

NATIONAL ROCK LOBSTER MANAGEMENT GROUP



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15th December 2008

The Hon. Phil Heatley
Minister of Fisheries
Parliament Buildings
Wellington

Dear Minister

Advice on Rock Lobster Fisheries for 2009-10

On behalf of the National Rock Lobster Management Group (NRLMG), it is my pleasure to congratulate you on your appointment as Minister of Fisheries. The NRLMG is the primary source of advice to the Minister of Fisheries on the management of, and issues relating to, New Zealand rock lobster fisheries. We look forward to providing the necessary information to enable you to make balanced and credible decisions on rock lobster fisheries.

The NRLMG is unique in that it provides advice to you directly. For all other fisheries, the Ministry of Fisheries provides the information to you. Of course, the NRLMG is bound by legislation and follows the same pattern as the Ministry does when advising on other stocks. In December each year we provide an Annual Report and Initial Position Papers (IPP) on a range of rock lobster stocks and issues. Statutory consultation on the IPPs is required and the NRLMG reviews and analyses submissions before developing final advice and presenting you with an FAP in February of the following year.

The NRLMG is a multi-stakeholder group comprised of representatives from customary, amateur and commercial sectors and, in principle, environmental groups. A number of people, principally scientists, additionally form an important part of the NRLMG as advisors. The Ministry is represented on the group primarily through operational policy but with science and compliance input as necessary. The Ministry NRLMG members play a key role in ensuring our advice meets statutory obligations and in coordinating consultations. My role is as independent chair.

Please find enclosed our Annual Report for 2008, incorporating IPPs relating to CRA 3, CRA 4, CRA 7, and CRA 8. The Annual Report provides background information on rock lobsters and rock lobster fisheries as well as outlining the function of the NRLMG. It is a means to provide general information and also to highlight issues that are not traversed through the IPPs. Of note in this respect is the reminder (sections 13 and 14) that progress is still needed to better estimate non-commercial removals and to ensure better compliance and enforcement. In addition, the Annual Report also draws attention to NRLMG-supported, stakeholder-initiated regulatory proposals relating to the CRA 7 Commercial Closed Season (section 11) and Amateur Cray Loops (section 12). These proposals have been submitted to the Ministry of Fisheries' internal prioritisation process for inclusion in the October 2009 Regulatory Review round. The Annual Report also provides a brief update on progress of the CRA 3 Multi-stakeholder Fishing Forum (section 15).

Sections 3 and 4 relate respectively to i) the need to adopt a new management procedure to guide TAC-setting for CRA 4 for the next three years and ii) proposals to vary sustainability measures for CRA 3, CRA 4, CRA 7 and CRA 8 in time for the 2009 fishing season. Because the issues traversed in sections 3 and 4 require decisions to be made by you, and because the decision-making process requires statutory consultation, these sections of the Annual Report are formatted as Initial Position Papers.

Section 3 (page 9) contains options for a new management procedure for CRA 4. The recommended procedure has been in operation already for two years as a guide to voluntary ACE shelving by the CRA 4 commercial industry. Information on the state of the CRA 4 stock suggests, however, that there is a need for a TAC reduction to meet statutory obligations. At this time, in the absence of a new stock assessment, the NRLMG is of the opinion that the best guide to TAC setting is the management procedure already developed and we therefore propose its adoption and use as a TAC setting guide for the next three years, at which time a new stock assessment and review of the management procedure would be appropriate.

CRA 4 quota holders paid directly for the development of the CRA 4 management procedure, independent of the Ministry science processes and the NRLMG. It was developed by stock assessment scientists, who are also NRLMG advisors, with major discussions taking place between scientists and stakeholders. The NRLMG is confident that decision-making based on the recommended management procedure will enable you to meet your statutory obligations whilst also meeting stakeholders' utilisation objectives. The 2009 TAC/TACC options for CRA 4 (section 4, page 29), provided for your consideration, include a reduction which would result if the recommended management procedure were to be implemented.

New management procedures to guide TAC-setting for CRA 7 and CRA 8 were adopted and implemented in early 2008. The CRA 7 and CRA 8 management procedures replaced previous ones used for those stocks which led to successful

rebuilds from low points ten years ago. The current procedures are designed to maintain CRA 7 and CRA 8 stocks at a high level with high probability. The NRLMG initial advice is to continue using the CRA 7 (section 4, page 33) and CRA 8 (section 4, page 36) management procedures to guide TAC setting until they are reviewed in four years time. Application of the rules, in both cases, would lead to TAC/TACC increases in 2009.

The position in CRA 3 (section 4, page 40) is somewhat more complicated as there is no management procedure to guide TAC setting in 2009. There is, however, a new stock assessment that clearly demonstrates the CRA 3 stock is likely below statutory targets and in need of rebuilding. There is already a commitment to development of a CRA 3 management procedure in 2009, ready for implementation in 2010. The appropriate time to consider formal targets and rebuild times is during that development work, involving tangata whenua, fishery stakeholders and other interested parties, primarily through the CRA 3 Forum. Because of the commitment to developing a management procedure, one option presented to you is to maintain the existing TAC and allowances in 2009. Two other TAC options are presented. The first would reduce the TAC by 8%, effectively ensuring no further reduction in stock size while the management procedure is developed. Under this option, commercial stakeholders have accepted that the entire reduction in TAC should come from a reduction in TACC. The other option would reduce the TAC by 19% in order to affect an increase in stock size even as the management procedure is being developed. The second option has less buy-in from the commercial industry and alternative allocation options are therefore provided, including a proportional reduction in TACC and recreational allowance.

I am grateful for the opportunity to discuss the NRLMG, our Annual Report and initial advice on the morning of 17th December. As ever, I am available to discuss these and any other rock lobster related matters at any time.

Yours sincerely

Dr Kevin Stokes

National Rock Lobster Management Group

Chairman

NATIONAL ROCK LOBSTER MANAGEMENT GROUP



NRLMG 2008 ANNUAL REPORT

**To
The Minister of Fisheries
HON. PHIL HEATLEY**

NEW ZEALAND ROCK LOBSTER FISHERY MANAGEMENT AREAS

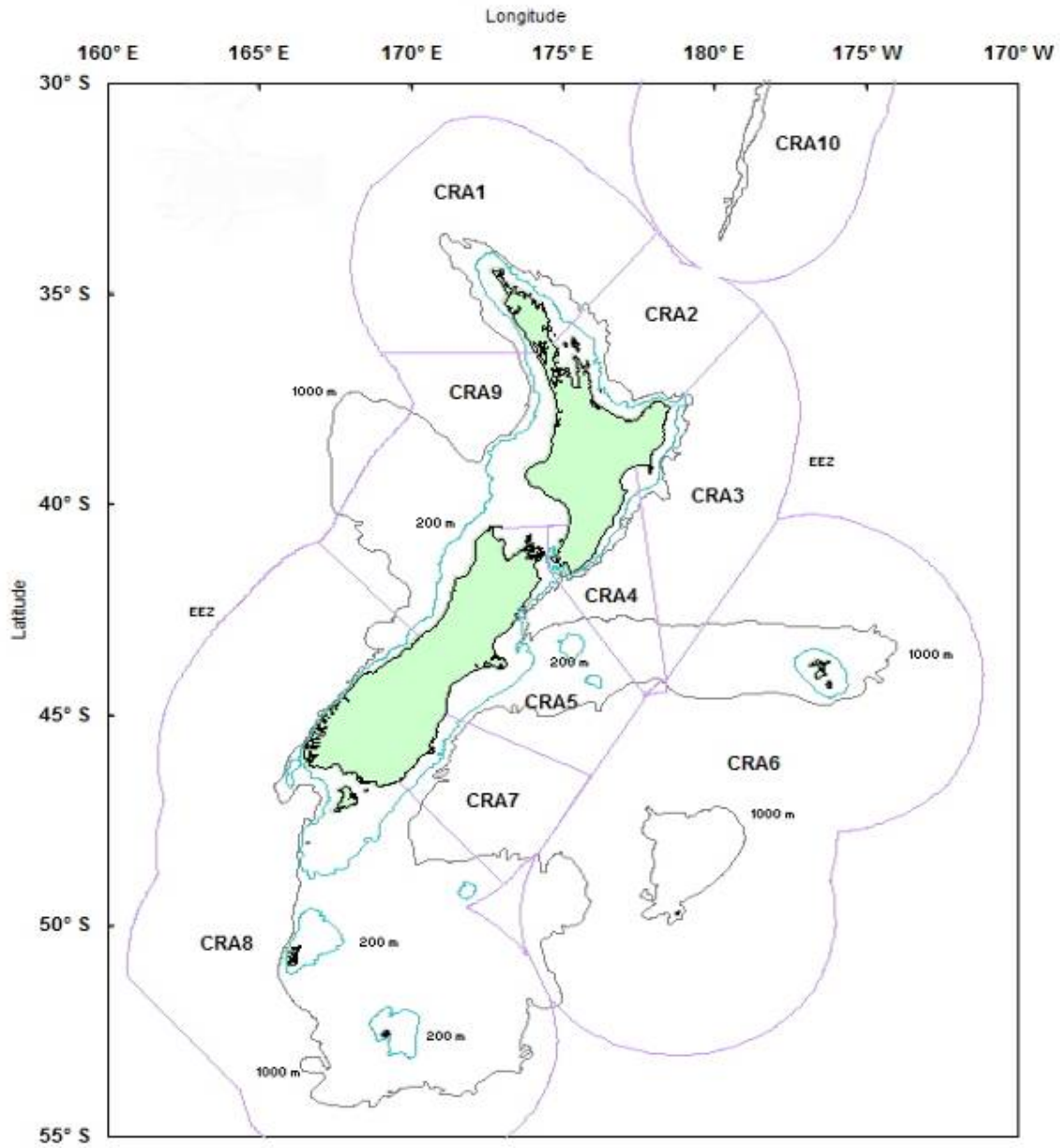


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1. SUMMARY OF THE REPORT

1. This report from the National Rock Lobster Management Group (NRLMG) is primarily an information document. The NRLMG would like to bring your attention, in particular, to:
 - a) the overview of the NRLMG, including its role, function, strategic vision, and framework for managing fisheries;
 - b) the NRLMG's initial advice on management interventions for the 2009-10 fishing year beginning 1 April 2009;
 - c) the two regulatory proposals relating to the CRA 7 Commercial Closed Season and Amateur Cray Loops which have been submitted to the MFish internal prioritisation process for inclusion in the October 2009 Regulatory Review round;
 - d) the priority issues relating to uncertainty in estimates of total removals and compliance and enforcement identified by the NRLMG.

2. The NRLMG recommends that you:
 - a) **confirm** your endorsement of the role and function of the NRLMG;
 - b) **direct** MFish to coordinate release of the NRLMG's initial advice on management interventions for public consultation;
 - c) **note** that the NRLMG will provide you with final advice on management interventions in February 2009.

INTRODUCTION TO THE 2008 ANNUAL REPORT

2. PURPOSE OF THE NRLMG ANNUAL REPORT

3. The purpose of the NRLMG Annual Report is to provide information on rock lobster fisheries and a comprehensive background to NRLMG advice and recommendations on sustainability measures and management controls for rock lobster fisheries to the Minister of Fisheries.
4. The Report reviews a range of topics considered and activities undertaken by the NRLMG during 2008. The report includes:
 - a) NRLMG initial advice on management interventions for rock lobster fisheries for the 2009-10 fishing year;
 - b) a description of the role and function of the NRLMG;
 - c) a description of the framework for managing rock lobster fisheries;
 - d) an explanation of stock assessments and management procedures;
 - e) an outline of priority management issues;
 - f) a description of stakeholder regulatory proposals supported by the NRLMG;
 - g) a report on the operation of a multi-sector stakeholder group for the CRA 3 fishery;
 - h) a description of New Zealand rock lobster fisheries.
5. The NRLMG's initial advice on rock lobster fisheries fulfils the role of a Ministry of Fisheries (MFish) Initial Position Paper (IPP) and is the basis for the Minister's statutory consultation with stakeholders on rock lobster issues. The NRLMG's initial advice is set out in section 3 but a separate Public Consultation Document has also been produced to facilitate the consultation process.
6. This year, the NRLMG is proposing adoption of a management procedure to guide statutory TAC setting in the CRA 4 fishery and variations to the TACs and allowances set for the CRA 3, CRA 4, CRA 7 and CRA 8 rock lobster fisheries.

**INITIAL ADVICE ON
MANAGEMENT INTERVENTIONS
FOR 2009/10 FISHING YEAR**

3. PROPOSAL TO ADOPT A MANAGEMENT PROCEDURE FOR CRA 4

EXECUTIVE SUMMARY

7. The National Rock Lobster Management Group (NRLMG) proposes using a management procedure to guide Total Allowable Catch (TAC) and Total Allowable Commercial Catch (TACC) setting in the Wellington/Hawke Bay rock lobster fishery (CRA 4).
8. The proposed CRA 4 Management Procedure:
 - a) uses standardised autumn-winter (April through September) commercial catch per unit effort (CPUE) as the indicator of lobster abundance for CRA 4
 - b) specifies the management objective as being to maintain the stock abundance at an acceptable level above the agreed sustainability indicators, while delivering an acceptable annual catch
 - c) contains a harvest control rule that calculates a TACC for each fishing year the procedure is operated; the TACC varies with changes in the abundance indicator
 - d) would be used for three years to guide TAC and TACC setting and then reviewed.
9. The NRLMG believes using the CRA 4 Management Procedure to guide TAC and TACC setting is consistent with the Fisheries Act 1996 (the Act). The central consideration is whether the procedure meets the TAC setting requirements of s 13 of the Act. Section 13 requires the Minister of Fisheries (the Minister) to set a TAC that moves the stock to, or maintains the stock at, a size at or above a level that can produce the maximum sustainable yield or that is not inconsistent with this objective. This stock size is commonly called Bmsy.
10. Bmsy has not been reliably estimated for CRA 4. Nevertheless, the NRLMG is confident the CRA 4 Management Procedure is consistent with s 13 because the procedure:
 - a) is expected, with 99% probability, to maintain stock size above the target stock size currently accepted as a proxy for Bmsy
 - b) is designed to achieve a stock size that is, on average, *larger than* the 2008 stock size. Therefore, whether current stock size is above, at or below Bmsy, applying the procedure would increase the stock size either towards Bmsy, or towards a level above Bmsy.

11. Rock lobsters are important taonga to tangata whenua in CRA 4, are prized by amateur fishers, and have high commercial value. Therefore the second key consideration is the impact of the proposed procedure on utilisation value.
12. The NRLMG believes customary Maori, amateur and commercial utilisation values would increase with application of the CRA 4 Management Procedure. This is because:
 - a) the procedure would improve fishing opportunities for all sectors by increasing the stock from its current size, and by maintaining, with high probability, an average stock size larger than both the current and target stock sizes
 - b) the procedure improves the “safety” of the CRA 4 stock by increasing TAC responsiveness to changes in abundance in the fishery
 - c) CRA 4 commercial stakeholders operated the procedure in 2007 and 2008 to guide voluntary commercial catch reductions with the express purpose of halting declining abundance to ensure the ongoing economic viability of the fishery.
13. Initial feedback from discussions with some of the representative customary Maori, amateur and commercial fishing organisations indicate they would support a management procedure approach. Customary Maori and amateur are keen to see an approach to TAC setting that is more responsive to changes in observed abundance in the CRA 4 fishery. CRA 4 commercial stakeholders support use of the CRA 4 Management Procedure to guide statutory TAC and TACC setting in the fishery.

PURPOSE OF THIS PAPER

14. This paper sets out the NRLMG’s initial advice on a proposal to adopt the CRA 4 Management Procedure to guide TAC and TACC setting in CRA 4. It includes the best information available to the NRLMG to inform decision making.
15. The key purpose of the paper is to seek information and comments from CRA 4 tangata whenua, CRA 4 fishery stakeholders and other interested parties on the proposal.

TERMINOLOGY IN THE PAPER

Management Procedure

16. A management procedure is a tool used to guide the setting of catch limits. Management procedures are becoming more widely used, especially in South Africa, Australia, Europe and North America, as well as in New Zealand. A management procedure:

- a) specifies what data will be used to make catch limit decisions
 - b) specifies how the data will be collected and analysed
 - c) contains a harvest control rule (a mathematical equation that determines what the specific output of the procedure will be, such as the exact TAC or TACC)
 - d) has been extensively simulation-tested using an operating model that is a model of the fishery system being managed.
17. Under a management procedure approach, agreement is obtained among managers and stakeholders before the procedure is implemented: they agree about the data inputs, the way the inputs will be treated to make inferences, the harvest control rule and the period for which the management procedure will be used. Extensive simulation testing of the procedure is undertaken to ensure it will deliver the desired outcomes.
18. The advantages of a management procedure approach, over the conventional approach of periodic stock assessments followed by decision making, are:
- a) the process leads to explicit definition of management objectives;
 - b) all participants in the fishery can become involved in the choice of procedure;
 - c) uncertainty in all facets of the assessment and management process can be addressed;
 - d) greater certainty of achieving outcomes is provided;
 - e) a reduction in the need for regular stock assessments, freeing resources for other research; and
 - f) the process is more understandable to fishers than the conventional approach.

Sustainability Indicators (Bmsy, Bref, Bmin)

19. The NRLMG uses sustainability indicators to report on stock health and to evaluate the effectiveness of management options. For most rock lobster stocks, performance is reported against a “target” stock size and a “minimum” stock size.
20. Three sustainability indicators are relevant to evaluation of the CRA 4 Management Procedure:

- a) The statutory target stock size, **Bmsy**. The Act requires the Minister to set a TAC that moves the stock towards, or maintains the stock at, a level at or above Bmsy or to set a TAC that is not inconsistent with this objective. Bmsy is not straightforward to estimate and uncertain when estimated; there is currently no reliable estimate of Bmsy for CRA 4.
 - b) The proxy target stock size, **Bref**. In the absence of a reliable Bmsy estimate, alternative and proxy targets are used. For CRA 4, the stock size associated with a reference period is used. In this period the stock showed good productivity and was demonstrably safe: it subsequently declined to lower levels and then recovered.
 - c) The minimum stock size, **Bmin**. Bmin is the stock size associated with lowest abundance in the observed history of the CRA 4 fishery.
21. For all these indicators, CRA 4 stock size is measured in terms of the autumn-winter vulnerable biomass. "Vulnerable" biomass is the total quantity of lobsters available to the fishery (i.e., it does not include lobsters that cannot be harvested such as undersize lobsters).
22. The NRLMG has specified the desired performance¹ in relation to these sustainability indicators as:
- a) stock size that fluctuates around the target (Bref) with at least 50% probability of achieving the target; and
 - b) stock size remains above the minimum (Bmin) with 95% probability.

SUMMARY OF PROPOSED MANAGEMENT OPTIONS

23. The NRLMG is seeking comments on the following management options:

Option	Description
Option 1	Adopt the CRA 4 Management Procedure to guide TAC and TACC setting in CRA 4
Option 2	Continue to use periodic stock assessments to guide TAC setting in CRA 4 (<i>status quo</i>)

Table 1: Management Options – CRA 4 TAC

¹ In October 2008, MFish released the Harvest Strategy Standard for New Zealand Fisheries (the HSS) that specifies performance standards for Quota Management System species. The NRLMG has not had time to generate the necessary information to incorporate the policy into its advice but will include reporting against the HSS, if necessary to do so, as new stock assessments are undertaken.

Option 1 – Adopt the CRA 4 Management Procedure to Guide TAC and TACC Setting in CRA 4

24. Under Option 1, the Minister would use the CRA 4 Management Procedure to guide statutory TAC setting decisions for CRA 4. The CRA 4 Management Procedure is described in detail in *Attachment 1* to this consultation paper.
25. Under Option 1, the Minister would be guided by the operation of the management procedure when setting the TAC and TACC for CRA 4 for the 2009-10, 2010-11 and 2011-12 fishing years. During 2011, the management procedure would be reviewed.

Option 2 – Continue to use Periodic Stock Assessments to Guide TAC Setting in CRA 4 (status quo)

26. Under Option 2, periodic stock assessments (which are relatively infrequent due to resource constraints) would continue to guide TAC setting for CRA 4. Seasonal CPUE information would also be used to monitor stock abundance between stock assessments.
27. Under Option 2, a CRA 4 stock assessment would be completed in 2009 to allow consideration of whether statutory TAC setting requirements were being met.

