcomes). The maximum shareholding provision provides a limit on the number of shares one shareholder (e.g. a large company) may hold, preventing monopolisation of shares by one shareholder (person or company), and to some extent, provides for a diversity of ownership and opportunity to enter the fishery. Restrictions on foreign shareholders remain in place. Providing a different maximum shareholding will remain limited in preventing associated persons or companies from controlling more than any defined maximum, however, it would continue to prevent monopolisation of shares by one shareholder. NSW DPI will consult on appropriate maximum shareholding in conjunction with the next review of the Plan. • Transfer of tags A question was raised on the ability to transfer tags between shareholders. The Plan provided for transfer of tags between shareholders only where transfer is associated with a share or quota transfer. Where such a transfer is made, discretion provides that tags may be returned to DPI before being received by the receiving shareholder. Tags are an important management tool and are strictly controlled and accounted. The position of DPI is that tag numbers would always be verified by DPI to ensure accurate transfer of individual tags, and to reduce liability to shareholders or potential compliance action should there be any errors in tags transferred. As tags will always be returned to DPI for

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	verification, future regulation will only provide for the direct issue and/or return of tags to and from DPI. Requests for issue of initial and/or additional tags necessary to take shareholders quota remain a high priority on receipt of a completed tag allocation form. • Trawl interactions with lobster trap gear In early 2017 a south coast shareholder raised interactions with his shelf lobster gear by Commonwealth trawlers, including loss of traps and acoustic release devices to DPI. A 'gentleman's' agreement has been in place for some time, however recent interactions are reported. The issue and relevant area of lobster fishing grounds has been raised with AFMA and SETFIA for promotion of industry awareness. AFMA will advise operators known to work the area of lobster fishing grounds and potential trap presence in the relevant area. Situation to be monitored. • South coast hookah permit A shareholder on the South coast holds a current S37 permit to use hookah when diving for lobsters. Working Group members advise that they are aware that offences were detected by nominated fishers working under the authority of the permit. Working Group members expressed request on whether the permit could be cancelled considering the nature of the offences detected. **Motion**: S37 permit should be suspended whilst being investigated. **Motion**: Options to expedite compliance outcomes be assessed to enable timely resolution considering permit is a special privilege. **Outcome** – DPI has investigated the circumstances reported by industry. No grounds are present to review the continuation of the permit, and no action is proposed. • White Spot Disease The Region 1 fisher member raised the importance of awareness of White Spot Disease (WSD). White Spot Disease, also known as infection with White Spot Syndrome Virus (WSSV), is a highly contagious viral disease of prawns that causes high rates of mortality in affected stock. Other crustaceans can be carriers of the virus, but they are rarely impacted by the disease. WSD poses no threat to human health or food safety. NSW Department of Primary Industries (DPI) is working together with other jurisdictions (states, territories and the Commonwealth) to help minimise the risk of White Spot Disease spreading. DPI has established an Importation Order that places restriction on the importation into NSW of any uncooked decapod crustaceans or polychaete worms from a

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	designated area encompassing all affected areas in south east Queensland. Fishers should remain aware and vigilant, and report any signs of white spot disease to 1800 675 888. Further information can be found at: http://www.dpi.nsw.gov.au/fishing/pests-diseases/animal-health/aquaculture/white-spot-disease **Outcome** – Discussed and noted. • Recreational lobster harvest The Region 3 fisher member raised increasing the accuracy of recreational lobster harvest estimates. Finalization of the NSW State-wide Recreational Fishing Survey 2013-14 in December 2015 provided a new major data point for estimations of the recreational sector harvest of a range of species, including rock lobsters. The robustness of the estimations continues to be challenged by the relatively low participation in lobster harvest. This study does confirm that National or State-wide surveys are unlikely to provide sufficiently robust estimations of the recreational lobster catch, and that targeted surveys or other reporting means would be necessary to provide accurate estimates of the harvest from this sector. **Outcome** – Programs to improve estimates of recreational lobster harvest will continue to be pursued.
18. Meeting Close	The Department thanked all participants for attending the meeting and closed the meeting at 18:15pm.