RATIONALE FOR MANAGEMENT OPTIONS

CRA 4 Stock Status

28. A stock assessment was last performed for CRA 4 in 2005. The stock assessment indicated stock abundance was well above the target stock size, Bref. The median expectation was that stock size would decline slightly over the subsequent three years but would remain above Bref. The average predicted reduction in stock size was six percent. Uncertainty around these median predictions was very high.
29. CPUE is considered a good indicator of relative abundance in CRA 4, and seasonal CPUE information suggests the CRA 4 stock size may have declined more than predicted by the 2005 stock assessment. The autumn-winter CPUEs declined from 0.728 kg/potlift in 2005, to 0.611 in 2006, and then to 0.527 in 2007. The CPUE increased in 2008 to 0.573 kg/potlift. These CPUE values are all higher than the minimum level observed since 1979 (0.412 in 1992), but are lower than the mean for the reference period 1979-88 (0.754). These historical values are not reference points, but they are closely related to the reference points based on the reference periods. In short, they suggest the stock is probably above Bmin but may be below Bref.
30. CRA 4 commercial stakeholders did not harvest the full TACC in 2004-05 (six tonne shortfall), in 2005-06 (72 tonne shortfall) or in 2006-07 (131 tonne shortfall). They voluntarily shelved 44% of annual catch entitlement (ACE) in 2007-08, and shelved 58% of ACE in 2008-09.

Given the decline in CPUE over the same period, the NRLMG considers that the current TAC is probably not sustainable.

31. The NRLMG notes that current catch levels probably are sustainable. CRA 4 quota shareowners used the CRA 4 Management Procedure to guide voluntary ACE shelving in 2007-08 and 2008-09; the procedure's abundance indicator – autumn-winter CPUE – increased from 0.527 kg/potlift in 2007 to 0.573 kg/potlift in 2008.

Rationale for Option 1

32. Management procedures have been successfully used to guide TAC setting in CRA 7 and CRA 8 since 1996. Management procedures were used first to rebuild the fisheries from a state of low abundance and then to maintain the stocks at target levels with high probability.
33. Adopting the CRA 4 Management Procedure would provide a mechanism to address the issue of a potentially unsustainable TAC quickly (i.e., from 1 April 2009). The procedure is designed to maintain the stock size at a level above both the current stock size and Bref. Use of the procedure is viable because:
 - a) the procedure was chosen from a large selection of procedures that were evaluated for performance against sustainability criteria (refer Breen *et al* (2006))
 - b) the procedure has been tested using a model of the CRA 4 fishery system based on the 2005 CRA 4 stock assessment model (which was accepted by the Ministry of Fisheries (MFish) Plenary in 2005)
 - c) the procedure has been tested for robustness to uncertainties in information, including uncertainties in recruitment, in the level of non-commercial catches and in the stock assessment results. The procedure was robust to these uncertainties in that desired performance against the sustainability indicators was maintained.

Rationale for Option 2

34. The *status quo* approach to addressing the issue of a potentially unsustainable rock lobster TAC is to conduct a stock assessment to confirm stock status and inform TAC setting.
35. The necessary information to complete a viable stock assessment is available for CRA 4. The stock assessment could be completed in 2009 and used to inform TAC setting for the 2010-11 fishing year.

ASSESSMENT OF MANAGEMENT OPTIONS

36. Assessment of the management options against statutory criteria is set out in *Attachment 2* to this consultation paper. Key considerations and impacts are discussed below.

Option 1 – Adopt the CRA 4 Management Procedure to Guide TAC and TACC Setting in CRA 4

Sustainability and Environment

37. Simulation-testing of the CRA 4 Management Procedure shows it to be very safe with respect to sustainability indicators. The procedure is expected to maintain stock size above both *Bref* and *Bmin* with high probability.
38. The NRLMG acknowledges that it does not have a reliable estimate of the statutory target, *Bmsy*. However, the NRLMG is confident the proposed three-year application of the CRA 4 Management Procedure is consistent with the statutory target because:
- a) *Bref* has previously been accepted by the MFish Plenary as a suitable proxy for *Bmsy* and the procedure is expected to maintain stock size above this proxy target with very high probability, and
 - b) the procedure is designed to achieve a stock size that is, on average, *larger than* the current stock size. Therefore, whether current stock size is above, at or below *Bmsy*, applying the procedure would increase the stock size either towards *Bmsy*, or towards a level above *Bmsy*.
39. The NRLMG also acknowledges that there is significant uncertainty in information on the CRA 4 fishery. The procedure has been tested for robustness to uncertainties in information, including uncertainties in recruitment assumptions, in the level of non-commercial catches and in stock assessment results. The procedure was robust to these uncertainties in that desired performance against the sustainability indicators was maintained.
40. Fishing methods used to harvest rock lobster (potting and hand gathering) are low impact; they result in low bycatch and low impact on the benthic environment when compared to other fishing methods. Simulation-testing suggests the average annual catch delivered by the procedure over a 20 year period would be 461 tonnes and the average autumn-winter CPUE would be 0.973 kg/potlift. This average level of fishing effort (470 thousand potlifts) is less than the effort expended in all past years except 1996 to 2000 and 2003, and therefore is unlikely to result in any increase in negative impacts on the marine environment.

Utilisation Value

41. Simulation-testing of the CRA 4 Management Procedure suggests that, as well as maintaining safe stock levels, the CRA 4 Management Procedure would provide for good utilisation.
42. The testing indicates the management procedure would:
- a) improve fishing opportunities for all sectors. Over the 20-year testing horizon the procedure delivered an average annual catch larger than the current estimated catch and an annual average CPUE higher than the current CPUE
 - b) the procedure improves the certainty of outcomes by being more responsive to changes in abundance in the fishery.
43. The harvest control rule in the CRA 4 Management Procedure, with allowances made for non-commercial catches, generates a recommended TAC; the recommended TACC is the TAC minus these allowances.
44. In the short term, commercial stakeholders are likely to be significantly negatively affected by operation of the procedure. CPUE is currently well below the target CPUE specified in the CRA 4 Management Procedure and therefore significant cuts to the TAC and TACC will likely occur to move CPUE back towards the target. The NRLMG notes that CRA 4 commercial stakeholders have implemented the procedure voluntarily since 2007 and so have already demonstrated a willingness to accept these short term impacts to achieve the longer-term benefits of applying the procedure.
45. Information on customary Maori and amateur catches is highly uncertain (although customary Maori information is improving). Current allowances made for customary, amateur and illegal fishing are estimated to be under-caught. The NRLMG notes that it is unlikely to receive, within the three-year application of the CRA 4 Management Procedure, information of sufficient quality to enable an assessment of whether and how allowances should be adjusted.
46. The NRLMG considers the most robust approach is to maintain existing allowances and review, in consultation with tangata whenua and stakeholders, the situation in three years. The following features of the CRA 4 Management Procedure mitigate any impacts that might arise from this approach:
- a) the procedure is tested for robustness to uncertainty in non-commercial catch information
 - b) the procedure uses an abundance indicator that is affected by all fishing activity (i.e., if non commercial fishing effort increases beyond that accounted for in the model, it will affect the abundance indicator and therefore the TACC calculated by the harvest control rule).

47. The NRLMG notes that, should new information become available, the Minister will be provided the information at the time of TAC and allowance setting so that he can make an informed decision about appropriate allocations.

Credibility and Acceptance

48. Management procedures are simpler for people to understand than stock assessments. They therefore tend to attract more interest and support.
49. As noted, the CRA 4 Management Procedure already has a very high degree of acceptance and support among CRA 4 quota shareowners and fishers, who have used the procedure voluntarily since 2007 to constrain commercial catches.
50. Adopting the CRA 4 Management Procedure reduces the frequency of stock assessments, freeing resources for other research and potentially reducing costs to commercial stakeholders.
51. Initial feedback from discussions with some of the representative customary Maori, and amateur fishing representatives in CRA 4 indicate they also would support a management procedure approach. Customary Maori and amateur fishers are keen to see an approach to TAC setting that is more responsive to changes in observed abundance in the CRA 4 fishery.
52. The NRLMG notes that Zone 5 Big Game Fishing Council Clubs (Zone 5 encompasses the CRA 4 area) have implemented a voluntary daily bag limit reduction (from 6 lobsters per person per day to 4) to support the voluntary commercial reductions and efforts to increase abundance in the fishery. This initiative has been supported by the Te Kupenga Whiturauroa a Maui Kaitiaki Forum.

Option 2 – Continue to use Periodic Stock Assessments to Guide TAC Setting in CRA 4 (status quo)

53. Compared with Option 1, continuing to use periodic stock assessments to guide TAC setting for CRA 4:
- a) is less responsive to observed changes in stock abundance in the fishery
 - b) provides lesser certainty of achieving desired sustainability and utilisation outcomes
 - c) appears to have less support among tangata whenua and stakeholders in CRA 4
 - d) may result in higher research costs to CRA 4 commercial stakeholders, and less efficient allocation of available research resources.

OTHER MANAGEMENT ISSUES

54. Operation of the CRA 4 Management Procedure (Option 1) for the 2009-10 fishing year would result in TAC and TACC decreases for CRA 4. A separate paper provides advice on the TAC and TACC adjustments that would be proposed for CRA 4 if the CRA 4 Management Procedure were to be adopted.

NRLMG INITIAL POSITION

55. Based on the available information and the evaluation set out above, the NRLMG's initial position is in favour of Option 1: **adopt** the proposed management procedure to guide TAC and TACC setting in CRA 4.
56. The NRLMG emphasises that this position is preliminary and is provided as a basis for consultation with tangata whenua and stakeholders. All submissions received on the proposal will be considered and discussed in final advice to the Minister. A copy of the final advice will be made available to iwi and stakeholders who make a submission on the proposal following announcement of the Minister's decision.

SPECIFICATIONS OF THE PROPOSED CRA 4 MANAGEMENT PROCEDURE

57. After a stock assessment for CRA 4 (Breen *et al.* 2006), a large set of management procedure evaluations was done, using an operating model based on the CRA 4 assessment model (Breen & Kim 2006b).
58. The 2005-06 catch in CRA 4 was 504 t; this was less than the TACC of 577 t. In the latter part of 2006 it was obvious that the catch for 2006-07 would be even further below the TACC (in the event it turned out to be 445 t). A series of industry meetings discussed options that included adoption of a management procedure or decision rule that would specify annually how much ACE should be voluntarily shelved.
59. The Breen & Kim (2006b) study was used as the basis for choosing a management procedure. One of the obvious requirements, not considered by Breen & Kim, was that the 2007-08 catch limit should be set low enough that it actually constrained the catch. A rule was chosen that specified a low catch limit (321 t) when using the most recent CPUE estimate. This rule, E170 (Figure 1), is specified as follows:

$$SCC_{y+1} = 500 \left(\frac{I_y}{0.9} \right)^{1.4}$$

Figure 1

where SCC is the specified commercial catch limit and I is standardised CPUE from the most recent AW season. There is no latent year²; the maximum allowable change is 75% and the minimum change is 5%.

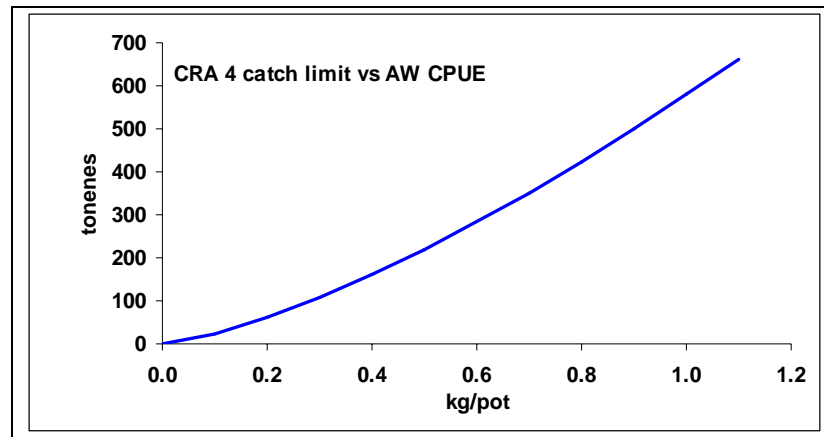


Figure 2: The CRA 4 Management Procedure.

60. The table below shows the history of the rule. In late 2006, the rule delivered a specified catch limit of 321 t. Not all quota owners shelved the requisite ACE, resulting in an operational limit of 339 t, a 41% reduction from the TACC.
61. In late 2007, the rule delivered a specified catch limit of 229 t. Not all quota owners shelved the requisite ACE, resulting in an operational limit of 245 t, a 57% reduction from the TACC.

Year	Applied to fishing year	AW CPUE	Rule Result	Operational Limit
2006	2007-08	0.656 kg/potlift	321.1 tonnes	339 tonnes
2007	2008-09	0.515 kg/potlift	228.9 tonnes	240 tonnes
2008		0.573 kg/potlift	265.9 tonnes	

Table 2: CRA 4 Management Procedure outcomes

STATUTORY CONSIDERATIONS

62. The following statutory considerations have been taken into account when forming the management options for CRA 4:

International Obligations and Treaty of Waitangi Settlement Act 1992 (s 5)

² The original MPEs described by Breen & Kim (2006b) used an asymmetric latent year, under a decrease could be made, but not an increase, in a year following a change. The latent year was dropped before a rule was adopted, at the request of NZ RLIC Ltd., after examination of the performance of the rule without a latent year.

63. Section 5 of the Act requires the Minister to act in a manner consistent with New Zealand's international obligations and Treaty of Waitangi (Fisheries Claims) Settlement Act 1992. To this end, the provisions of general international instruments such as UNCLOS and the Fish Stocks Agreement have been implemented through the provisions of the Act. The NRLMG is not aware of any specific international obligations relating to rock lobster fisheries. The proposed options are consistent with the obligations relating to the Treaty of Waitangi (Fisheries Claims) Settlement Act 1992.
64. The NRLMG recognises that rock lobster (koura) is an important taonga species, and notes that Option 1 - the proposed management procedure - is expected to maintain stocks at a level above the current stock level and therefore improve fishing opportunities for all sectors. Option 2 is riskier in that stock abundance may be below the target. Should the Minister choose this option, the risk is mitigated by the NRLMG commitment to undertake further analysis and provide further advice in 2009. The NRLMG notes that Maori commercial fishing interests have had opportunities to input into the development of the CRA 4 Management Procedure through membership of the CRA 4 commercial stakeholder organisation. NRLMG members have also sought and received ideas and input from some CRA 4 customary Maori fishing interests on preferred approaches to TAC setting. The NRLMG hopes to receive more information and input in response to this consultation document.

Purpose of the Act (s 8)

65. Section 8 of the Act describes the purpose of the Act as being to provide for the utilisation of fisheries resources while ensuring sustainability, and defines the meanings of utilisation and sustainability. The management options presented seek to achieve the purpose of the Act. The proposals seek to ensure TACs are set sustainably and take into account the respective costs of management versus utilisation benefits.

Environmental considerations (s 9)

66. Section 9 of the Act prescribes the following environmental principles that must be taken into account when exercising powers in relation to utilisation of fisheries resources while ensuring sustainability:
- a) **Section 9(a)** requires that associated or dependent species (i.e., those that are not harvested) should be maintained above a level that ensures their long-term viability. Potting and hand gathering fisheries have a relatively low level of by-catch and the NRLMG is not aware of any interactions between the fisheries and non-harvested species of concern.
 - b) **Section 9(b)** requires the maintenance of biological diversity of the aquatic environment be taken into account. The decision on whether to adopt a management procedure to guide TAC setting in CRA 4 does not directly impact on the long term viability and biological diversity of the aquatic environment in CRA 4. Analysis of the impact of quantum reductions or increases resulting from

application of the procedure (Option 1) or stock assessment (Option 2) will be undertaken in relevant consultation documents.

- c) Section 9(c) requires that the Minister to take into account the principle that habitat of particular importance for fisheries management should be protected. The NRLMG is not aware of any such habitats that are affected by the CRA 4 fishery.

Information Principles (S 10)

- 67. **Section 10** of the Act sets out the information principles, which require that decisions be based on the best available information, taking into account any uncertainty in that information, and applying caution when information is uncertain, unreliable, or inadequate. In accordance with s 10, the absence of information should not be used as a reason to postpone, or fail to take, any measure to achieve the purpose of the Act, including providing for utilisation at levels considered to be sustainable. A thorough review of available information has been undertaken by the NRLMG and the best available information has been used to evaluate the management options presented. The NRLMG has endeavoured to set out the relevant uncertainty in, and inadequacy of, that information so that the appropriate caution can be applied in assessing the proposed management options.

Sustainability Measures (s 11)

- 68. **Sections 11(1)(a), (b) and (c)** set out matters the Minister must take into account when varying the TAC for CRA 4, including any effects of fishing on any stock and the aquatic environment, any existing controls under the Act that apply to the stock or area concerned, and the natural variability of the stock. Such matters will be addressed directly in consultation papers that seek quantum variations to the TAC as a result of application of the proposed management procedure (Option 1) or stock assessment (Option 2). The NRLMG notes, however, that recruitment into rock lobster stocks is highly variable and that this variability is taken into account by stock assessment scientists when developing and testing management procedures and undertaking stock assessments CRA 4. Existing controls under the act are also considered during these processes.
- 69. **Sections 11(2)(a) and (b)** require the Minister to have regard to any provisions of any regional policy or plan under the Resource Management Act 1991 and any management strategy or plan under the Conservation Act 1997 that apply to the coastal marine area and are considered relevant when varying the TAC for CRA 4. The NRLMG is not aware of any such provisions that should be taken into account.
- 70. **Section 11(2A) (b)** requires the Minister to take account of any relevant and approved fisheries plans when varying the TAC in CRA 4. There is no approved fisheries plan in place for CRA 4. The NRLMG is aware that Ngati Kahungunu is in the process of developing a fisheries plan relating to Ngati Kahungunu fisheries.

71. **Sections 11(2A) (a) and (c)** require the Minister to take into account any conservation or fisheries service, or any decision not to require such services, when varying a TAC. The NRLMG is not aware of any proposed services that affect the CRA 4 stock. No decision has been made to not require such a service in CRA 4 at this time.

TAC Setting Considerations (s 13)

72. **Section 13:** Rock lobster stocks are managed under s 13 of the Act. Under s 13(2) the Minister must set a total allowable catch that:

- a) maintains the stock at or above a level that can produce the maximum sustainable yield, having regard to the interdependence of stocks; or
- b) enables the level of any stock whose current level is below that which can produce the maximum sustainable yield to be altered—
 - (i) in a way and at a rate that will result in the stock being restored to or above a level that can produce the maximum sustainable yield, having regard to the interdependence of stocks; and
 - (ii) within a period appropriate to the stock, having regard to the biological characteristics of the stock and any environmental conditions affecting the stock; or
- c) enables the level of any stock whose current level is above that which can produce the maximum sustainable yield to be altered in a way and at a rate that will result in the stock moving towards or above a level that can produce the maximum sustainable yield, having regard to the interdependence of stocks.

73. In the case of *Anton’s Trawling Company v The Minister of Fisheries* (High Court, Wellington, CIV 2007-485-2199, 28 February 2008) Miller J said that before a TAC could be set under the above provisions the Minister must be provided with an estimate of both current biomass and the biomass that can produce the maximum sustainable yield. Neither of these figures are available for rock lobster so s 13 (2A), which was passed as a consequence of Miller J’s decision, becomes applicable.

74. **Section 13(2A)** says that:

- (2A) For the purposes of setting a total allowable catch under this section, if the Minister considers that the current level of the stock or the level of the stock that can produce the maximum sustainable yield is not able to be estimated reliably using the best available information, the Minister must—

- a) not use the absence of, or any uncertainty in, that information as a reason for postponing or failing to set a total allowable catch for the stock; and
- b) have regard to the interdependence of stocks, the biological characteristics of the stock, and any environmental conditions affecting the stock; and
- c) set a total allowable catch—
 - (i) using the best available information; and
 - (ii) that is not inconsistent with the objective of maintaining the stock at or above, or moving the stock towards or above, a level that can produce the maximum sustainable yield.

75. It is the NRLMG's view that the measures advanced in this paper meet the requirement of being "not inconsistent with the objective of maintaining the stock at or above, or moving the stock towards or above, a level that can produce the maximum sustainable yield."
76. In considering the way in which and rate at which a stock is moved towards or above a level that can produce maximum sustainable yield under subsection (2) (b) or (c), or (2A) (if applicable), the Minister shall have regard to such social, cultural, and economic factors as he or she considers relevant. The CRA 4 Management Procedure (Option 1) is a maintenance procedure and would act to move the stock quickly towards the target. The NRLMG notes that the procedure is expected to maintain stock size above the target stock size with high probability.
77. The NRLMG has no information on which to base the evaluation of Option 2, as modelling work has not been undertaken on alternative TAC setting options.

TACC Setting Considerations (s 20 and 21)

78. Section 20 and 21 specify a number of matters that must be taken into account when setting or varying a TACC. Section 21 requires the Minister to allow for non-commercial Maori and amateur fishing interests, and other sources of fishing-related mortality when setting or varying the TACC. These allowances will be considered and provided for when quantum changes to the TAC are proposed.
79. Section 21(4) also requires that any mātaimai reserve or closures/restrictions under s 186A to facilitate customary Maori fishing be taken into account. Mātaimai reserves and section 186A closures are located within CRA 4 – the Moremore Mātaimai Reserves (Hawke Bay) and the Pukerua Bay 186A closure (Wellington). The NRLMG considers that both management options presented in this paper will contribute to a larger and more sustainable CRA 4 stock that will benefit abundance both inside and outside mātaimai reserves and s 186A closures.

80. Section 21(5) also requires that any regulations to prohibit fishing made under s 311 be taken into account when setting allowances for amateur fishing interests. The NRLMG is not aware of any restrictions under s 311 that have been placed on fishing in any area within CRA 4.

4. PROPOSAL TO VARY SUSTAINABILITY MEASURES FOR CRA 3, CRA 4, CRA 7 AND CRA 8

EXECUTIVE SUMMARY

81. The NRLMG proposes varying the TACs and allowances for CRA 3, CRA 4, CRA 7 and CRA 8 for the 2009-10 fishing year beginning 1 April 2009.

Variations to TACs Resulting From Operation of Management Procedures

82. The proposed variations to the TACs of CRA 7 and CRA 8 are the result of the operation of management procedures adopted by the Minister in March 2008 to guide TAC setting for these stocks. The NRLMG has reviewed best available information and has found nothing that would warrant the Minister setting aside the management procedures for 2009-10. Implementing the procedures would result in TAC increases of 65.12 tonnes and 57 tonnes for CRA 7 and CRA 8 respectively.
83. The proposed variation to the CRA 4 TAC is also the result of the operation of a management procedure being considered for adoption in Consultation Paper 1. The NRLMG has reviewed best available information and has found nothing that would warrant the Minister choosing not to be guided by the procedure for 2009-10. Implementing the procedure would result in a TAC decrease of 311 tonnes.
84. The NRLMG proposes achieving the new proposed TACs for CRA 4, CRA 7 and CRA 8 by varying only the commercial catch allowances (i.e., the TACCs). The NRLMG notes that, in respect to CRA 4, varying the TACC is the most effective means of achieving the decrease in catch sought and that CRA 4 commercial stakeholders support this approach.
85. In respect of CRA 7 and CRA 8, the NRLMG recommends increasing only the TACCs because best available information on customary Maori and amateur catch in CRA 7 and CRA 8 suggests that existing allowances are not being caught. Amateur representatives to the NRLMG note that increased fishing activity may have increased amateur catches beyond the current allowances, but no data exists to confirm or quantify such increases at this time. The NRLMG notes that any risk associated with increased amateur catch is mitigated by the operation of the management procedures: the abundance indicators in the procedures measure the impact all fishing has on abundance and vary the proposed TACs accordingly.

Variations to TACs Resulting From Stock Assessment – CRA 3

86. The proposed variation to the CRA 3 TAC is the result of an updated stock assessment. The stock assessment indicates CRA 3 is below the target stock size and is likely to decline over the next four years at current catch levels. The NRLMG proposes a range of options to

restore the stock to target stock size, including retaining the current TAC for 2009-10 (Option 1), cutting the TAC by 26 tonnes (Option 2) and cutting the TAC by 62 tonnes (Option 3). Each of the options includes the development and adoption of a management procedure to guide TAC setting from 2010-11. The NRLMG is seeking feedback on options for achieving the proposed TACs. For Options 1 and 2, the NRLMG proposes reducing the TACC only. For Option 2, the NRLMG proposes two approaches: (A) reducing the TACC only; or (B) reducing the TACC and recreational allowance proportionally.

87. Each of the options has a different risk (to sustainable utilisation) and impact (to cultural, social and economic values) profile. The NRLMG's initial position is that Option 2 provides the best balance between managing risks to sustainability, uncertainty in information, and impacts on CRA 3 fishers.

PURPOSE OF THIS PAPER

88. This paper sets out the NRLMG's initial advice on proposals to amend the TACs and allowances for CRA 3, CRA 4, CRA 7 and CRA 8. It includes the best information currently available to the NRLMG to inform decision making.
89. The key purpose of the paper is to seek information and comments from tangata whenua, fishery stakeholders and other interested parties on the proposals.

TERMINOLOGY IN THIS PAPER

Management Procedures

90. A management procedure is a tool used to guide the setting of catch limits. A general description of management procedures is provided in Consultation Document 1.

Sustainability Indicators (Bmsy, Bref, Bmin)

91. As noted in Consultation Paper 1, the NRLMG uses sustainability indicators to report on stock health and to evaluate the effectiveness of management options.
92. Three sustainability indicators are relevant to the evaluation of the proposals in this paper:
- a) The statutory target stock size, **Bmsy**. Section 13 requires the Minister to set TACs for rock lobster stocks that move the stocks to, or maintain the stocks at, a level at or above Bmsy, or that is not inconsistent with this objective. Bmsy is not straightforward to estimate and often uncertain when estimated.
 - b) The proxy target stock size, **Bref**. When a Bmsy estimate is absent or unreliable, alternative and proxy targets are used. Bref is generally a stock size at or above the

stock size associated with a period in the fishery that showed good productivity and was demonstrably safe.

- c) The minimum stock size, **Bmin**. Bmin is either the stock size associated with lowest abundance in the observed history of the fishery or $\frac{1}{2}$ Bref.

93. For all the stocks considered in this paper, stock size is measured in terms of the vulnerable biomass. "Vulnerable biomass" is the amount of lobster that is available to the fishery (i.e., it does not include lobsters that cannot be harvested such as undersize lobsters).

94. The desired performance ₃ in relation to these sustainability indicators is:

- a) stock size that fluctuates around the target with at least 50% probability of achieving the target; and
- b) stock size remains above the minimum with 90% probability.

³ In October 2008, MFish released the Harvest Strategy Standard for New Zealand Fisheries (the HSS) that specifies performance standards for Quota Management System species. The NRLMG has not had time to generate the necessary information to incorporate the policy into its advice but will include reporting against the HSS, if necessary to do so, as new stock assessments are undertaken.

SUMMARY OF PROPOSED MANAGEMENT OPTIONS

95. Tables 3 and 4 set out the variations to TAC and allowances in rock lobster fisheries proposed for the 2009-10 fishing year beginning 1 April 2009:

Variations to TACs and Allowances Resulting From Operation of Management Procedures

96. The NRLMG is seeking comments on the following proposed TAC and TACC variations for CRA 4, CRA 7 and CRA 8:

Stock		Current Catch Limits (<i>Status quo</i>)	2009-10 Catch Limits From Operation of Management Procedures
CRA 4	TAC	771 tonnes	460 tonnes
	TACC	577 tonnes	266 tonnes
CRA 7	TAC	143.88 tonnes	209 tonnes
	TACC	123.88 tonnes	189 tonnes
CRA 8	TAC	1053 tonnes	1110 tonnes
	TACC	966 tonnes	1023 tonnes

Table 3: TAC and Allowance Options for CRA 4, CRA 7 and CRA 8

Variations to TACs Resulting From Stock Assessment – CRA 3

97. The NRLMG is seeking comments on the following range of TAC and allocation options for CRA 3:

CRA 3	Option 1 Current Catch Limits (<i>Status quo</i>)	Option 2 Reduce the TAC by 8% and decrease the TACC only	Option 3A Reduce the TAC by 19% and decrease the TACC only	Option 3B Reduce the TAC by 19% & decrease the TACC & Recreational Allowance
TAC	319 tonnes	293 tonnes	257 tonnes	257 tonnes
TACC	190 tonnes	164 tonnes	128 tonnes	134 tonnes
Recreational Allowance	20 tonnes	<i>Unchanged</i>	<i>Unchanged</i>	14 tonnes

Customary Allowance	20 tonnes	<i>Unchanged</i>	<i>Unchanged</i>	<i>Unchanged</i>
Other Fishing Mortality	89 tonnes	<i>Unchanged</i>	<i>Unchanged</i>	<i>Unchanged</i>

Table 4: *TAC and Allowance Options for CRA 3*

OPERATION OF MANAGEMENT PROCEDURES FOR THE 2009-10 FISHING YEAR

98. Two agreed (CRA 7 and CRA 8) and one proposed (CRA 4) management procedures have been operated to guide TAC setting for the 2009-10 fishing year.
99. The NRLMG believes implementing the catch limits generated by the management procedures is consistent with the Act. In all cases, operation of the relevant management procedure results in a TAC that moves the stock to a level at or above Bmsy, or that is not inconsistent with this objective.

CRA 4 (WELLINGTON/HAWKE BAY ROCK LOBSTER FISHERY)

Management Options and Rationale for CRA 4

Option 1

Set the CRA 4 TAC and TACC based on the operation of the CRA 4 Management Procedure

100. Under Option 1, the TAC for CRA 4 would be reduced from 771 tonnes to 460 tonnes, and the TACC would be reduced from 577 tonnes to 266 tonnes, from 1 April 2009. The allowances set for customary Maori, amateur and other fishing mortality would remain unchanged.
101. The proposed variations result from operation of the proposed CRA 4 Management Procedure. The operation of the CRA 4 Management Procedure represents the best available information to guide TAC setting for CRA 4 fishery in 2009-10 (refer Consultation Paper 1).

Option 2

Maintain the current TAC and allowances for CRA 4

102. Under Option 2, the current CRA 4 TAC and allowances would be retained for the 2009-10 fishing year.
103. Available information suggests the current CRA 4 TAC may be unsustainable but information is uncertain. Under Option 2 a CRA 4 stock assessment would be completed in 2009 to provide information on the status of the fishery and to assess a range of alternative TAC setting options.

Assessment of Management Options for CRA 4

104. Assessment of the management options against statutory criteria is set out in Attachment 1 to this consultation paper. Key considerations and impacts are discussed below.

CRA 4 Sustainability Indicators and Stock Status

105. No reliable estimate of Bmsy is currently available for CRA 4. A proxy target, Bref, has been agreed by the MFish Plenary and is the autumn-winter vulnerable stock size associated with the period 1979-88. Bmin is the autumn-winter vulnerable stock size associated with the lowest observed abundance in the CRA 4 fishery.
106. No new stock assessment has been conducted in 2008 so information on current stock size is uncertain:
- a) the 2005 stock assessment indicated stock abundance was well above the Bmin and Bref. The median expectation was that stock size would decline slightly over the subsequent three years but would remain above Bref. Uncertainty around these median predictions was very high
 - b) CPUE is considered a good indicator of relative abundance in CRA 4; seasonal CPUE information suggests current stock size is probably above Bmin but may now be below Bref.
 - c) CRA 4 commercial stakeholders did not harvest the full TACC in 2004-05, 2005-06 or 2006-07 and voluntarily shelved ACE in 2007-08 and 2008-09. Given the decline in CPUE over the same period, the NRLMG considers it probable the TAC is not sustainable.

Assessment of Option 1 – Set CRA 4 TAC and TACC based on Operation of the CRA 4 Management Procedure

107. The proposed decrease in TAC is not inconsistent with the objective of moving the stock to Bmsy. The proposed decrease would increase CRA 4 stock size. Ongoing application of the CRA 4 Management Procedure is expected to meet sustainability criteria by maintaining stock size above the proxy target, Bref, and Bmin with high probability.
108. The proposed decrease would not result in any negative impacts on the marine environment. Fishing methods used to harvest rock lobster (potting and hand gathering) are low impact; they result in minimal bycatch and low impact on the benthic environment when compared to other fishing methods. In addition, the estimated average annual level of fishing effort (470 thousand potlifts) expected from application of the CRA 4 Management Procedure is less than the effort expended in all past years except 1996 to 2000 and 2003, and therefore is unlikely to result in any increase in negative impacts on the marine environment.
109. The NRLMG considers the proposed TAC decrease would improve fishing opportunities for all sectors by increasing stock size and catch rates. Ongoing application of the CRA 4 Management Procedure is expected to deliver an average annual catch larger than the current estimated catch and an annual average commercial CPUE higher than the current commercial CPUE
110. The NRLMG proposes achieving the full TAC decrease by reducing only the TACC. Reducing only the TACC provides greatest certainty that stock size will increase, as information on catch and catch rates in customary Maori and amateur fisheries is scarce and uncertain (although information on customary catch is improving). CRA 4 commercial stakeholders support this approach but emphasise the need to ensure catches by other sectors remain within the allowances provided to ensure the TACC cut does not become a re-allocation of available catch.
111. Using 2007 export information, the value of 311 tonnes of rock lobster (i.e., the proposed reduction to the TACC) is approximately \$12.6 million. The NRLMG notes, that the voluntary commercial catch limit applied by the CRA 4 commercial sector for 2008-09 is 240 tonnes. The proposed TACC would therefore potentially result in 26 tonne more rock lobster being landed by commercial stakeholders in 2009-10 than in 2008-09.

Assessment of Option 2 – Maintain the current TAC and allowances for CRA 4

Sustainability and Environment

112. The NRLMG considers it highly likely that, if the full TACC were to be taken in the 2009-10 fishing year, stock size in CRA 4 would decline. Autumn-winter CPUE declined between 2004 and 2007 despite reducing commercial landings. The most recent autumn-winter CPUE showed a slight increase with commercial catch limited to less than half the TACC.
113. The decline in stock size would be reduced or prevented if commercial stakeholders continued to implement voluntary commercial catch reductions. Voluntary commercial

catch reductions are not guaranteed and may not even be possible to achieve within the decision-making timeframe. CRA 4 commercial stakeholders support, and are anticipating statutory TAC and TACC reductions (guided by the CRA 4 Management Procedure), and therefore have not initiated voluntary ACE shelving discussions for the 2009-10 fishing year.

114. The decline in stock size would be reduced or prevented if commercial stakeholders could not, or chose not, to harvest the full TACC for economic reasons. Recent information suggests that harvesting the full TACC may not be economically viable; the current CPUE is 0.573 kg/potlift and the fishery failed to catch the TACC in 2005 when the CPUE was slightly above 0.7 kg/potlift. However, the economic environment has changed significantly since 2005 making drawing any conclusions about likely commercial harvest in 2009-10 difficult.

Utilisation Value

115. A reduction in stock size in 2009-10 would affect utilisation value by:
- a) reducing fishing opportunities for customary Maori and amateur fishers in the short –medium term
 - b) increasing the likelihood of a relatively larger cut to the CRA 4 TAC and TACC in 2010-11 than might be applied in 2009-10 under Option 1 and, potentially, the average annual catch and average catch rates achievable in the short-medium term
 - c) reducing responsiveness to changes in abundance in the fishery, and thereby creating uncertainty.

Credibility and Acceptance

116. CRA 4 tangata whenua and fishing stakeholders are keenly aware of the decline in stock size and fishing opportunities in the fishery. Delaying action for one year may not be seen as acceptable or credible.

NRLMG INITIAL POSITION ON CRA 4

117. Based on the available information and the evaluation set out above, the NRLMG's initial position is in favour of Option 1: reduce the TAC for CRA 4 as specified by the proposed CRA 4 Management Procedure by reducing only the TACC.
118. The NRLMG has identified no reason why the Minister should not use the results of the proposed CRA 4 Management Procedure to guide statutory TAC setting decisions.

CRA 7 (OTAGO ROCK LOBSTER FISHERY)

Management Options and Rationale for CRA 7

Option 1

Set the CRA 7 TAC and TACC based on the operation of the CRA 7 Management Procedure

119. Under Option 1, the TAC for CRA 7 would increase from 143.88 tonnes to 209 tonnes from 1 April 2009 as specified by the CRA 7 Management Procedure. To achieve this new TAC, the CRA 7 TACC would be increased from 123.88 tonnes to 189 tonnes. The allowances set for customary Maori, recreational and other fishing mortality would not be changed.
120. The CRA 7 Management Procedure was adopted by the Minister in March 2008 to guide TAC setting in CRA 7. The procedure is described in detail in Attachment 2 to this consultation paper.

Option 2

Maintain the current TAC and allowances for CRA 7

121. Under Option 2, the current CRA 7 TAC and allowances would be retained for the 2009-10 fishing year (refer Table 3).
122. There is no clear basis for recommending alternative TAC options for CRA 7 in the 2009-10 fishing year; consequently, under Option 2, the management approach to CRA 7 TAC setting would need to be revised.

Assessment of Management Options for CRA 7

123. Assessment of the management options against statutory criteria is set out in *Attachment 1* to this consultation paper. Key considerations and impacts are discussed below.

CRA 7 Sustainability Indicators and Stock Status

124. An estimate of Bmsy is available for CRA 7 but is uncertain. A proxy target, Bref, has been agreed previously by the MFish Plenary and is the annual vulnerable stock size associated with the period 1979-81. Bref represents a larger stock size than the uncertain Bmsy estimate and therefore is a more conservative target stock size. The Bmin used for stock assessment was the lowest stock size estimated by the stock assessment model, and for the management procedure evaluations was ½ Bref.

125. A stock assessment was last performed for CRA 7 in 2006. The 2006 stock assessment results indicated stock size in 2005-06 was approximately 1.7 times Bref.
126. Standardised CPUE is considered to be a good indicator of relative stock size in CRA 7 and is the abundance indicator used in the CRA 7 Management Procedure. Standardised CPUE has increased in the last two fishing years, indicating that stock size has increased (Figure 3).

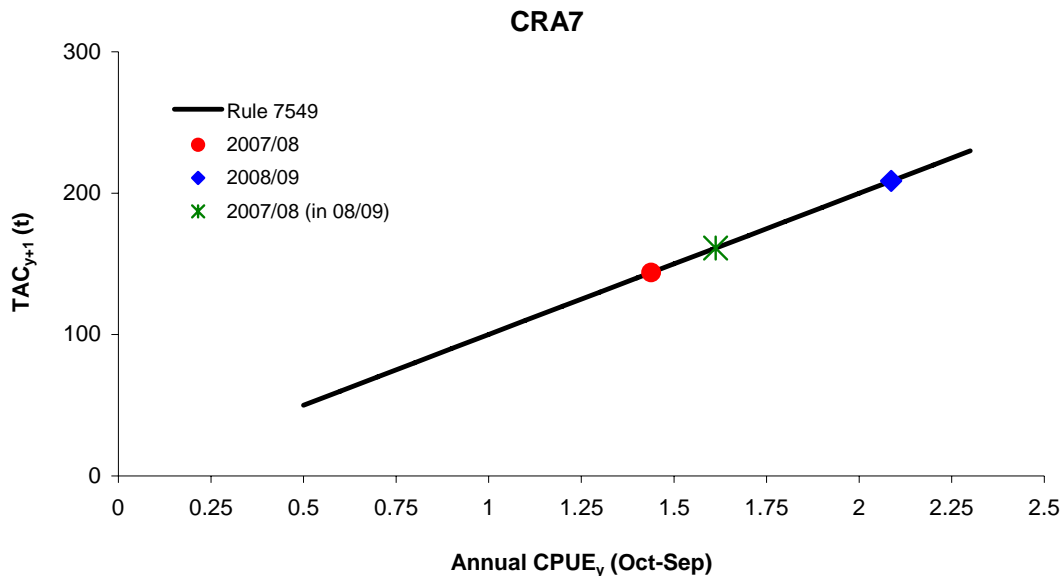


Figure 3: Current (2008-09) CPUE (2.09 kg/pot lift) and 2007-08 CPUE values (one calculated in December 2007 and the most recent calculated at the end of October 2008). Figure 3 also shows a graphical representation of the CRA 7 Management Procedure, showing TAC in the next year as a function of CPUE in the current year.

Assessment of Option 1 – Vary the CRA 7 TAC and TACC based on Operation of the CRA 7 Management Procedure

127. The proposed increase in TAC would not pose a risk to sustainability. The CRA 7 Management Procedure is responsive to variability in the stock size and is designed to maintain stock size well above Bref with high probability. The procedure is expected to maintain a stock size of 1.5 times Bref and to maintain stock size above Bmin with over 99% probability.
128. The proposed increase would not result in any increase in negative impacts on the marine environment. Rock lobster fishing methods are low impact and the NRLMG considers it unlikely the proposed change to the TAC will have a demonstrable adverse effect on protected species, the benthos or biological diversity.
129. The NRLMG proposes allocating the full TAC increase to commercial only as best available information suggests existing customary Maori and recreational allowances are not being caught. Table 5 below shows the current non-commercial allowances for CRA 7 and the best available estimates of non-commercial catches.