NSW Lobster Fishery Research Program Update Summary

Monitoring, research & assessment

Catch and catch rates

The commercial TAC of 160 t TACC was fully caught in 2015-16 and catch is again on-track to approach the 2016-17 TACC of 160 t. The TACC has essentially been caught (> 95% taken) in each of the last 12 years or 13 years if we include the current year. This means that the TACC has effectively been limiting catch – an important factor contributing to ongoing growth of the lobster population. Catch rates (CPUE derived from logbook data) have increased substantially since the mid-1990s, albeit with some short-term decreases along the way. Catch per unit effort (CPUE) during 2015-16, based on reported catch and effort reported in the commercial logbook, was slightly greater than those of the preceding 3 years and was the greatest observed during the 47-year time-series. CPUE for the incomplete current season (2016-17) is similar to levels achieved during the preceding 4 years.

Discarding of legal lobsters became significant during 2015-16 for the first time since the introduction of quota management with 11,598 lobsters (approx. 10 t) released at sea. Approximately half of this quantity has been captured and returned to the water during the current 2016-17 season. Such discarding has occurred when deep-water fishers filled their quotas before lifting all their traps during their final soak.

Indicators of future recruitment to the fishery

Catches of pueruli (lobster post-larvae) from the annual survey during 2016-17 were greater than the 22 year average at Coffs Harbour, Sydney and Ulladulla and around average at Sydney. At the southern locations, Sydney and Ulladulla, abundances of pueruli were approximately double the abundances observed at these locations during the preceding 3 years. Although we have seen huge year-to-year variability in annual settlements of pueruli over the past 22 years, there has been a significant trend of increasing abundance across the 2 decades. All arrangements are now in place for the 2017-18 surveys.

Records of the approximate number of sub-legal sized lobsters caught and returned to the water (as reported in logbooks) provide a useful forecast of the abundance of legal (> 104 mm CL) the following year. Catch rates of sub-legals from the shallow-water fishery in 2016-17 suggest another year of good recruitment of 104^{+} mm CL lobsters in the shallows in early 2017-18 with associated good rates of catch.

Fishery-independent survey of spawning stock

This survey is biennial (every 2nd year), so the survey done between September and December in 2016 was our first look at the spawning stock since 2014. As usual, the survey was done at 2 sites at each of 4 locations (Tuncurry, Crowdy Head, Coffs Harbour, Iluka) with 13 x 1-week soaks of 4 traps at each site.

Catch rates of mature females (> 167 mm CL) and berried females during the 2016 survey were similar to those achieved 2 years prior in 2014 and represented the greatest abundances observed during the 21 year history of the survey. These catch rates and the catch rates of lobsters greater than the maximum legal length (> 180 mm CL) were 3 to 4 times greater than those observed during the first 3 years of the survey (1998 to 2000). This provides solid evidence of the rebuilding of the spawning stock of Eastern Rock Lobster and is consistent with the increases in spawning biomass estimated from the computer-based model of the population and fishery.

Modelling the population and fishery

The length-structured computer-based model of the lobster population and fishery was updated with recent data and used to: (i) provide estimates of various components of biomass over the history of the fishery and (ii) forecast likely changes in biomass during the next 6 years that would result from alternative future TACCs. This is an important part of the annual stock assessment and provides a basis for the TAC committee to set a TACC for the following year. Three model scenarios were considered for the current assessment, each making different assumptions about levels of historical catch and trends in recent recruitment. Under all scenarios, there has been a spectacular improvement in the total, exploitable and spawning components of biomass since the major management changes to the fishery in the mid-1990s. Of great importance, each scenario of the model estimated the current spawning biomass to be greater than 30% of the virgin (pre-exploitation) level. Note that the fishery management strategy treats a depletion of 25% of virgin spawning biomass as a limit reference point for the stock. In other words, this is a level that we want to stay well above – because at some point below this level, recruitment may decline markedly.

The population of Eastern Rock lobsters has undergone a spectacular recovery over the past decade. Based on evidence from the population model and the survey components of our research and monitoring program, increased biomass in the spawning stock and increased recruitment have resulted increased abundance of lobsters in the exploitable size range (104-180 mm CL). This has provided the opportunity for the TACC to be safely increased to the current 160 t, the greatest TACC that has been set for our fishery (since the introductions of TACCs two decades ago!

Tagging study to understand movement of lobsters along the NSW coast

Toward the end of the 2015-16 fishing year, several fishing businesses were returning to the water lobsters that they captured on the mid- and outer-shelf that were surplus to their quotas. Two such businesses (one in the Jervis Bay region and one on the Central coast) allowed us to place individually-numbered research tags in lobsters before returning them to the water. Approximately 2,000 tagged lobsters were returned to these mid- and outer-shelf depths in early 2016. We took the same opportunity in early 2017 when we tagged another 1,000 lobsters in mid-shelf waters off Narooma. Subsequent recaptures of these lobsters will provide information about the movement of these animals along the NSW coast. Formal analyses of recapture data will not be useful for another year or two but already we have had had multiple recaptures of lobsters on the north coast of NSW that were originally tagged off the south coast. Information about this experiment and details concerning how to report recaptures of these lobsters has been circulated to all shareholders and to local fisheries offices along the NSW coast.