CRA 7	Customary Allowance	Recreational Allowance	Other Fishing Mortality	Total Non-Commercial
Allowances	10 tonnes	5 tonnes	5 tonnes	20 tonnes
Estimated Catches	1 tonne	4.51 tonnes	1 tonne	6.51 tonnes

Table 5: *Current Non-Commercial Allowances and Estimated Catches for CRA 7.*

130. Amateur representatives to the NRLMG note that increased fishing activity in CRA 7 may have increased amateur catches beyond the current CRA 7 recreational allowance. There are no data to confirm or quantify amateur catch increases at this time. In compiling advice, the NRLMG has relied on the catch data provided to and accepted by the MFish Plenary.
131. The NRLMG notes that the bag limit, not the recreational allowance, constrains amateur catch. Amateur fishers in CRA 7 are not seeking a daily bag limit increase at this time. Any risk associated with underestimating amateur catch is mitigated by:
- a) the estimated aggregate non-commercial catches being less than half the current aggregate non-commercial allowances
 - b) the operation of the management procedures - the abundance indicator used in the procedure measures the impact *all* fishing has on abundance and varies the proposed TAC accordingly.
132. Additionally, the CRA 7 Management Procedure is designed to maintain the CRA 7 stock well above the target stock size and consequently provide good fishing opportunities for all sectors.
133. Using 2007 export information, the value of the 65.12 tonne increase in commercial catch is estimated to be \$2.6 million.

Assessment of Option 2 – Maintain the current TAC and allowances for CRA 7

134. Compared with Option 1, retaining the current TAC and allowances for CRA 7 would likely:
- a) result in a stock size well in excess of the target stock size
 - b) result in increased fishing opportunities in the non-commercial fisheries

- c) constrain utilisation in the commercial fishery and result in an opportunity cost of \$2.6 million.

135. The NRLMG believes that choosing not to implement the results of an agreed management procedure without an explicit reason would also reduce stakeholder confidence in the application of management procedures. Such a decision may also affect development and implementation of management procedures for other fisheries in New Zealand.

NRLMG INITIAL POSITION ON CRA 7

136. Based on the available information and the evaluation set out above, the NRLMG's initial position is in favour of Option 1: increase the TAC for CRA 7 as specified by the CRA 7 Management Procedure and allocate the increased catch to the TACC. The NRLMG has identified no reason why the Minister should not use the results of the previously agreed procedure to guide statutory TAC setting decisions.

CRA 8 (SOUTHERN ROCK LOBSTER FISHERY)

Management Options and Rationale for CRA 8

Option 1

Vary the CRA 8 TAC and TACC based on Operation of the CRA 8 Management Procedure

137. Under Option 1, the TAC for CRA 8 would be increased from 1053 tonnes to 1110 tonnes from 1 April 2009 as specified by the CRA 8 Management Procedure. To achieve this new TAC, the CRA 8 TACC would be increased from 966 tonnes to 1023 tonnes. The allowances set for customary Maori, recreational and other fishing mortality would not be changed.
138. The CRA 8 Management Procedure was adopted by the Minister in March 2008 to guide TAC setting in CRA 8. The procedure is described in detail in Attachment 2 to this consultation paper.

Option 2

Maintain the current TAC and allowances for CRA 8

139. Under Option 2, the current CRA 8 TAC and allowances would be retained for the 2009-10 fishing year (refer Table 3).

140. There is no clear basis for recommending alternative TAC options for CRA 8 in the 2009-10 fishing year, consequently, under Option 2, the management approach to CRA 8 TAC setting would need to be revised.

Assessment of Management Options for CRA 8

141. Assessment of the management options against statutory criteria is set out in Attachment 3 to this consultation paper. Key considerations and impacts are discussed below.

CRA 8 Sustainability Indicators and Stock Status

142. An estimate of Bmsy is available for CRA 8 but is uncertain. A proxy target, Bref has been agreed previously by the MFish Plenary and is the annual vulnerable stock size associated with the period 1979-82. The uncertain Bmsy estimate represents a slightly larger stock size than Bref (at 1.14 times Bref) and therefore is the more conservative target stock size. The Bmin used for stock assessment was the lowest stock size estimated by the stock assessment model, and for the management procedure evaluations was ½ Bref.
143. A stock assessment was last performed for CRA 8 in 2006. The stock assessment results indicated stock size in 2005-06 was approximately 2.0 times Bref and 1.75 times Bmsy.
144. Standardised CPUE is considered to be a good indicator of relative stock size in CRA 8 and is the abundance indicator used in the CRA 7 Management Procedure. Standardised CPUE has increased in the last two fishing years, indicating that stock size has increased (Figure 4).

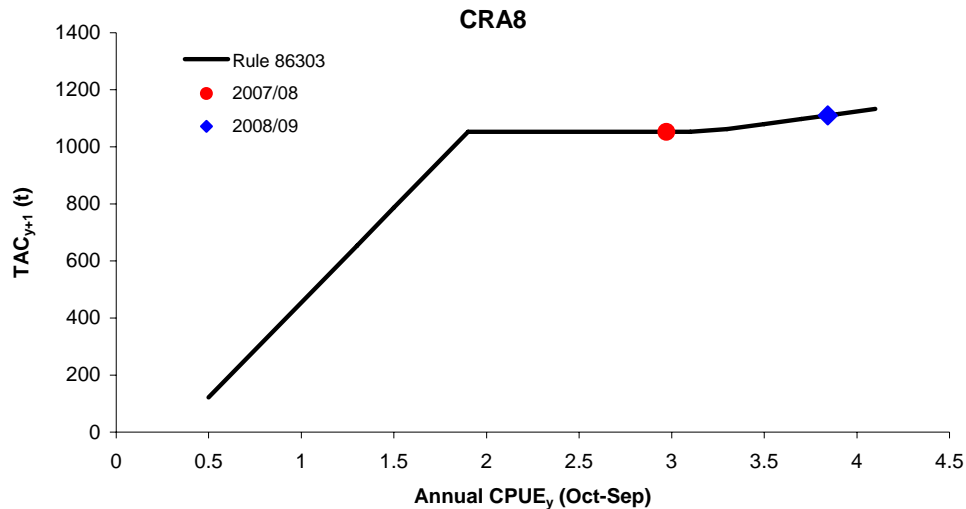


Figure 4: The 2007–08 and 2008–09 CPUE values. Figure 4 also shows a graphical representation of the CRA 8 Management Procedure, showing TAC in the next year as a function of CPUE in the current year.

Option 1 – Vary the CRA 8 TAC and TACC based on Operation of the CRA 8 Management Procedure

145. The proposed increase in TAC does not pose a risk to sustainability. The CRA 8 Management Procedure is conservative and is designed to maintain stock size well above the Bref and Bmsy targets with high probability. The procedure is expected to maintain a long-term average stock size of 2.0 times Bref and to maintain stock size above Bmin with over 99% probability.

146. The proposed increase would not result in any increase in negative impacts on the marine environment. Rock lobster fishing methods are low impact and the NRLMG considers it unlikely the proposed change to the TAC will have a demonstrable adverse effect on protected species, the benthos or biological diversity.

147. The NRLMG proposes allocating the full TAC increase to commercial only as best available information suggests existing customary Maori and recreational allowances are not being caught. *Table 6* below shows the current non-commercial allowances for CRA 8 and the best available estimates of non-commercial catches.

CRA 8	Customary Allowance	Recreational Allowance	Other Fishing Mortality	Total Non-Commercial
Allowances	30 tonnes	29 tonnes	28 tonnes	87 tonnes
Estimated Catches	2 tonne	20.1 tonnes	18 tonne	40.1 tonnes

Table 6: *Current Non-Commercial Allowances and Estimated Catches for CRA 8.*

148. Amateur representatives to the NRLMG note that increased fishing activity in CRA 8 may have increased amateur catches beyond the current CRA 8 recreational allowance. Recreational catch surveys have been undertaken in the Fiordland Marine Area but there are no data to confirm or quantify catch increases across the whole CRA 8 fishery at this time. In compiling advice, the NRLMG has relied on the catch data provided to and accepted by the MFish Plenary.

149. The NRLMG notes that the bag limit, not the recreational allowance, constrains amateur catch. Amateur fishers in CRA 8 are not seeking a daily bag limit increase at this time. Any risk associated with underestimating amateur catch is mitigated by:

- a) the estimated aggregate non-commercial catches being less than half the current aggregate non-commercial allowances

- b) the operation of the management procedures - the abundance indicator used in the procedure measures the impact *all* fishing has on abundance and varies the proposed TAC accordingly.

150. Additionally, the CRA 8 Management Procedure is conservative and designed to maintain the CRA 8 stock well above the target stock size and consequently provide good fishing opportunities for all sectors.
151. The export value of the 57 tonne increase in CRA 8 commercial catch of lobsters is \$2.3 million.

Option 2 – Maintain the current TAC and allowances for CRA 8

152. Compared with Option 1, retaining the current TAC and allowances for CRA 8 would likely:
- a) result in a stock size well in excess of the target stock size
 - b) result in increased fishing opportunities in the non-commercial fisheries
 - c) constrain utilisation in the commercial fishery and result in an opportunity cost of \$2.3 million.
153. The NRLMG believes choosing not to implement the results of an agreed management procedure without an explicit reason would also reduce stakeholder confidence in the application of management procedures. Such a decision may also affect development and implementation of management procedures for other fisheries in New Zealand.

NRLMG Initial Position on CRA 8

154. Based on the available information and the evaluation set out above, the NRLMG's initial position is in favour of Option 1: increase the TAC for CRA 8 as specified by the CRA 8 Management Procedure and allocate the increased catch to the TACC. The NRLMG has identified no reason why the Minister should not use the results of the previously agreed procedure to guide statutory TAC setting decisions.

STOCK ASSESSMENT DRIVEN TAC REVIEWS

155. Periodic stock assessments are undertaken for rock lobster stocks without current management procedures. In 2008, the stock assessment for CRA 3 was updated.
156. For a detailed description of the CRA 3 stock assessment, refer to the MFish Rock Lobster Plenary Report (attached to the NRLMG 2008 Annual Report as Annex 2)

CRA 3 (GISBORNE ROCK LOBSTER FISHERY)

MANAGEMENT OPTIONS FOR CRA 3

157. The management options for CRA 3 are summarised in Table 2 above.

Option 1 – Maintain the current TAC and allowances for CRA 3 (Status Quo)

158. Under Option 1, the current CRA 3 TAC and allowances would be retained for the 2009-10 fishing year (refer Table 4). A CRA 3 Management Procedure would be developed in 2009. The procedure would be designed to restore the fishery to an agreed specified target and would be used to guide statutory TAC setting for CRA 3 from the 1 April 2010.

Option 2 – Reduce the CRA 3 TAC by 8% and adjust only the TACC

159. Under Option 2, the TAC for CRA 3 would be reduced from 319 tonnes to 293 tonnes from 1 April 2009. To achieve this new TAC, the TACC would be reduced from 190 to 164 tonnes. The allowances for customary Maori, recreational, and other fishing mortality would remain unchanged. As with Option 1, a CRA 3 Management Procedure would be developed in 2009 and used to guide statutory TAC setting for CRA 3 from the 1 April 2010.

Option 3A – Reduce the CRA 3 TAC by 19% and adjust only the TACC

160. Under Option 3A, the TAC for CRA 3 would be reduced from 319 tonnes to 257 tonnes from 1 April 2009. To achieve this new TAC, the TACC would be reduced from 190 tonnes to 128 tonnes. The allowances for customary Maori, recreational, and other fishing mortality would remain unchanged. As with Option 1, a CRA 3 Management Procedure would be developed in 2009 and used to guide statutory TAC setting from the 1 April 2010.

Option 3B – Reduce the CRA 3 TAC by 19% and adjust the TACC and the recreational allowance

161. Under Option 3B, the CRA 3 TAC would be reduced from 319 tonnes to 257 tonnes from 1 April 2009 (as proposed under Option 3A). To achieve this new TAC, the TACC would be reduced from 190 tonnes to 134 tonnes and the recreational allowance would be reduced from 20 tonnes to 14 tonnes. The allowances for customary Maori and other fishing mortality would remain unchanged. As with Option 1, a CRA 3 Management Procedure would be developed in 2009 and used to guide statutory TAC setting for CRA 3 from the 1 April 2010.

RATIONALE FOR MANAGEMENT OPTIONS FOR CRA 3

CRA 3 Sustainability Indicators

162. A Bmsy reference point has been calculated for CRA 3. The Bmsy calculation is sensitive to the period chosen to represent mean recruitment, which varies substantially over the period for which estimates are available; this causes uncertainty in Bmsy. The NRLMG and MFish Plenary therefore consider this Bmsy estimate unreliable as a target stock size for the fishery.
163. The current Bref for CRA 3 is the stock size associated with a standardised autumn-winter CPUE of 0.75 kg/potlift. This target level was selected for the fishery as it represented a desirable and economically sustainable catch rate for the commercial fishery. It was also noted to be beneficial to other fishery stakeholders as it represented a larger stock size than the Bref used previously.
164. Bmin is set at the lowest stock size estimated by the stock assessment model.

CRA 3 STOCK STATUS

165. The 2008 CRA 3 stock assessment incorporated best available relevant information including new growth rate information, and updated commercial CPUE and length-frequency information. An important feature of the new stock assessment is that it incorporates a “regime shift” in growth. Analysis of the new growth rate information showed that a change in growth rates has occurred between two CRA 3 research data sets: one dataset encompasses 1975-81 and the other 1996-2006. Growth rates are slower in the latter dataset.
166. The stock assessment results indicate that current stock size is just above Bmin and well below Bref. Under current catches and recent recruitments the assessment model predicts a 75% probability that stock size will decline over the next four years.

Rationale for Option 1 – Maintain the current TAC and allowances for CRA 3 (status quo)

167. Option 1 is considered a viable option because a plan is already in place to rebuild CRA 3.
168. The CRA 3 Multi-stakeholder Fishing Forum (the CRA 3 Forum), a group comprising customary Maori, amateur and commercial fishing stakeholders in CRA 3, has been working to develop a CRA 3 Fisheries Plan. Although not yet finalised and approved by the Minister, the Draft CRA 3 Fisheries Plan notes that its priority goals are to rebuild the CRA 3 stock to target stock size and to manage the stock so that large fluctuations in catch are reduced. To achieve these goals, the CRA 3 Forum plans to work with stock assessment scientists to identify an appropriate management procedure to guide TAC setting from 1 April 2010. The NRLMG has prioritised research resources in 2009 to support development of the management procedure.

169. Management procedures have been successfully used to guide TAC setting in CRA 7 and CRA 8 since 1996. Management procedures were used first to rebuild the fisheries from low stock sizes and then to maintain the stocks at target levels with high probability. A CRA 3 Management Procedure would provide a mechanism to rebuild the CRA 3 fishery. The procedure would:

- a) have a high level of support because it would be chosen by CRA 3 tangata whenua and fishery stakeholders from a large selection of procedures that were evaluated for performance against sustainability criteria
- b) be tested using a model of the CRA 3 fishery system based on the 2008 CRA 3 stock assessment model
- c) be tested for robustness to uncertainties in information to ensure the procedure was robust to these uncertainties.

Rationale for Option 2 – Reduce the CRA 3 TAC by 8% and adjust only the TACC

170. Available information suggests the CRA 3 stock is below target stock size and is likely to decline further under current catch levels. Furthermore, current stock size is estimated to be just over Bmin. Option 2 is considered a desirable option because it immediately reduces the TAC to a level that is considered likely to prevent stock decline.

171. The 2008 stock assessment results indicate reducing the TAC by 8% to 293 tonnes provides a 50% expectation that stock size in 2012 would be greater than current stock size. Achieving the decrease by cutting only the TACC provides the greatest probability that the desired reduction in catch will be achieved. The size of the cut to the TACC is moderate and designed to lessen the short term impact on commercial utilisation values whilst ensuring good conditions for implementation of a management procedure from 1 April 2010.

172. The management procedure development process planned for 2009 would still be used to capture cross-sector agreement around rebuild specifications, and would be implemented from 1 April 2010.

Rationale for Option 3A – Reduce the CRA 3 TAC by 19% and adjust only the TACC

173. The larger cut proposed in Option 3A provides a higher probability (88%) that stock size will increase by 2012 at a constant TAC of 257 tonnes. It also provides greater certainty that stock size will remain above Bmin (92%). Achieving the decrease by cutting only the TACC provides certainty that the desired reduction in catch will be achieved. The cut has a larger short-term impact on commercial utilisation values.

Rationale for Option 3B – Reduce the CRA 3 TAC by 19% and adjust the TACC and the recreational allowance

174. Option 3B proposes the same cut as Option 3A but “shares the pain” of the cut by pro-rating the cut across the TACC and recreational allowance.

Assessment of Management Options for CRA 3

175. Assessment of the management options against statutory criteria is set out in *Attachment 3* to this consultation paper. Key considerations and impacts are discussed below.

Assessment of Option 1 – Maintain the current TAC and allowances for CRA 3 (status quo)

Sustainability and Environment

176. Of the options put forward, Option 1 poses the greatest risk to the health of the CRA 3 fish stock. Stock assessment results suggest stock size is just above Bmin and is likely to decline at current catch levels. Bmin represents the lowest stock size from which the CRA 3 fishery has previously recovered.
177. The risks associated with Option 1 are mitigated by the expectation that the current TAC will be retained for one year only. A TAC adjustment is expected in 2010 when the CRA 3 Management Procedure becomes available to guide TAC setting.
178. Note: All the options presented would not result in negative fishing impacts on the marine environment. Fishing methods used to harvest rock lobster (potting and hand gathering) are low impact; they result in minimal bycatch and have a low impact on the benthic environment when compared to other fishing methods. In addition, fishing effort under all options is expected to be lower than the long-term average for the CRA 3 fishery.

Utilisation Value

179. Of the options put forward, the NRLMG believes Option 1 also poses the greatest overall risk to utilisation values associated with the CRA 3 fishery.
180. In real terms, impacts on utilisation value are difficult to assess because of the intended application of a management procedure from 2010. Compared to other options, commercial stakeholders in particular, but also amateur fishers (*cf.* option 3B), are likely to benefit in the very short-term by retaining their existing catching rights in 2009 and by having time to prepare for any reductions in catch limits that may occur in 2010. However, because stock size is expected to decline at current catch levels, in the short-medium term

fishers may be affected by a reduced stock size, or by subsequent and more severe catch limit cuts, or by a longer timeframe to achieve the desired stock rebuild.

Credibility and Acceptance

181. The NRLMG considers retaining the current TAC for even one year is the least credible option because of the proximity of current stock size to Bmin.
182. All the options presented in this paper are consistent with the management procedure approach set out in the Draft CRA 3 Fisheries Plan and being progressed by the CRA 3 Forum. Option 1, however, poses the greatest risk to the stock, given the timeframe to implement the approach.

Assessment of Option 2 – Reduce the CRA 3 TAC by 8% and adjust only the TACC

Sustainability and Environment

183. Option 2 poses less risk to the health of the CRA 3 fish stock than Option 1. Stock assessment projections indicate a median expectation that stock size would be the same after the four-year projections horizon under a TAC of 293 tonnes.
184. The probability of falling below Bmin over the four year projection horizon of the stock assessment is higher than desirable (at approximately 40%) but is mitigated by the intended application of a management procedure from 2010.

Utilisation Value

185. Option 2 also poses less overall risk to utilisation values associated with the CRA 3 fishery than Option 1. Compared with Options 3A and 3B, Option 2 is the “medium impact” option on stakeholder utilisation values.
186. The short-term impact on commercial stakeholders would be a 26 tonne decrease in TACC. Using 2007 export information, the value of the 26 tonne decrease in commercial catch of lobsters is estimated to be \$1.1 million. The short-term impact on customary Maori and amateur fishing stakeholders is considered to be neutral.
187. Longer-term, the impact of the reduction is likely to be beneficial for all fishers. The proposed cut, along with application of a management procedure from 2010, is likely to:
- a) reduce the severity of catch limit cuts when a management procedure to rebuild the stock is implemented, or the timeframe associated with the rebuild, when compared with Option 1

- b) improve fishing opportunities for all sectors by growing the stock size
- c) improve the certainty of outcomes by being more responsive to changes in stock size.

Credibility and Acceptance

- 188. Reducing the TAC in 2009 is considered a more credible option than Option 1 given current information on the status of the stock. The NRLMG notes that, in general, tangata whenua and fishery stakeholders are supportive of TAC adjustments based on good science.
- 189. Amateur fishing representatives to the NRLMG note that amateur fishers in CRA 3 have expressed dissatisfaction with current amateur catch rates in the fishery and, with new information available to guide TAC setting, would prefer to see a TAC cut in 2009 to begin a rebuild of the stock.
- 190. Commercial stakeholders in CRA 3 have noted their belief that the 2008 stock assessment is somewhat pessimistic, citing the increasing trend in standardised CPUE as evidence that stock size is growing at current catch levels. CRA 3 commercial stakeholders have indicated support for Option 2 – a moderate cut to the TAC in 2009 plus application of an agreed management procedure from 2010. They have noted a willingness to bear the full cost of the TAC cut but emphasise the need to ensure catches by other sectors remain within the allowances provided to ensure the cut does not become a re-allocation of available catch.
- 191. The NRLMG acknowledges that there is significant uncertainty in information on the CRA 3 fishery and, in particular, that the stock assessment projections are sensitive to the period chosen from which to estimate future recruitment. However, the stock assessment is considered robust by the Rock Lobster Fisheries Assessment Working Group (RLFAWG) and MFish Plenary, and represents the best information currently available on the status of the CRA 3 fishery.

Assessment of Option 3A – Reduce the CRA 3 TAC by 19% and adjust only the TACC

Sustainability and Environment

- 192. Option 3A poses the least risk to the health of the CRA 3 fish stock of all the options. The probability that stock size will increase over a four year timeframe with a constant TAC of 257 tonnes is approximately 88%.
- 193. The probability of falling below Bmin is 82% and is consistent with desired performance against sustainability indicators.

Utilisation Value

194. Option 3A has the largest short-term impact on commercial utilisation values.
195. The short-term impact on commercial stakeholders would be a 62 tonne decrease in TACC. Using 2007 export information, the value of the 62 tonne decrease in commercial catch is estimated to be \$2.5 million. The short-term impact on customary Maori and amateur fishing stakeholders is considered to be neutral.
196. As with Option 2, the longer-term impact of the reduction, combined with application of a management procedure, is likely to be beneficial, resulting in:
- a) reduced severity of catch limit cuts when a management procedure is implemented, or the timeframe associated with the rebuild, when compared with Options 1 and 2
 - b) improved fishing opportunities for all sectors by growing the stock size
 - c) improved certainty of outcomes by being more responsive to changes in stock size.

Credibility and Acceptance

197. Reducing the TAC in 2009 is considered a more credible option than Option 1 given current information on status of the stock.
198. As noted, amateur fishing representatives to the NRLMG prefer to see the TAC cut in 2009 to begin a rebuild of the stock. Amateur fishers have noted a preferred rebuild timeframe of five years. The NRLMG notes that Option 3A is the option most likely to achieve this outcome but also notes that cross-sector discussions to agree management objectives (including way and rate of rebuild) are scheduled for 2009, as part of the management procedure development process.
199. CRA 3 commercial stakeholders do not support Option 3A. As already noted, CRA 3 commercial stakeholders consider the 2008 stock assessment somewhat pessimistic and inconsistent with their recent experiences in the fishery. They believe that if this magnitude of cut is considered, the “pain” of the cut should be shared among amateur and commercial stakeholders.

Assessment of Option 3B – Reduce the CRA 3 TAC by 19% and adjust the TACC and the recreational allowance

Sustainability and Environment

200. Option 3B proposes the same reduced TAC as Option 3A but provides less certainty of achieving the desired reduction in catches because of the lack of amateur catch information. Although the amateur allowance would be cut, actual amateur catch is unlikely to be reduced under Option 3A unless dual action is taken to constrain catches (e.g., a bag limit reduction). The NRLMG is not proposing a bag limit cut at this time.

Utilisation Value

201. The immediate impact of Option 3B on commercial stakeholders is slightly less than Option 3A. The reduction in TACC is 56 tonnes, which has an associated export value of approximately \$2.2 million. Despite the reduction in amateur allowance, amateur fishing values are unlikely to be negatively impacted unless dual action is taken to constrain catches.
202. The immediate impact on customary Maori and amateur fishing stakeholders is considered to be neutral. As with Option 2, the longer-term impact of the reduction, combined with application of a management procedure, is likely to be beneficial, resulting in:
- a) reduced severity of subsequent catch limit cuts, or a reduced timeframe to rebuild, when a management procedure is implemented, when compared with Options 1 and 2;
 - b) improved fishing opportunities for all sectors by growing the stock size;
 - c) improved certainty of outcomes by being more responsive to changes in stock size.

Credibility and Acceptance

203. Reducing the TAC in 2009 is considered a more credible option than Option 1 given current information on status of the stock.
204. As noted, amateur fishing representatives to the NRLMG prefer to see the TAC cut in 2009 to begin a rebuild of the stock. They do not consider Option 3B credible as no tangible reduction in amateur catch would be achieved without action to restrain catches. Amateur fishers in CRA 3 do not support a bag limit cut. They consider a bag limit unwarranted because amateur catch levels have already been reduced by the decline in stock size.

205. CRA 3 amateur fishers believe they have been more severely affected by the reduction in stock size than other sectors because they do not have access to smaller lobsters (i.e., customary Maori catch is not size limited and commercial fishers have access to a smaller-size lobsters in winter). The NRLMG notes that both stock assessments and the setting of TACs and allowances take into account the differing size limits on catches. The NRLMG also notes that all fishing sectors in CRA 3 have been affected by declining stock size and there is no information available to assess whether one sector has been more affected than another.

NRLMG INITIAL POSITION ON CRA 3

206. The NRLMG's initial position is in favour of Option 2: decrease the TAC for CRA 3 by 8% to 293 tonnes and achieve the decrease by decreasing the TACC from 190 tonnes to 164 tonnes, whilst keeping the allowances for customary Maori, recreational and other sources of fishing mortality constant. Option 2 includes development of a management procedure to guide TAC setting in CRA 3 from 1 April 2010.
207. Based on the available information and the assessment set out above, the NRLMG believes Option 2 provides the best balance between managing risk to the sustainability of the CRA 3 fishery, uncertainty in available information, and impacts of reduced catch limits on CRA 3 fishers. Option 2 also provides for the development and use of a management procedure to guide TAC setting from 2010. The NRLMG believes the management procedure development process is the appropriate forum for CRA 3 tangata whenua and fisheries stakeholders to agree specific rebuild management objectives, including objectives relating to the way and rate of rebuild.

FINAL REMARKS

208. The NRLMG's initial positions are noted for each fishery. These initial positions are based on the available information and the evaluation set out above.
209. The NRLMG emphasises that this position is preliminary and is provided as a basis for consultation with tangata whenua and stakeholders. The NRLMG invites submitters to provide their comments, with supporting information, for inclusion in this advice. The NRLMG is particularly interested in:
- a) any information that might be relevant to the Minister's decision on whether to operate the management procedures for CRA 4, CRA 7 or CRA 8 for the 2009-10 fishing year
 - b) any information on customary Maori and amateur catches that might provide a basis for alternative catch allocations
 - c) any other information that might address current uncertainties in information.

210. All submissions received on the proposals will be considered and discussed in final advice to the Minister. A copy of the final advice will be made available to iwi and stakeholders who make a submission on the proposal following announcement of the Minister's decision.

STATUTORY CONSIDERATIONS

211. In considering the proposals set out in this paper, the following statutory considerations have been taken into account.

International Obligations and Treaty of Waitangi Settlement Act 1992 (s 5)

212. **Section 5** of the Act requires the Minister to act in a manner consistent with New Zealand's international obligations and Treaty of Waitangi (Fisheries Claims) Settlement Act 1992. To this end, the provisions of general international instruments such as UNCLOS and the Fish Stocks Agreement have been implemented through the provisions of the Act. The NRLMG is not aware of any specific international obligations that would be affected by the proposed TACs and allowances.
213. The NRLMG considers the proposed options are consistent with the obligations relating to the Treaty of Waitangi (Fisheries Claims) Settlement Act 1992. The NRLMG recognises that rock lobster (koura) is an important taonga species. All proposals seek to maintain good fishing opportunities, or improve stock health and therefore improve fishing opportunities, for all sectors including commercial and customary Maori. For CRA 3 and CRA 4 *status quo* options represent a risk to short-term and long-term customary Maori value. These risks are set out in the main body of the paper.
214. The NRLMG notes that national-level representatives of customary fishing interests are members of the NRLMG and have contributed to the development of the proposals. Some regional-level CRA 3 and CRA 4 customary Maori interests have helped to identify the TAC-setting options presented. The management procedures for CRA 7 and CRA 8 were consulted on in 2007; the NRLMG looks forward to receiving the views of tangata whenua on the operation of these procedures to guide TAC setting for the 2009-10 fishing year.

Purpose of the Act (s 8)

215. **Section 8** of the Act describes the purpose of the Act as being to provide for the utilisation of fisheries resources while ensuring sustainability, and defines the meanings of utilisation and sustainability. The management options presented seek to achieve the purpose of the Act. The options presented seek to achieve sustainable TACs and take into account the respective costs of management versus utilisation benefits.

Environmental considerations (s 9)

216. **Section 9** of the Act prescribes three environmental principles that the Minister must take into account when exercising powers in relation to utilising fisheries resources and ensuring sustainability.
- a) **Section 9(a)** requires that associated or dependent species (i.e., those that are not harvested) should be maintained above a level that ensures their long-term viability. Potting and hand gathering fisheries have a relatively low level of by-catch and the NRLMG is not aware of any interactions between the fisheries and non-harvested species of concern.
 - b) **Section 9(b)** requires the maintenance of biological diversity of the aquatic environment be taken into account. Potting is the only commercial fishing method used to harvest rock lobsters in CRA 7 and CRA 8. Some information is available on the impact of this method on the aquatic environment, and Australian research suggests there is little impact on seaweed and other benthic communities, including fragile coral reef ecology, from rock lobster potting. Consequently, the NRLMG considers it unlikely the proposed changes to the TACs and TACCs will have a demonstrable adverse effect on biological diversity in CRA 3, CRA 4, CRA 7 or CRA 8.
 - c) **Section 9(c)** requires the protection of habitats of particular significance to fisheries management. The proposed changes to TACs and TACCs are unlikely to affect habitats of particular significant to fisheries management; identified habitats of significance have already been provided protection through mechanisms such as the Fiordland Marine Management Act 2005, which prohibits all commercial fishing within the internal waters of Fiordland and introduces protection in an area that is recognised as being internationally important.

Information Principles (S 10)

217. **Section 10** of the Act sets out the information principles, which require that decisions be based on the best available information, taking into account any uncertainty in that information, and applying caution when information is uncertain, unreliable, or inadequate. In accordance with s 10, the absence of information should not be used as a reason to postpone, or fail to take, any measure to achieve the purpose of the Act, including providing for utilisation at levels considered to be sustainable. A thorough review of available information has been undertaken by the NRLMG and the best available information has been used to evaluate the management options presented. The NRLMG has endeavoured to set out the relevant uncertainty in, and inadequacy of, that information so that the appropriate caution can be applied in assessing the proposed management options.

Sustainability Measures (s 11)

218. When setting or varying a sustainability measure, **Section 11(1)** of the Act requires the taking into account of: (i) any effects of fishing on any stock and the aquatic environment; (ii) the existing management controls that apply to the stock or area concerned; and (iii) the natural variability of the stock.
219. The adverse effects of fishing on the aquatic environment are discussed under the Environmental Considerations section.
220. Apart from the existing TAC, TACC and allowances, a range of management controls apply to rock lobster fisheries including minimum legal sizes, daily bag limits for amateur fishers, method restrictions, protection of egg-bearing females, closed areas and closed seasons (CRA 3 and CRA 7 only).
221. The proposed changes to TACs and TACCs are unlikely to affect these measures. Industry reports, however, that the closed season in CRA 7 may limit the ability of commercial operators to harvest the proposed increased TACC. A proposal to extend the CRA 7 commercial season is currently in the MFish internal prioritisation process.
222. Recruitment to rock lobster stocks is highly variable. This variability was taken into account by the RLFAWG and the NRLMG when developing stock assessment model for CRA 3 and the management procedures for CRA 4, CRA 7 and CRA 8.
223. **Sections 11(2)** requires regard to: (i) any regional policy statement, regional plan or proposed regional plan under the Resource Management Act 1991; (ii) any management strategy or management plan under the Conservation Act 1987 that apply to the area and are considered relevant; and (iii) sections 7 and 8 of the Hauraki Gulf Marine Park Act 2000.
224. There are seven regional councils with jurisdictional boundaries covering CRA 3, CRA 4, CRA 7 and CRA 8 (Gisborne, Hawke Bay, Horizons, Greater Wellington, Otago, Southland, and West Coast). The NRLMG is not aware of anything in the proposed coastal plans for these councils that would be affected by this proposal.
225. There are six Department of Conservation Conservancies with jurisdictional boundaries covering CRA 7 and CRA 8 (East Coast, Hawke Bay, Wellington, Wanganui, Otago, Southland, and West Coast). The NRLMG is not aware of anything in the proposed strategies for these conservancies that would be affected by this proposal.
226. CRA 3, CRA 4, CRA 7 and CRA 8 fisheries do not intersect with the Hauraki Gulf Marine Park; therefore there are no relevant considerations under the Hauraki Marine Park Act 2000.

227. **Section 11(2A)** requires the Minister to have regard to: (i) any conservation services or fisheries services and any decision not to require conservation services or fisheries services; and (ii) any relevant fisheries plan approved under s 11 of the Act.
228. The NRLMG does not consider that existing or proposed services materially affect this proposal. No decision has been made not to require a service in these fisheries. The NRLMG is not aware of any relevant fisheries plans approved under s 11 of the Act. The NRLMG is aware that Ngati Kahungunu is in the process of developing a fisheries plan relating to Ngati Kahungunu fisheries, which intersect with CRA 4.
229. The NRLMG notes the Fiordland Marine Management Act 2005 requires the Minister must have regard to any advice or recommendations provided by the Fiordland Marine Guardians on any matters covered by the Act. The NRLMG notes the Fiordland Marine Guardians will be consulted on this proposal.

TAC Setting Considerations (s 13)

230. Rock lobster stocks are managed under **Section 13** of the Act. Under s 13(2), the Minister must set a total allowable catch that:
- a) maintains the stock at or above a level that can produce the maximum sustainable yield, having regard to the interdependence of stocks; or
 - b) enables the level of any stock whose current level is below that which can produce the maximum sustainable yield to be altered—
 - i. in a way and at a rate that will result in the stock being restored to or above a level that can produce the maximum sustainable yield, having regard to the interdependence of stocks; and
 - ii. within a period appropriate to the stock, having regard to the biological characteristics of the stock and any environmental conditions affecting the stock; or
 - c) enables the level of any stock whose current level is above that which can produce the maximum sustainable yield to be altered in a way and at a rate that will result in the stock moving towards or above a level that can produce the maximum sustainable yield, having regard to the interdependence of stocks. In the case of *Anton's Trawling Company v The Minister of Fisheries* (High Court, Wellington, CIV 2007-485-2199, 28 February 2008) Miller J said that before a TAC could be set under the above provisions the Minister must be provided with an estimate of both current biomass and the biomass that can produce the maximum sustainable yield.

Neither of these figures are available for Rock Lobster so s 13 (2A), which was passed as a consequence of Miller J's decision, becomes applicable.

231. **Section 13(2A)** says that:

(2A) For the purposes of setting a total allowable catch under this section, if the Minister considers that the current level of the stock or the level of the stock that can produce the maximum sustainable yield is not able to be estimated reliably using the best available information, the Minister must—

- a) not use the absence of, or any uncertainty in, that information as a reason for postponing or failing to set a total allowable catch for the stock; and
- b) have regard to the interdependence of stocks, the biological characteristics of the stock, and any environmental conditions affecting the stock; and
- c) set a total allowable catch—
 - (i) using the best available information; and
 - (ii) that is not inconsistent with the objective of maintaining the stock at or above, or moving the stock towards or above, Bmsy.

232. It is the NRLMG's view that the TAC variations guided by operation of the CRA 4, CRA 7 and CRA 8 management procedures meet the requirement of being "not inconsistent with" the objective of maintaining the stock at or above, or moving the stock towards or above, Bmsy.

233. For CRA 3, the 2008 Stock Assessment provides an estimate of current biomass. The estimate of Bmsy is considered unreliable therefore a reference period biomass that has been accepted as a suitable proxy target for Bmsy by the RLFAWG and MFish Plenary is used. The NRLMG considers the range of options presented to address low abundance and an unsustainable TAC in CRA 3 to meet the requirement of being "not inconsistent with" the objective of maintaining the stock at or above, or moving the stock towards or above, Bmsy.

234. In considering the way in which and rate at which a stock is moved towards or above a level that can produce maximum sustainable yield under subsection (2) (b) or (c), or (2A) (if applicable), the Minister shall have regard to such social, cultural, and economic factors as he or she considers relevant. Available information suggests CRA 3 and CRA 4 are below target stock size and need rebuilding. Regard is given to social, cultural and economic factors in assessing the TAC options put forward to rebuild these fisheries.

TACC Setting Considerations (s 20 and 21)

235. **Sections 20 and 21** specify a number of matters that must be taken into account when setting or varying a TACC. Section 21 requires you to allow for non-commercial Maori and amateur fishing interests, and other fishing mortality when setting or varying the TACC. The NRLMG notes that information on non-commercial harvest is scarce and uncertain. For CRA 3 and CRA 4, the proposals to reduce only the TACCs result in a greater proportion of the TAC being allocated to customary Maori and amateur fishing interests. An option of pro-rating a proposed CRA 3 TAC reduction across the TACC and the recreational allowance is presented and discussed in the body of the paper.
236. When considering allocation of the proposed TAC increases for CRA 7 and CRA 8, best available information on the harvest needs of customary Maori and amateur fishers is considered, along with risks association with uncertain information.
237. Allowances for other fishing mortality are left unchanged. The allowances are based on best available, but highly unreliable, information about illegal unreported catch in each of the fisheries.
238. **Section 21(4)** also requires that any mātaimai reserve or closures/restrictions under s 186A to facilitate customary Maori fishing be taken into account. Mātaimai reserves and section 186A closures are located within CRA 3, 4, 7 and 8 – the Moremore (Hawke Bay), Puna wai-Toriki (Otago), Tuma Toka and Te Whaka Te Wera (Southland) mātaimai reserves and the Pukerua Bay 186A closure (Wellington). The NRLMG considers that the management options presented in this paper will contribute to sustainable utilisation of rock lobster stocks and will benefit abundance both inside and outside mātaimai reserves and s 186A closures. The risks posed to sustainability and utilisation values, including customary Maori utilisation are set out in the body of the paper.
239. **Section 21(5)** also requires that any regulations to prohibit fishing made under s 311 be taken into account when setting allowances for amateur fishing interests. The NRLMG is not aware of any restrictions under s 311 that have been placed on fishing in any area within CRA 3, 4, 7 or 8.

Administrative Issues

240. To implement this proposal would require the publishing of Gazette Notices under s 13 (TACs) and s 20 (TACCs) of the Act, together with some publicity to ensure fishers are aware of the changes.

SPECIFICATIONS OF THE CRA 7 AND CRA 8 MANAGEMENT PROCEDURES

241. Both the CRA 7 and CRA 8 management procedures specify that:

- a) the output variable is TAC (tonnes) and that standardised CPUE (kg/pot) is to be used as the input variable,
- b) standardised CPUE is to be based on the autumn–winter (AW: April–September) season of the current fishing year and the spring–summer (SS: October–March) season of the previous fishing year, and
- c) CPUE is to be standardised according to the recent usage described in annual Fishery Assessment Reports (FARs), using a data extract obtained in November to ensure that sufficient data from the most recent AW season have been entered.

CRA 7 Management Procedure Specifications

242. For CRA 7, the management procedure is specified as follows:

- a) The TAC is to be set at 100 times the standardised CPUE;
- b) The management procedure is to be evaluated every year (no “latent year”);
- c) If the procedure results in a TAC that changes by less than 5%, no change will be made; and
- d) If the procedure results in a TAC that changes by more than 50%, the TAC will be changed by 50% only.