Genetics project (collaborative project with La Trobe university)

The overarching aim of this project is to utilise molecular techniques to examine the population structure, larval dispersal and connectivity of Eastern rock Lobster. PhD student, Laura Woodings, is studying the genetics of samples of lobster tissue obtained from multiple locations on the NSW coast and smaller sample sizes from Tasmania and New Zealand to answer several key questions. This project will continue for another 6-12 months but results so far: (i) confirm that there are no significant spatial differences in the genetics of lobsters and pueruli from different locations and depths along the NSW and that our assumption of a single unit stock is valid; (ii) show no significant difference between the genetics of Eastern Rock Lobsters in Tasmania and those in NSW, suggesting that the Easterns found in Tasmania result from the transport of phyllosoma (lobster larvae) from the NSW spawning stock as far south as Tasmania when oceanographic conditions (features of the East Australia Current) permit; and (iii) minimal genetic variation between Easterns found in New Zealand (referred to as Packhorse lobster over there) and NSW suggests the possibility that recruitment in New Zealand may result from spawning stocks in both New Zealand and NSW!

Crustacean direct ageing project (collaborative project with Southern Cross University & multiple other agencies)

The full title for this FRDC-funded project is "*Direct age determination with validation for commercially important Australian lobster and crab species (western, eastern, southern and ornate rock lobsters and crystal, Tasmanian giant and mud crabs)".* Principal Investigator is

Dr Jesse Leland from Southern Cross University and our NSW involvement concerns a single species - Eastern Rock Lobster. The aim of the project is to see whether the age of lobsters can be directly determined from growth marks in gastric ossicles (had parts within the gut of lobsters). This would then provide an ageing method similar to counting the growth rings in trees or the growth rings in the otoliths of finfish. Results from this project are now under review with a final report due within a couple of months. Preliminary results show some correlation between (i) ossicular growth mark counts and carapace length and (ii) ossicular growth mark counts and indirectly obtained age estimates (based on a length-age relationship obtained from tag return data). However, an aquarium-based experiment to investigate the timing and frequency with which growth marks were formed in the ossicles has not returned particularly useful results. Consequently, the timing of growth mark formation and the frequency of their formation remains unclear. These results are similar to what is being found for several other lobster species around the world. If a "tight" relationship between growth marks and age was validated, this would facilitate direct aging of lobsters and would open the door to routinely estimating the age-structure rather than simply the length-structure of the stock. Potentially this would then also facilitate the use of age-structured rather than length-structured assessment models. This is not a likely outcome within the next few years but this area of research continues to be of significant interest internationally.

Oceanography project (collaborative project with University of New South Wales)

This project, titled *"A unique integrated approach to predicting fisheries recruitment"* involves physical oceanographers from the University of New South Wales (led by Dr Moninya Roughan), NSW DPI, and Prof. Andrew Jeffs from Auckland University and commenced in 2016. It involves developing models that combine physical oceanography (ocean currents, etc.) and biology (lobster biology and behaviour) in order to understand the processes that determine location to location and year to year differences in puerulus recruitment to the NSW coast. Why is there such year to year variability in puerulus settlement along the NSW coast? Do year to year differences in the direction and strength of ocean currents (the east Australia current and associated eddies) explain the patterns of puerulus settlement we have observed during the last 2 decades? Do differences in these currents and eddies explain why there is an occasional recruitment of Eastern Rock Lobsters in Tasmania? Do these oceanographic models predict that any larvae are transported from the NSW coast across the Tasman Sea to New Zealand in some years? A series of models of varying complexity are being developed to address these questions and determine the importance of ocean currents, food availability for phyllosoma (and therefore the energy stores phyllosoma can accumulate) and the subsequent capacity for pueruli to survive their swim toward the coast to settle in the shallows (and on our puerulus collectors!).

Development of these models is well underway with model-predicted patterns of puerulus settlement being similar to the patterns observed from our survey over the past 2 decades. This is a very positive early result from this work. We expect to have a substantial body of results from this project available in early 2018.