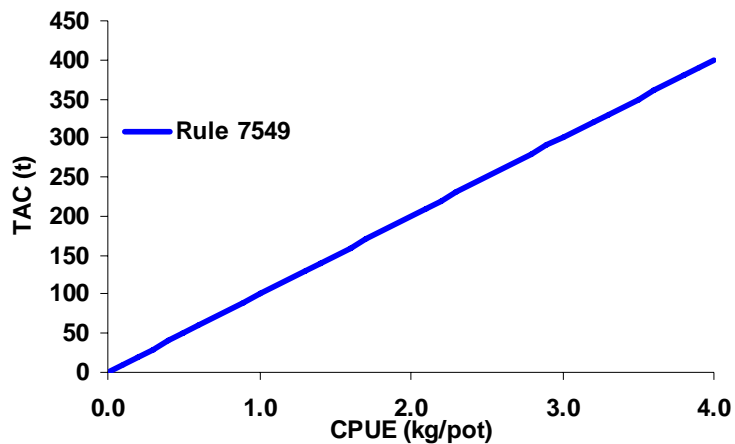


Figure 5: *CRA 7 Management Procedure.*

CRA 8 Management Procedure Specifications

243. For CRA 8, the management procedure is specified as follows:

The relation between CPUE, indicated by C_y , and TAC, indicated by T_{y+1} , is given in Figure 6 below:

$$T_{y+1} = \begin{cases} h - s_1(p_1 - C_y) \frac{h}{p_1}, & C_y < p_1, \\ h, & p_1 \leq C_y \leq p_2, \\ h + s_2(C_y - p_2) \frac{h}{p_1}, & C_y > p_2. \end{cases}$$

Figure 6

- a) The parameters referred to in the equations above for this management procedure are:

h	p_1	p_2	s_1	s_2
1053	1.9	3.2	1.2	0.16

Figure 7

- b) The management procedure is to be evaluated every year (no “latent year”);
- c) If the procedure results in a TAC which changes by less than 5%, no change will be made;
- d) There is no limit to the amount by which a TAC may change.

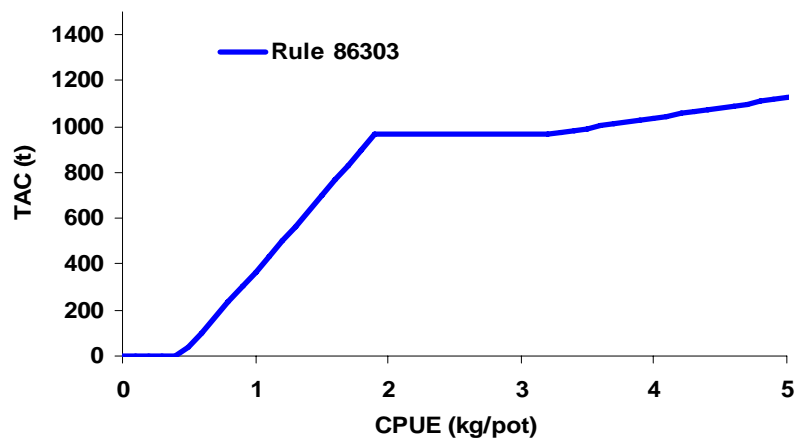


Figure 8: CRA 8 Management Procedure.

244. Management procedures should not remain in place for longer than about five years without a review, because in five years the operating model used to evaluate management procedures will be obsolete, and fishery performance should be re-evaluated. Such a review was written into the 2002 NSS Management Procedure (Bentley et al. 2003). The NRLMG recommends that a review of these management procedures take place in 2012.

In Summary

245. The NRLMG notes:
- a) a separate Public Consultation Document has also been produced to facilitate public consultation on these proposals;
 - b) after consultation is completed, the NRLMG will provide you with final advice on management interventions for 2009-10 fishing year in February 2009;
246. The NRLMG recommends that you:
- a) **direct** MFish to coordinate release of the NRLMG's initial advice on management interventions for public consultation.

NRLMG STRATEGIC VISION

AND

FRAMEWORK FOR ROCK LOBSTER FISHERIES

5. ROLE AND FUNCTION OF THE NRLMG

247. The NRLMG is the primary source of advice to the Minister of Fisheries on rock lobster fisheries issues. The NRLMG comprises representatives of the customary Maori, amateur, commercial, environment and conservation interests, and delegated MFish personnel, NIWA, SeaFIC, and other consultant science advisors also assist the NRLMG.
248. In 1992, the then Minister of Fisheries, Hon D L Kidd, endorsed the establishment of a national group, the NRLMG, to revise and develop the Rock Lobster Management Plan devised by the Rock Lobster Steering Committee (RLSC) (1991) and asked sector groups to nominate representatives. The RLSC was established by the same Minister to develop a long-term management plan for the lobster fisheries that at that time were considered to be seriously depleted by overfishing.
249. The NRLMG has since presented fifteen annual reports, containing recommendations for the sustainable management of these most important New Zealand inshore fisheries. The NRLMG seeks technical advice from experts, and develops refinements and improvements to the management regimes currently in place for rock lobster fisheries.
250. The NRLMG strives to provide quality advice to the Minister to assist in the statutory decisions on TACs, TACCs, and other management controls.

Role of the NRLMG

251. The NRLMG operates in accordance with standards and specifications drawn from an extensive review in 2001 of the role and objectives of the NRLMG in consultation with the Minister of Fisheries. The NRLMG and the Minister agreed:
- a) to maintain the NRLMG as the primary source of advice to the Minister of Fisheries;
 - b) to encourage and coordinate the development and implementation of Fishery Plans for rock lobster fisheries;
 - c) to act as a default regional planner for rock lobster research and management in circumstances where no Fishery Plan proposal was contemplated, or where a lack of organisation and coordination precludes any regional oversight by sector groups;
 - d) to retain a national coordinating body with well established and identifiable links to and from regional sector groups;

- e) to coordinate and provide sector group input to research and information planning processes;
- f) to coordinate and provide input to, and maintain an oversight of, the relevant Working Group processes and timetables;
- g) to provide well informed, credible, and consistent research and management information and advice to sector groups, Government agencies, and Ministers.

Roles and responsibilities of members and advisers

252. Noting a preference for membership and participant numbers being kept at current levels with some flexibility accorded to need and circumstance, the NRLMG and the Minister also agreed the roles and responsibilities of the participating members and advisers as follows.

253. Sector Representatives – TOKM, NZRFC, NZ RLIC, ECO4

- a) To provide consistent expertise, experience, knowledge, networking – to and from sector constituency. “It is important that each member represents the views of their constituent groups and relays discussions from the Group back to their constituents”... (Hon. Pete Hodgson, March 2001)

254. MFish – Fisheries Management, Compliance Advice, Science

- a) To facilitate and coordinate information and advice to and from the NRLMG;
- b) To ensure consistent information and advice to MFish personnel and to tangata whenua;
- c) To enable science (including stock assessment and biological), economic, social policy, and other advice deemed necessary by the NRLMG.

255. Advisory members – Stock Assessment, Biology and Behaviour, Economic, Social

- a) To maintain oversight of NRLMG deliberations and offer advice and guidance, including cautions, to assist the development and implementation of research and information plans, Fishery Plans, or regional harvest initiatives.

⁴ Te Ohu Kaimoana; New Zealand Recreational Fishing Council; NZ Rock Lobster Industry Council; Environment and Conservation Organisations of New Zealand.

256. Chairman
- a) To facilitate NRLMG meetings and to oversee the development and delivery of the NRLMG Annual Report.
257. The NRLMG has not only played a role in developing a significant level of consensus among user groups, which aids the decision making process, but also has encouraged the development of management initiatives throughout the country which have contributed to the improvement in rock lobster stocks over recent years.
258. Stock assessments since 1992 have tracked increasing abundance in most fisheries, and where stock rebuild has been less than optimum, management responses have been implemented which should ensure the sustainable utilisation of those fisheries within acceptable stock rebuild timeframes.
259. The NRLMG advises and informs regional stakeholder groups. This ensures that local issues are addressed within the context of the Fisheries Act and in a manner that is consistent with the overall harvest strategy for rock lobster fisheries.
260. The NRLMG continues to persevere with its efforts to formulate robust and enduring harvest strategies that will not require annual review, rather only fine-tuning when new information indicates that some adjustment is necessary. To that end, the NRLMG continues to develop and refine management procedures incorporating 'harvest control rules' which are designed to guide management actions.

2008 Work Programme

261. The NRLMG has given consideration to a number of rock lobster fisheries management issues during 2008. The most important of these are:
- a) research programme activities, including the CRA 3 stock assessment and the operation of Management Procedures for CRA 4, CRA 7 and CRA 8;
- b) a proposal to remove the commercial closed season in CRA 7 (Otago rock lobster fishery);
- c) a proposal to allow the use of "cray loops" for recreational harvesting of rock lobsters;
- d) the ongoing CRA 3 Multi-stakeholder Fishing Forum process;

262. Also in 2008 a primary function of the NRLMG was to conduct Rock Lobster Research Planning, and in that role to consider the full range of research activities for the period 2007 to 2009 considered relevant to the agreed plan and strategic vision for rock lobster fisheries. The NRLMG again provided the core sector group participation in the annual Rock Lobster Research Planning Group process which culminates in the Research Co-ordinating Committee recommendations to the Minister of Fisheries in relation to required research services.
263. In addition, some members of the NRLMG have attended and participated in the RLFAWG meetings held during 2008. The NRLMG contributed to the development of management procedures and agreed biological reference points for incorporation into fisheries management decisions.
264. Over the past year the NRLMG convened on nine occasions to deliberate on a range of research, planning and management issues with the aim of confirming advice and recommendations for regulatory amendments to meet statutory timetables and to ensure the presentation of this annual report and sustainability recommendations to the Minister of Fisheries by 16th December 2008.

Organisational Arrangements

265. Costs of participation in the NRLMG are borne by the representative organisations, and the NZ RLIC usually supplies venues and facilities. The NZ RLIC and MFish share secretarial and administrative duties.

Attendance During 2007

Representation	Meetings Attended	Apologies
Chairman / Acting Chairman	9	-
Ministry of Fisheries	9	-
NZ Recreational Fishing Council	9	-
Te Ohu Kaimoana	9	-
Environment and Conservation Organisations	0	0
NZ Rock Lobster Industry Council	9	-
Science Advisors	9	-

In Summary

266. The NRLMG notes:

- a) that whilst supporting and encouraging the development and implementation of Fishery Plans for rock lobster, the NRLMG will continue to operate the current management framework outlined in this document and will work within the roles and responsibilities confirmed in the most recent review;
- b) the NRLMG is supporting and encouraging the development and implementation of Fishery Plans for rock lobster;
- c) that previous Ministers have endorsed the NRLMG as the primary source of TAC, TACC and management advice for New Zealand rock lobster fisheries; and

- d) that previous Ministers have endorsed the NRLMG as an appropriate body to consult on any matters relevant to the management of rock lobster fisheries.

267. The NRLMG recommends that you:

- e) **confirm** your endorsement of the role and function of the NRLMG.

NRLMG membership in 2008

Dr Kevin Stokes	Chairman
Dr Kevin Sullivan	MFish
Leigh Mitchell	MFish
Santiago Bermeo-Alvear	MFish
Alan Riwaka	Te Ohu Kaimoana Trustees Ltd
Stan Pardoe	Te Ohu Kaimoana Trustees Ltd
Keith Ingram	NZ Recreational Fishing Council
Geoff Rowling	NZ Recreational Fishing Council
Bruce Carter	NZ Recreational Fishing Council
Malcolm Lawson	NZ Rock Lobster Industry Council
Daryl Sykes	NZ Rock Lobster Industry Council
<i>No nominee</i>	Environment & Conservation Organisations

Science Advisers to the Group

The NRLMG draws on a range of sources of science advice including but not restricted to the membership of the Rock Lobster Fishery Assessment Working Group convened by MFish.

Administrative Support Services

Helen Regan	
Fiona McKay	NZ Rock Lobster Industry Council

6. STRATEGIC VISION

268. The NRLMG has developed a Strategic Vision for the NZ Rock Lobster Fisheries. The vision is consistent with the Fisheries Act 1996, enhances an agreed management framework, and provides a basis for consideration of short, medium, and long term research and management issues, including that:

- a) rock lobster stocks will be managed effectively (including cost effectively) to maintain the status of the stocks at or above the agreed biological reference points, consistent with the Minister's legislative responsibility;
- b) fisheries will be managed using a property rights/ Quota Management System (QMS) regime with the principal management actions exerted via output controls (TACs) while a range of input controls will still apply where this proves appropriate to individual situations;
- c) the strategy will provide for management flexibility, whilst ensuring sustainability, to enable all sector groups to maximise their benefits within a shared fishery;
- d) management of the fisheries will take place within a clear policy environment, e.g., there will be clear, explicit, and agreed rules to describe property rights in the fisheries and the allocation between user group sectors. In addition, there will be explicit and agreed decision rules to prescribe management actions that result from monitoring and assessment of fisheries;
- e) reliable and cost effective means to monitor and assess fish stocks will be in place. The catches taken and effort deployed by all extractive user groups will be effectively quantified, documented, and managed in accordance with the exercise of rights;
- f) adverse environmental effects of fishing activities will be averted or minimised;
- g) aquaculture of rock lobsters will be a permissible activity, governed by policies which ensure sustainable use of the wild stock within a rights based framework;
- h) a shift of management responsibility to user groups will be promoted within the Fishery Plan framework provided for in the 1996 Fisheries Act; and
- i) collaborative/consultative national co-ordination of research and management recommendations and development of policy will continue within the NRLMG or similar organisation; and

- j) co-operative management initiatives, which may include the development of regional user groups and Fishery Plans, will be encouraged; and
- k) sustainable management and use of rock lobster fisheries will occur in an environment where the New Zealand public are well informed and educated on matters dealing with fisheries in general and rock lobster fisheries in particular.

7. FRAMEWORK FOR MANAGING ROCK LOBSTER FISHERIES

269. The framework for managing rock lobster and the attendant recommendations of the Group are consistent with expectations of a robust and enduring harvest strategy leading to a continuing sustainability of rock lobster stocks, and in the view of the Group are also consistent with the statutory obligations enshrined in the Fisheries Act 1996.

Goal

270. The rock lobster fisheries should be managed and be maintained at or above the assessed and agreed biological reference points, using a comprehensive approach that recognises a range of commercial, customary non-commercial, amateur, and environmental concerns and values.

Strategies to Achieve Goal

271. The strategies will allow the population size to:
- a) increase in each fishing year that it is below the target in agreed management procedures; or be maintained at or above that level.
272. The extent of change in population size that can be sought will be determined after consideration of:
- a) economic and social factors including:
 - i. the economic cost and benefits, social factors and rate of adjustment to the fishing industry,
 - ii. the availability of rock lobster to Maori and amateur fishing groups,
 - iii. the economic return from the fishery; and
 - b) biological and environmental factors including:
 - i. the uncertainty in the assessment of stock size and other biological parameters, and
 - ii. the risk to the population; and
 - c) the timeframe over which the management options will have effect.

273. The strategies will identify the effects of fishing on the aquatic environment and provide for the implementation of measures to:

- a) avoid, remedy, or mitigate any adverse effects of fishing on the aquatic environment;
- a) maintain associated or dependent species above a level that ensures their long-term viability;
- b) maintain the biological diversity of the aquatic environment; and
- c) protect habitat of particular significance for fisheries management.

Implementing the Strategies

274. The tactics or actions developed to implement the strategies will:

- a) be produced through a process that involves all sector groups, minimises conflicting views, and involves all participants in the group disclosing their positions on the issues considered in order to promote co-operation and encourage full and frank discussion;
- b) be based on advice from scientists on the steps necessary to achieve the goal within various time frames;
- c) consider available management options including but not limited to catch reductions, area closures, gear restrictions, enhancement, legal size changes, measures to maximise egg production, recruitment, and to minimise juvenile mortality;
- d) promote and enable effective, including cost effective, compliance with fishery rules;
- e) consider the costs and implications of management options including:
 - i.* the resources that are needed and currently available for research, compliance and administration;
 - ii.* the integrity of the research database;
 - iii.* whether the management alternatives can be effectively implemented;

- iv. how the impact of the management options are to be measured or estimated;
 - v. the impact of the management options on industry, customary non-commercial, and amateur fishers and the degree of their acceptance of the measures; and
 - vi. the impact on other fisheries and the aquatic environment.
 - d) be based on the best available information;
 - e) recognise any uncertainty in the available information and be precautionary when information is uncertain, unreliable, or inadequate; and
 - f) not use the absence of, or any uncertainty in, any information as a reason for postponing or failing to take any measure to achieve the purpose of the Fisheries Act 1996.
275. The NRLMG will provide a timely annual report containing recommendations for management, research and compliance of rock lobster fisheries to the Minister.

Harvest Strategy

276. The NRLMG pursues a dynamic harvest strategy for rock lobster fisheries. It is willing to consider and accept TAC changes in two situations:
- a) where stock modelling demonstrates that, after a TAC change, abundance is likely to move towards agreed biological reference points within an agreed period; and
 - b) where a TAC change is triggered by a fully tested and accepted management procedure (including a harvest control rule), such as the ones described elsewhere in this report, designed either to rebuild a stock unit or to maintain the stock unit near an agreed biological reference point.

Assessment and Indicators

277. In accordance with the goal for managing rock lobster fisheries, stock assessment research will continue to be an important component of the management framework. The Rock Lobster Fisheries Assessment Working Group (RLFAWG) continues to refine and improve stock assessment techniques and to identify areas of uncertainty and information needs.
278. For a number of years, MFish has commissioned a major rock lobster stock assessment project incorporating extensive stock monitoring, data grooming and stock modelling, and a

rock lobster recruitment project, based on monitoring puerulus settlement at selected sites around the New Zealand coast.

279. Since 1997 NZ RLIC has been contracted to provide stock monitoring and assessments in collaboration with NIWA, Trophic Research, StarrFish, Haist Consultancy and, for the first two periods, the SeaFIC Science Group. Within the overall research programme, the NZ RLIC has contracted NIWA, Lat37 Ltd, and Trophic Research and others to undertake catch sampling and data entry, and to construct and maintain databases for the tagging projects. NIWA holds the MFish contract for the rock lobster puerulus settlement project.
280. Intensive catch sampling (including logbooks) and tagging are undertaken to MFish agreed standards and specifications. Vessel logbook data are now routinely incorporated into the stock assessment process. Logbook programmes supervised by technicians are well established in CRA 2, CRA 5, and CRA 8.
281. NIWA, StarrFish, Haist Consultancy and Trophic scientists continue to refine and improve stock assessment methods with routine oversight from the RLFAWG chaired by MFish Science Group. The SeaFIC Science Group provides a useful peer review of the process.
282. An independent peer review of rock lobster stock assessment methodology commissioned by MFish in 2007 again concluded that key aspects of the current assessment model represent state-of-the-art methodology and are appropriate for assessments of the rock lobster stocks.



Rock Lobster tag and release with electronic data recording system

Management Procedures and Decision Rules

283. The NRLMG has established two simple decision rules for the NSN and NSC substocks. Each year, the rule for each substock compares the current estimate of standardised CPUE with the index from 1992-93. The two estimates are considered significantly different if their 1-

standard-error bars do not overlap. Under these rules, TAC changes are considered only when the two CPUE estimates differ significantly.

284. For the NSS substock (CRA 7 and CRA 8) the NRLMG recommended, and in 2002 the Minister accepted, a more complex and extensively tested management procedure. This procedure was designed to rebuild the CRA 8 fishstock to the target level.
285. New management procedures designed to maintain the stock near agreed target levels were tested under the stock assessment research contract (CRA2003-02) in 2007. These were designed around a decision rule matrix that enables stakeholders to consider biological, economic and other outcomes, and their associated risks, when choosing fishery goals. The rules are described as “maintenance rules” and were agreed by the Minister in 2008 and used to guide TAC/TACC decisions for both CRA 7 and CRA 8.
286. In 2005 CRA 4 commercial stakeholders collaborated with the stock assessment science team to develop and implement a Management Procedure benchmarked against reference levels used in the 2005 stock assessment. The procedure has been used in two successive seasons to guide industry decisions to voluntarily reduce the commercial catch limit in order to halt an observed decline in CRA 4 stock abundance and improve the economic performance of the industry.
287. The CRA 4 Management Procedure has since been accepted by the NRLMG as a suitable basis on which to recommend to the Minister that TAC/TACC decisions be made for CRA 4 in 2009.

Tactics

288. There are a number of mechanisms by which total removals from the fishery can be adjusted if circumstances dictate. These are:
- a) adjusting the TAC;
 - b) changes in minimum legal size (MLS) limits;
 - c) adjustments to escapement provisions;
 - d) closed seasons;
 - e) fishing method restrictions;
 - f) effort controls;

- g) closed areas;
- h) adjustments to commercial quotas and amateur bag limits;
- i) limitations on the numbers of participants in the fishery;
- j) improved handling to reduce sub-legal mortality;
- k) protection of soft-shelled lobsters and berried females;
- l) effective enforcement which provides a greater deterrent to illegal fishing;
- m) effective compliance services, such as education, which encourages voluntary compliance; and
- n) maximised voluntary compliance with fisheries laws by fishers.

8. SUMMARY OF RESEARCH ACTIVITIES

2008 Rock Lobster Research Programme

289. In 2008 the NZ RLIC, in collaboration with sub-contracted stock monitoring and stock assessment providers, commenced the third sequence of the three year CRA 2006-01 research contract. This contract incorporates extensive stock monitoring coverage, stock assessments, and the maintenance and development of management procedures incorporating harvest control rules.
290. Stock assessment scientists completed a CRA 3 Stock Assessment; operated the CRA 4 Management Procedure that may guide future statutory decisions on TACs and TACCs for the fishery; and operated the CRA 7 and CRA 8 Management Procedures used to guide statutory TAC setting in these fisheries. These activities resulted in the management proposals set out in Section 3.
291. Stock assessment scientists also operated an industry Management Procedure to guide voluntary commercial catch limits for CRA 5; and commenced an evaluation of an industry management procedure option for CRA 6.
292. NIWA continued the annual monitoring of rock lobster larval settlement. Work continues to attempt to establish correlation between settlement and future abundance that may be useful to inform management responses in anticipation of seasonal variability in stock abundance.

Stock Monitoring

293. Industry logbook data from CRA 2, CRA 5, and CRA 8 continue to be incorporated into the stock assessment process. CRA 6 logbook data is being used to inform the development of a draft CRA 6 Management Procedure. These programmes are supported by commercial lobster fishermen who measure and record all rock lobsters in four designated pots each fishing day. The data, which are designed to be representative of the respective fisheries, are providing reliable and consistent information for stock assessments.
294. Sequences of stock monitoring are undertaken as Fisheries Research Services in CRA 1, CRA 2, CRA 3, CRA 4, CRA 5, CRA 7, and CRA 8.
295. Industry-funded technicians and administrative support staff continue to be employed in the Bay of Plenty, Canterbury-Marlborough, Chatham Islands, Otago, and Southern rock lobster fisheries.

296. Regional administrative and support staff are contracted and supervised by the NZ RLIC on behalf of industry. The NZ RLIC contracts Trophia Research to maintain the CRA Logbook database and to analyse and report logbook data to participants and to the annual assessment process.
297. The NZ RLIC and Trophia Research have further refined a web-based tag and release “track and trace” system that enables more timely reporting of tag recapture data by commercial and non-commercial extractive users. The system can be accessed at <http://tagtracker.trophia.co.nz/>.

Research Planning

298. In 2008, MFish again designated the NRLMG as the forum for the Rock Lobster Research Planning process. This process contributes to the MFish Business Plan. The NRLMG was selected as a model for fisheries research planning groups because of its multi-sector representation and participation, and the degree of recognition given by the Minister when seeking sustainability advice.
299. The NRLMG sought and actively encouraged additional participants to the Rock Lobster Research Planning process that commenced in August and concluded with the Research Co-ordinating Committee submissions in September/October 2008. These included interest groups not directly represented on the NRLMG, and potential service providers.
300. The initial focus was to identify the information needs for rock lobster fisheries. The planning process also took account of the research projects in progress during 2007/08 into 2009.
301. The NRLMG has previously confirmed a range of immediate and medium term research needs, the results of which will inform the Minister when making sustainability decisions, and may assist stakeholders wanting to develop and implement Fishery Plans.
302. The projects that are considered essential to the stock assessment and modelling, to the management procedures including harvest control rule evaluation and analysis, and to management decisions are:
- a) stock assessment;
 - b) stock monitoring; and
 - c) better non-commercial catch estimates including estimates of illegal removals.

9. STOCK ASSESSMENT OVERVIEW

Introduction

303. Stock assessments are conducted periodically to evaluate the status of rock lobster stocks in relation to agreed or intended management outcomes. One stock assessment was completed in 2008 – for CRA 3 (Gisborne/East Coast - Tairāwhiti).

Reference points

304. Where stakeholder group agreed management strategies, and estimates of biomass that could produce the maximum sustainable yield are absent, the NRLMG believes that biological reference periods provide appropriate alternatives for management consideration for the reasons outlined in the discussion that follows.
305. To assess the status of a stock, the RLFAWG examines a variety of performance indicators. Because estimates of virgin biomass are very uncertain, estimates of the statutory target stock status, B_{msy} , also tend to be very uncertain and so are not regularly used as performance indicator. Indicators used are based on “vulnerable biomass”: the pre-season biomass that is legally available and vulnerable to the fishery in the AW season (i.e., at or above the MLS, excluding berried females, and taking selectivity-at-size and seasonal vulnerability into account).
306. Stock assessments provide estimates of the current biomass, B_{curr} , which for rock lobster fisheries is defined as vulnerable biomass from the year following the last year of data. Stock assessments also project forward, providing an estimate of projected biomass, B_{proj} , which is the vulnerable biomass associated with the end of the projection period.
307. B_{ref} is defined as a proxy for B_{msy} and is generally taken to be the average vulnerable biomass from a reference period. B_{ref} has been calculated as the average start-of-season vulnerable biomass in the AW season during the defined reference period.
308. The choice of reference period is perforce arbitrary and open to debate. When selecting reference periods the RLFAWG and the NRLMG consider a number of important factors:
- a) a period for which good data are available from which to estimate vulnerable biomass;
 - b) a period during which the fishery is well developed, but by no means fully developed – the fishery has continued to produce catches after the end of the reference periods; and

c) a period in which the biomass was relatively stable.

309. For example, the target reference point Bref was defined for CRA 8 in 2002 as the biomass from 1979 through 1981. In this period the fishery showed good productivity and the biomass level was demonstrably safe: it subsequently declined to lower levels and then recovered. The 2006 assessments of CRA 7 and CRA 8 used 1979-81 as the reference period.
310. Brefs are neither the highest nor lowest biomass levels that have been experienced and observed in the CRA areas for which reference periods are chosen. In every case, stock abundance has fallen lower than the Brefs and biomass has increased from those lower levels.
311. In compiling advice to the Minister, the NRLMG has determined that stock size should fluctuate around the target Bref with at least 50% probability of achieving the target.
312. A “limit” reference point – Bmin – is also used. Bmin is the minimum biomass indicator, and is generally defined as the lowest point (nadir) of the vulnerable biomass trajectory but is sometimes defined in relation to another reference points (e.g., $\frac{1}{2}$ Bmsy or $\frac{1}{2}$ Bref).
313. In compiling advice to the Minister, the NRLMG has determined that the probability of being below that reference level should be small (<10%). In simple terms the stock at limit Bmin is an undesirable stock status.
314. The NRLMG has therefore adopted Brefs as “target” reference points because, in the absence of estimates of Bmsy, they provide credible and practical benchmarks of sustainability and utilisation against which management actions that are consistent with legislative obligations can be recommended to the Minister.

CRA 3 Stock Assessments Conducted in 2008

315. The CRA 3 stock assessment was updated in 2008. The assessment concluded that the CRA 3 stock is currently below the target stock size, Bref and is above Bmin. Under current catches and recent recruitments the assessment model predicts a 75% probability that stock size will decline over the next four years.
316. The CRA 3 stock assessment is reported in the Fishery Assessment Plenary Report appended to this Report (Annex 2) and proposed management options to address low stock abundance in the fishery are set out in the NRLMG’s initial advice included in section 3.

10. MANAGEMENT PROCEDURE OVERVIEW

Introduction to Management Procedures and Harvest Control Rules

317. Harvest control rules for rock lobster fisheries were first implemented following agreement by the Minister in 1993.
318. Generically the main benefit of harvest control rules and management procedures is that they enable the Minister's legislative obligations to be met in relation to sustainable utilisation while providing greater certainty to stakeholders over future management interventions.
319. Specifically, the benefits of harvest control rules are that:
- a) they allow users to plan rationally;
 - b) they force stakeholders and managers to define management goals clearly;
 - c) they force stakeholders and managers to agree on data used in making decisions;
 - d) they force stakeholders and managers to establish clear rules in advance to guide management interventions;
 - e) they incorporate uncertainty into the decision making process formally and objectively; and
 - f) they may act to increase the user's understanding and acceptance of decisions.
320. There are currently two types of rule in operation. One type is the rule for the NSN and NSC substocks which provides guidance, based on commercial CPUE, on when stock assessments should be undertaken. The decision rule does not provide guidance on management interventions, except that TAC changes should not be considered unless CPUE is significantly different from that in the reference year. The decision rule for NSN and NSC substocks was constructed to allow for increases in TACs where rebuild would not be significantly delayed by taking such an action.

	Objective	Performance indicators
Yield	Maximise catch	Mean and median annual catch (t) Probability of falling below current TACC
Abundance	Maintain high abundance – there are economic, biological, and social benefits of high catch rates	Mean of CPUE (kg per potlift)
Stability	Minimise frequency of quota adjustments – a maximum of 3 to 5 years is preferred	Frequency of TAC adjustments Average annual variation in TACC (% AAV)
Safety	Minimise risk of low biomass levels	Probability of CPUE staying above the 1997 level
Diversity	Maintain a wide size range of lobsters – fishers are able to respond to changes in market demand	The proportion of lobsters in the catch that weigh 1kg or greater (%)
Rebuild	Maximise rate of rebuild	Mean annual percentage increase in CPUE Time to rebuild (yrs)

Table 7: Management objectives and associated performance indicators to be considered in the development of harvest control rule candidates.

321. The other type is the Management Procedure that guides sustainability decisions for CRA 7 and CRA 8 and is recommended for CRA 4. Under this type of rule, agreement is obtained among managers and stakeholders when the management procedure is designed: they agree about the data inputs, the harvest control rule and the period for which the management procedure will be used. Extensive simulation testing of the management procedure is necessary to ensure that it will deliver the desired stock behaviour.
322. The application of these management procedures results in management action consistent with the Minister's legal obligations.

Operation of the NSN and NSC Management Procedures

323. This section presents evaluations of the NSN and NSC decision rules for the 2008–09 fishing year, based on CPUE data extracted in October 2008.
324. The operation of the current CRA 7 and CRA 8 Management Procedures and the recommended CRA 4 Management Procedure are described elsewhere in this Report.
325. Complexity of management procedures and complexity of evaluation are problematic. The technical complexity is beyond most people unfamiliar with current assessment technology. Therefore, a focus of continuing work should be to develop communication techniques to

ensure stakeholders are able to understand the implications of proposed management procedures, and to accept and support their application.

Data preparation procedures

326. For decision rule analyses, the data are extracted using method “B4” (Bentley *et al.* 2005) and aggregated by fishing year, month, rock lobster statistical area, and vessel. The standardisation procedure (Maunder & Starr 1995) uses month, statistical area, and fishing year as explanatory variables.
327. Procedures are used which scale the standardised indices to CPUE levels consistent with those observed by fishermen.

Decision Rule for NSN (CRA 1 & CRA 2) AND NSC (CRA 3, CRA 4, CRA 5)

328. The decision rule described by Breen *et al.* (1994) was modified by the NRLMG for the NSN and NSC substocks to allow consideration of TAC increases. The original decision rule required that a substock be assessed whenever a “standardised CPUE analysis” (Maunder & Starr 1995) showed a “significant” decrease in the CPUE for a given year relative to the CPUE estimate for 1992/93. A year index is considered “significantly different” from the 1992/93 year index if the standard-error bars do not overlap (Table 8).

NSN – CRA 1 & CRA 2

329. The standardised CPUE for the NSN substock increased steadily between the 1992/93 and 1998/99 fishing years. There were four consecutive years of decrease between 1998/99 and 2002/03, but this trend appears to have reversed and the standardised indices since 2004/05 show increases relative to 2003/04. The increase in the NSN series relative to the 2003/04 fishing year extends to both components of the NSN. The standardised index and the simple arithmetic mean show similar trends and both are above the low abundance observed in the late 1980s and early 1990s.
330. Under the NSN decision rule, the 2006 CPUE is “significantly” above the 1992 CPUE.

NSC – CRA 3, CRA 4, CRA 5

331. As in the NSN substock, standardised CPUE for the NSC substock increased steadily between the 1992/93 and 1998/99 fishing years. Since then, there has been a continuous drop in CPUE to a level nearly 50% below the 1998/99 peak. This decline has occurred in all three components of the NSC, although not in synchrony, with CRA 5 dropping from a 2003 peak while CRA 3 and CRA 4 started declining sooner.

332. The CRA 3 CPUE has reached a plateau over the last 3 years at a level slightly above the nadir observed in 1992/93. As was noted for the NSN substock, the standardised index for 2006/07 remains above the lowest level, which was observed in 1992/93.
333. Under the decision rule, the 2006 CPUE is “significantly” above the 1992 CPUE.
334. On the basis of these results no stock assessments are invoked for NSN and NSC stocks. However, in response to observed stock decline and concerns expressed by extractive users, a full CRA 3 stock assessment was completed in 2008.

	1992/93	1992/93	1992/93	2007/08	2007/08	2007/08	
Substock	Index	Lower	Upper	Index	Lower	Upper	Result
NSN	0.971	0.938	1.005	1.739	1.667	1.814	*
NSC	0.395	0.387	0.402	0.819	0.797	0.841	*

Table 8: Decision rule indices for 1992/93 and 2007/08 fishing years (1 April to 31 March) for the NSN and NSC substocks. The index is the year effect from a standardised CPUE analysis using 1984/85 and 1982/83 as base years for the NSN and NSC respectively. The table also shows the upper and lower bounds, which are the index plus and minus one standard error respectively. The final column indicates the significance of change between the two years (* = significant increase).

Operation of the CRA 4, CRA 7, and CRA 8 Management Procedures

335. Descriptions of the proposed CRA 4 Management Procedure, and the agreed CRA 7 and CRA 8 Management Procedures are provided in the NRLMG’s initial advice. The initial advice also reports on the operation of the procedures for the 2009-10 fishing year.

11. OTAGO (CRA 7) CLOSED SEASON

336. The NRLMG considered a proposal by the Otago Rock Lobster Industry Association (ORLIA) and it was submitted to the MFish internal prioritisation process in 2005 and again in 2006. The proposal failed to achieve enough priority to be progressed due to insufficient resources being available to MFish to run all regulatory proposals under consideration.

337. The original proposal:

The Otago Rock Industry Association recommends the Fisheries (South-East Commercial Fishing) Regulations 1986 Regulation 8 be amended to remove the closed season for commercial rock lobster fishing in CRA 7.

338. MFish advised the ORLIA to include information on possible impacts on other fishery participants and include a range of options to avoid remedy or mitigate these potential impacts.

339. Industry representatives then brought the ORLIA proposal back to the NRLMG and it was submitted to MFish's 2007 internal prioritisation process. The proposal failed to progress a third time.

340. The ORLIA then modified the proposal and submitted it to the MFish internal prioritisation process in November 2008.

341. The modified Proposal:

The current proposal is to amend regulation 8 of the Fisheries (South-East Area Commercial Fishing) Regulations 1986 to provide for a closed season during the period commencing on 20th day of November in any year and ending on the 31st of March in the next year (both days inclusive).

NRLMG Recommendation

342. The NRLMG notes:

- a) that the ORLIA has again submitted the proposal to the MFish internal prioritisation process for inclusion in the 2009 Regulatory Review rounds.

12. HAND OPERATED CRAY LOOPS

343. The New Zealand Recreational Fishing Council (NZRFC), supported by the NRLMG, has requested that hand-operated lassoes (cray loops) be included as an allowed method for amateur fishers taking rock lobster. (Both NZRFC and NRLMG consider spring-loaded loops should not be allowed, as these may cause unnecessary injury to lobsters.)
344. In 2005, Fisheries Minister Jim Anderton reviewed amateur rock lobster fishing methods. The Minister made provision for some new methods but decided to retain the restriction⁵ on the use of cray loops because there was insufficient information about their impacts.
345. Following the Minister's decision, the NZRFC conducted research⁶ to determine the impacts of hand-held loops on rock lobster. The NZRFC research concluded that hand-operated loops caused significantly fewer injuries to appendages and carapaces of both hard-shell and soft-shell lobsters than hand collection (an allowed method).
346. The NZRFC research has not been peer reviewed by the Rock Lobster Fisheries Assessment Working Group but has been considered by the NRLMG, who found it sufficient to formulate a management position.
347. In 2007, stakeholders raised concern about the 'absurdity' in being able to possess cray loops but not use them to catch lobsters. These concerns prompted a request from the Minister that the matter be resolved. On being informed about the NZRFC research underway, the Minister noted he was content to wait until the NZRFC research was complete.
348. Hand-operated loops were used by amateur fishers prior to the Minister's 2005 decision, as it was not widely known the method was restricted.
349. Reviewing the restriction on the use of cray loops may contribute to realising "best value" from rock lobster fisheries by improving amateur fishing access. Amateur access would be improved because the range of efficient harvesting methods available to amateur fishers would increase.
350. Allowing cray loops would not impact on the utilisation opportunities of other fishers unless it was to result in significantly increased total amateur catch.

⁵ The use of cray loops to take rock lobsters by amateur fishers is currently unlawful as the loops do not meet the definition of any of the methods allowed in the regulations.

⁶ Powrie, W. 2008: Injury caused by hand collection and lasso collection of New Zealand Rock Lobster (*Jasus edwardsii*). Unpublished report prepared for the NZRFC.

351. Reviewing the restriction on the use of cray loops would contribute to “credible fisheries management” by addressing an enforcement difficulty. Currently it is lawful to possess both cray loops and lobsters but unlawful to use loops to take lobsters. This makes enforcement difficult as unless a fishery officer sees a fisher taking a lobster with a cray loop there is no way to prove whether the loop was used to take lobster.
352. Should the issue not be addressed in the forthcoming review round, credibility, particularly as relates to the enforcement of rules relating to loops, will continue to be undermined. There is a high likelihood this would result in controversy with a medium impact.
353. It is expected that the external discussion of the proposal to amend the amateur regulations will have a low level of controversy at a regional and national level.

NRLMG Recommendation

354. The NRLMG notes:
- a) that the proposal is agreed by the NRLMG and has been submitted to the MFish internal prioritisation process for inclusion in the 2009 Regulatory Review rounds.

13. UNCERTAINTY IN ESTIMATES OF TOTAL REMOVALS

Overview

355. Accurate information about total removals is necessary to enable appropriate management decisions to ensure sustainability. Information on the level of commercial removals is collected by the QMS reporting system. However, the infrastructure for collecting information on amateur, customary, and illegal removals is poorly developed.
356. The lack of accurate information on non-commercial and illegal catch contributes to the uncertainty of the stock assessment, detracts from the effectiveness of agreed harvest strategies and undermines the incentives created by the QMS.
357. In the case of rock lobster fisheries, to allow any or all of the individual catch components to increase without control will jeopardise the rebuild strategy and erode existing harvest rights and opportunities. No control is possible if catch components are unknown. No effective control is possible if catch components are uncertain.
358. Because the catch projections contained in stock assessments are made under the assumption of constant catches fixed at levels used in the assessment, an increase in future catch levels would result in an increased probability of a decrease in biomass and likely lower future biomass.
359. Significant uncertainty is associated with non-commercial removals from rock lobster fisheries. This situation has potential to confound the reliability of stock assessments, and to confound the expectations for, and to compromise the implementation of, Management Procedures, regional harvest initiatives and Fishery Plans.
360. In the case of those stocks generally regarded as “shared fisheries”, or those where stock abundance is less than optimum and high levels of non-commercial fishing activity are evident, the need for reliable and credible non-commercial catch data is urgent.

Customary Harvest

361. There is minimal information on customary non-commercial harvest even though customary fishing regulations have been promulgated. In the South Island the Fisheries (South Island Customary Fishing) Regulations 1999 came into force on 20 April 1998. Customary fishing regulations for the North Island and Chatham Islands, the Fisheries (Kaimoana Customary Fishing) Regulations 1998 came into force on 1 February 1999. The regulations become effective in different areas as nominated representatives of the tangata whenua are

appointed ⁷. Uptake of the North Island and South Island Customary Fishing Regulations has been slow. However, MFish has in recent years provided more resource to inform and educate tangata whenua about the Customary Fishing Regulations, and to encourage discussion where disputes about boundaries exist. This has resulted in greater uptake of the regulations, particularly on the east coast of the North Island.

362. The North Island and South Island customary regulations provide for quarterly reporting of permits issued for customary fishing purposes. Information derived from those permits is intended to improve the estimates of the level of customary harvest and although all available information has been presented to the RLFAWG there is no information available from areas still managed under Regulation 27.

Amateur Harvest

363. MFish telephone, diary, and ramp surveys have provided some amateur landing data from which estimates have been derived. Estimates of amateur harvest exist only for recent years and the results of the amateur catch surveys commissioned by MFish in 2000 remain highly uncertain and are not used in stock assessments. They were rejected by the RLFAWG. For the most recent rock lobster stock assessments the RLFAWG has assumed amateur catches and the trends in those catches over time.
364. MFish has sought tenders for research contracts aimed at improving recreational harvest estimates for rock lobster.

Illegal Take

365. The level of illegal removals from NZ rock lobster fisheries, previously estimated to be 378 tonnes nationally.
366. Illegal estimates were last amended in 2005. At that time MFish Compliance provided updated point estimates of 'unreported' illegal removals, and advised that "MFish does not currently have a reliable robust and defensible methodology to estimate illegal fishing. Our approach uses the 'method' employed last year to provide information on the CRA 3 fishery." In 2004, MFish Compliance had advised that "Difficulties arise in trying to verify and cross check the figures provided and this is a limiting factor of the methodology. Therefore, estimates cannot be verified and have an associated low level of confidence."
367. Estimates of illegal take, and associated historical pattern, are consequently highly uncertain. The RLFAWG has very little confidence in them.

⁷ See Annex 1

368. MFish's "Illegal Estimates Project", which is currently underway, focuses on identifying processes and methodologies to improve estimates of illegal take. The timeline for completing this project is unknown.

In Summary

369. The NRLMG notes:
- a) that accurate and reliable data for all sectors are essential to the stock assessment process;
 - b) that accurate and reliable data for all sectors are essential to the fishery management decision making process, particularly in circumstances where catch reductions are considered necessary to maintain or improve stock abundance;
 - c) that sufficient resources must be deployed to monitor non-commercial removals from rock lobsters fisheries to maintain the integrity of the TACs set for stocks, to maintain the integrity of the allowances made to extractive users within the TACs, and to maintain the fishing opportunity associated with those allowances;
 - d) that increased emphasis should be placed on the full implementation of the North and South Customary Regulations.

14. COMPLIANCE AND ENFORCEMENT ISSUES

Illegal Removals

370. The NRLMG has consistently stated over many years that reduced illegal fishing activity will facilitate attainment of the goal of the framework for managing rock lobster fisheries and improve harvest opportunities for legitimate extractive users.
371. Industry, customary, and amateur fishing representatives on the NRLMG have consistently expressed the view that Government should make a greater contribution to the existing Compliance budget and therefore enable more resources to be deployed into minimising illegal removals from the rock lobster fisheries.
372. Industry, customary, and amateur fishing representatives on the NRLMG agree that better compliance could be attained if rock lobster compliance strategies were developed and implemented.
373. MFish representatives on the NRLMG believe that these strategies can be further developed by stakeholders and MFish within the Fisheries Plan process.

In Summary

374. The NRLMG notes:
- a) the significance of the illegal catch component and its negative effect both on the stock and on legitimate extractive users;
 - b) that all user groups recommend that the Minister takes steps to ensure that compliance strategies and services (including enforcement and education services) are sufficient to minimise illegal catch;
 - c) that sufficient resources must be deployed to constrain illegal unreported removals in the first instance to the levels of the allowances made in setting TACs, and ideally to much lower levels so as to improve the quality of the fishing experience to be enjoyed by legitimate users.

15. CRA 3 MULTI-STAKEHOLDER FISHING FORUM

375. In May 2006, representatives of the customary, recreational and commercial Gisborne rock lobster fishing sectors came together to form the CRA 3 Multi-stakeholder Fishing Forum (the CRA 3 Forum). The CRA 3 Forum was set up following the Minister's concurrence with an NRLMG recommendation that a multi-stakeholder group be established to discuss and resolve two perceived utilisation issues in the CRA 3 fishery.
376. The two perceived utilisation issues relate to:
- a) "*equity of access to fish in CRA 3*": specifically whether or not commercial fishers are provided an "access advantage" with the winter commercial concession; and
 - b) "*inter-sector spatial conflict*": specifically whether there is increased spatial overlap between commercial and non-commercial sectors in CRA 3 limiting recreational access to rock lobster.
377. The issues are "perceived" issues in that there is no independent quantitative information to confirm an impact is occurring and fishery participants have differing views about what is causing the problems. Some participants consider current low abundance in the CRA 3 fishery is affecting the fishing success of all fishery participants and no single group is more affected than another, whereas others consider the fishing success of some sectors is more strongly affected than others because of the current management framework. In April 2005, the Minister reduced the CRA 3 TAC by 42% to ensure sustainability. The NRLMG is consulting on options to reduce the TAC further to secure the long-term sustainability of the stock.

The CRA 3 Forum

378. On establishment, the CRA 3 Forum set *Terms of Reference* and agreed its purpose. The CRA 3 Forum's stated purpose is wider than the two utilisation issues identified by the Minister – it is "*to develop, implement and manage an integrated fisheries management plan for the CRA 3 fishery*".
379. The CRA 3 Forum established two levels of operation:
- a) The *CRA 3 Forum*, which comprises tangata whenua and fishery stakeholder representatives, and is the decision making group; and
 - b) The *CRA 3 Working Group*, which is a smaller group of Forum representatives. The Working Group completes analyses topical issues between Forum meetings and

provides the Forum with recommended courses of action. The CRA 3 Working Group is also responsible for drafting CRA 3 Forum documents.

380. The CRA 3 Forum contracted an independent facilitator to run meetings. The contractor was initially paid for by the commercial sector but is now paid for by MFish. The CRA 3 Forum also seeks and is provided information and support from the NRLMG.

381. Despite the commitment of all sectors, the progress of the CRA 3 Forum in the first year was slow. Each sector had strongly held views on the nature of the issues in the fishery and the best way to resolve them. Consequently, it took some time for discussions to move beyond sector-based solutions and focus on developing common goals and designing solutions that would deliver these goals.

CRA 3 Fisheries Management Plan

382. In July 2007, the CRA 3 Forum gained momentum. The CRA 3 Forum agreed to develop a CRA 3 Fisheries Management Plan (the CRA 3 Plan) with MFish, and agreed a process and timeline to develop the Plan. Key milestones in the process included:

a) complete a first draft of the proposed CRA 3 Plan (including fishery objectives, assessment of current management framework, and required management strategies) by 30 November 2007 for CRA 3 Forum members to discuss with those whom they represent.

b) complete a final proposed CRA 3 Plan by 31 March 2008.

383. The CRA 3 Forum completed a first draft CRA 3 Plan as per the first milestone. In March 2008, the CRA 3 Forum decided to delay their second milestone to seek expert feedback from the NRLMG and science advisors. It was proposed at this time that a final Plan would be sent to the Minister of Fisheries on or before 14 June 2008.

384. A final draft CRA 3 Plan was considered by the CRA 3 Forum on 16 June 2008. Forum members agreed with the content of the Plan; however recreational sector participants considered the Plan incomplete because it only included management tools and services with cross-sector agreement and did not include their tools of closed areas to commercial fishing near Gisborne and removal of the winter commercial concession from all CRA 3 statistical areas. Consequently, the Plan was not approved by the CRA 3 Forum and was not presented to the Minister.

385. Whilst discussions on the Plan's completeness continue, the CRA 3 Forum's Working Group are progressing, and where possible, implementing priority management tools and services in the draft CRA 3 Plan to benefit the health of the CRA 3 fishery. The priority management tools and services contribute to the Plan's high level goals of "A Sustainable CRA 3 Fishery", "Quality Information for Decision-Making", and "A Fishery for All Sectors".

386. Up to May 2009, the CRA 3 Working Group plans to progress the following management tools and services:
- a) Develop, test and implement a management procedure to guide TAC setting in the CRA 3 fishery
 - b) Develop and implement an education strategy on the CRA 3 fishery and on CRA 3 management tools and rules
 - c) Develop, distribute and promote a cross-sector code of practice on handling rock lobster
 - d) Develop and deliver an education and resource package on customary catch reporting
 - e) Develop and deliver an education package on environmental factors affecting rock lobster abundance
 - f) Implement closed seasons in statistical areas 909 and 910; and remove the winter commercial concession in statistical area 911.
387. In September 2008, the CRA 3 Commercial Industry chose to voluntarily implement one of the priority management tools ahead of schedule. A voluntary commercial closed season was put in place for statistical areas 909 and 910 from 1 September 2008 to 15 January 2009.
388. The CRA 3 Forum is currently developing a voluntary cross-sector guide on handling rock lobster, which it plans to release before Christmas 2008.

Forum Challenges

389. The progress of the CRA 3 Forum since July 2007 has not been without challenges. In mid-September 2007, recreational sector participants announced their withdrawal from the CRA 3 Forum. They expressed frustration with the slow progress in resolving recreational concerns and noted their intention to approach the Minister directly. Although understanding of the recreational sector's frustration, both the Minister and the remaining CRA 3 Forum members encouraged the recreational sector representatives to return to the Forum table. Recreational sector representatives returned at the end of October 2007.
390. In June 2008, sign-off of the final draft CRA 3 Plan was sought from Forum customary, recreational and commercial participants. Recreational sector participants did not sign-off on the Plan as drafted as because it did not include their preferred management tools of closed areas to commercial fishing near Gisborne and removal of the winter commercial

concession from all CRA 3 statistical areas. Recreational sector participants continue to attend CRA 3 Forum meetings but are not currently involved in CRA 3 Working Group processes because of dissatisfaction with the process (recreational representatives) and because of concern about breaches of *Terms of Reference* by recreational participants (other Working Group members). The Working Group is, however, committed to resolving these issues early in 2009.

391. Despite these challenges, the CRA 3 Forum and the CRA 3 Working Group have continued to talk and make progress to benefit the health of the CRA 3 fishery for everyone.

Recommendations

The NRLMG notes that:

- a) the NRLMG is available to provide you with advice on the CRA 3 Forum's draft CRA 3 Fisheries Plan.

ROCK LOBSTERS

16. ROCK LOBSTERS

392. The spiny rock lobster (*Jasus edwardsii*; koura) has always been important to Maori and for much of this century has supported increasingly important commercial and amateur fisheries. Rock lobsters support one of the country's oldest commercial fisheries, and are one of the seafood industry's top export earners.
393. The commercial fishery has developed through a number of phases as catches have increased with the development of export markets. Management of the resource has changed in response to the changing status of the stocks and the expectations of stakeholder groups.
394. Since 1990 the rock lobster fishery has been managed within the Quota Management System (QMS) and governed by a mix of output controls and fishery regulations, including the provision of a minimum legal size, a prohibition against taking berried females and soft-shelled animals, method restrictions, the requirement that all pots be fitted with escape gaps, and closed seasons in some areas.
395. The current management of the rock lobster fishery is focused on moving stocks to agreed biological reference points and maintaining them at this level or above, primarily through the adjustment of Total Allowable Catches (TACs).

THE RED ROCK LOBSTER AND ITS NATURAL HABITAT

396. Lobsters are strictly marine. They are 10 legged and all have the same basic body plan (head, tail, 2 pairs of antennae, no less than 6 pairs of mouthpart appendages and 5 pairs of legs).
397. 'Crayfish' or 'Cray' are strictly freshwater and are clawed, i.e., New Zealand's Koura. Unfortunately 'Cray' is a common term used for New Zealand's marine lobsters. Koura is the general Maori name for both (freshwater) crayfish and (marine) lobsters.
398. New Zealand has four species of rock lobsters (spiny lobsters), the most common of which is the Red Rock Lobster. The scientific name of the Red Rock Lobster is *Jasus edwardsii*. In Australia this species is known as the 'Southern Rock Lobster'.
399. The other species found in New Zealand are the:
- a) Packhorse Rock Lobster (Green Rock Lobster). The scientific name is *Sagmariasus verreauxi*. This lobster is less than 1% of commercial rock lobster landings. It is the world's largest rock lobster.

- b) Deepwater Rock Lobster (*Projasus parkeri*) is taken occasionally as incidental catch from trawling but is not marketed.
- c) a Tropical Rock Lobster species (*Panulirus sp.*) found only at the Kermadec Islands.

400. The Red Rock Lobster is dark red and orange above, paler and yellowish below. The body is spiny, especially on the head. They can weigh up to 8 kg and reach lengths of about 60 cm (excluding the feelers).

401. In contrast the Packhorse lobster is green; has a distinctive 'carapace' (the protective shell of the head and thorax). The Packhorse's carapace has a distinctive shape at the front part and distinctive patterns of spines. The Packhorse also has a lack of sculpting on its tail. As the world's largest rock lobster it has been found to weigh up to 20 kg and reach lengths of 70 cm.



402. The Deepwater Rock Lobster has a distinctive apricot colour, two prominent rows of spines on its carapace and a central ridge along the top of its tail. It is a much smaller rock lobster reaching lengths of 25 cm.

403. The Tropical Rock Lobster species is a medium sized species of the western pacific. They have a distinctive structure at the base of each feeler that produces a sharp, rasping sound when the feelers move.

Habitat

404. Very small lobsters usually shelter alone in small cracks or holes. As they grow they become more gregarious and can be found in groups of 50 or more. This behaviour helps to protect them from predators. Once they become sexually mature their willingness to share dens varies seasonally especially for males (see section on reproduction).

405. During the day Red Rock Lobsters are normally found in rock crevices (dens), which provide shelter from predators, storms, and the sun. They generally leave the dens around dusk to forage for prey, returning just before dawn
406. The Deepwater Rock Lobster is a very deepwater lobster, found between 500m and at least 900m. Our knowledge of its deep rocky habitats is very limited.

Distribution

407. The Red Rock Lobster, *Jasus edwardsii*, is found throughout New Zealand, on seamounts in the Tasman Sea and around southern Australia. In New Zealand they are found from the Three Kings Islands in the north all the way to the Auckland Islands in the south and to the Chatham Islands in the east. They are also found on shallower seamounts to about 300 m depth throughout New Zealand's Exclusive Economic Zone. The Red Rock Lobsters found at the Auckland Islands are the southern-most rock lobsters in the world.
408. Packhorse Rock lobsters are widely distributed, as far north as the Kermadec Islands, south to Foveaux Strait, and east to the Chatham Islands. They are fished mainly in the far north of NZ. (They also occur in eastern Australia – northern Victoria and New South Wales - where they are commonly called the Eastern Rock Lobster).
409. The Deepwater Rock Lobster is widespread in the southern oceans. Most commonly found in the Bay of Plenty, off Wairarapa and the Chatham Rise.

ANATOMICAL FEATURES OF RED ROCK LOBSTER

External Features - location and identification

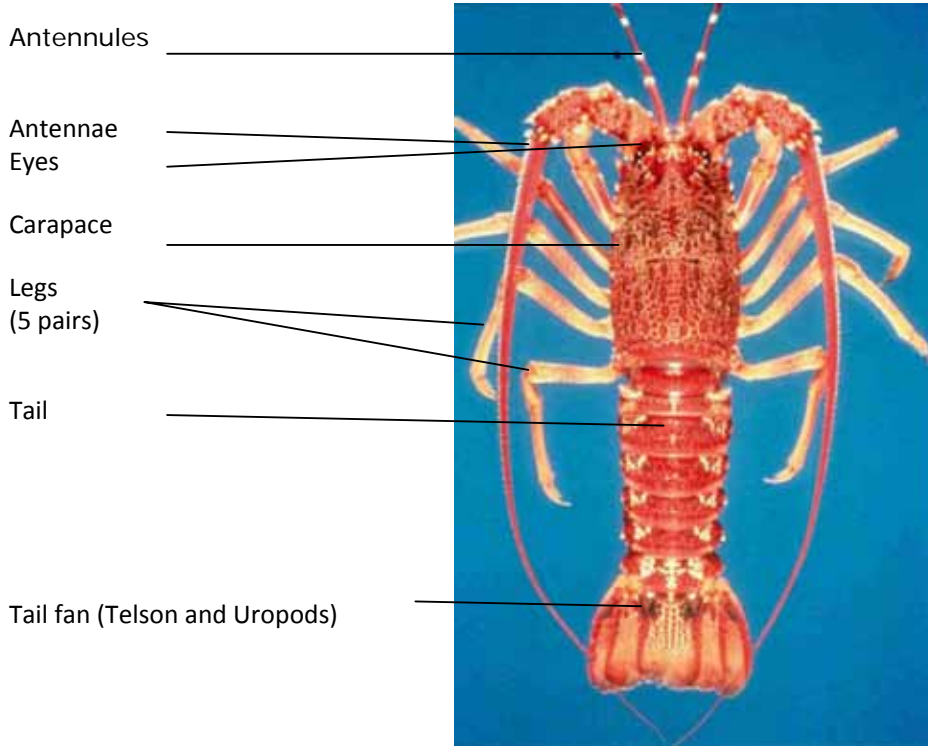


Photo: A. Blacklock

External features and their function

External Feature	Function
Eye	Compound eyes at the tip of the eye stalks
Antennae	Long "feelers" that can be rotated around to fend off predators. They also have some sensory function.
Antennules	The short slender appendages are capable of detecting food (tasting), danger, and pheromones
Legs	5 pairs of legs used for walking and feeding
Carapace (or cephalothorax, the head & thorax)	Protection of vital organs such as the liver, stomach, gonads, gills and heart by the exoskeleton case
Tail (or abdomen)	Consisting of 6 separate, moveable parts, plus the tail fan (telson and uropods). The main muscle for movement (swimming) away from danger. Under the tail are paired feather-like appendages (pleopods).

Internal Features – location and identification

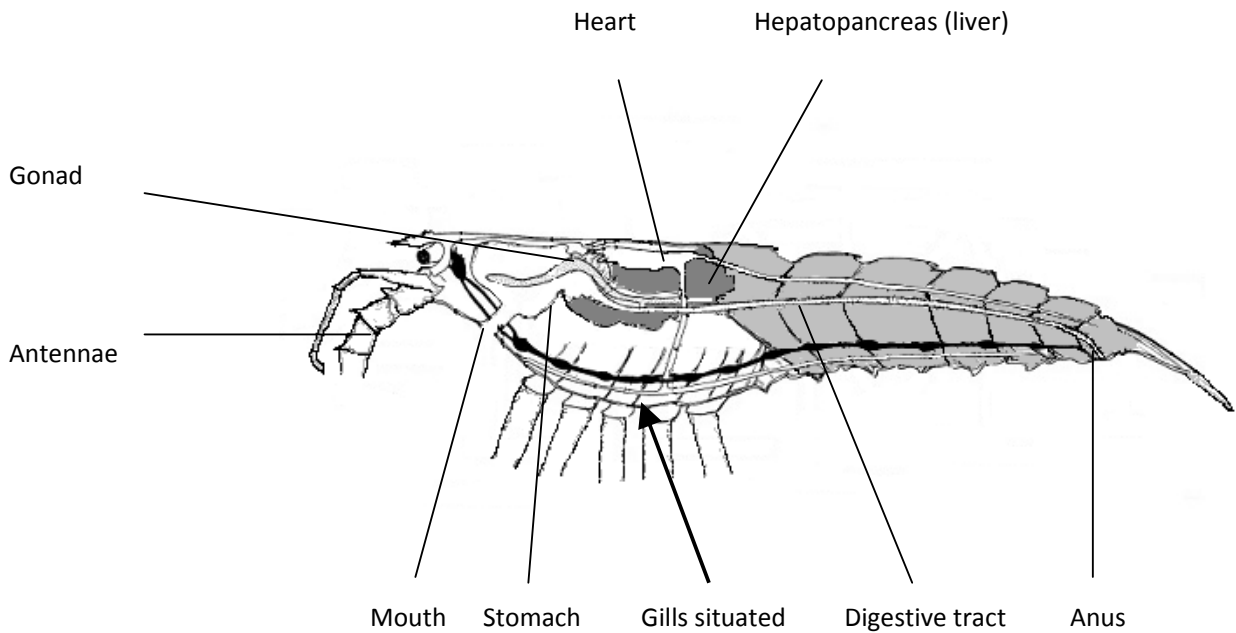


Illustration: G. Moss

Internal Feature	Function
Mouth	The mouth is for the ingestion of food. It has a series of appendages associated with it that help bring the food to the mouth and crush it before ingestion.
Gills	The gills, which sit under the carapace at the base of each leg, are used for the uptake of oxygen from the water and release of carbon dioxide
Heart	The heart pumps the blood around the body of the lobsters
Gonad	The gonad produces eggs or sperm for reproduction.
Hepatopancreas (or liver)	The hepatopancreas (or liver) produces the digestive fluids which break down the food that is eaten
Digestive track	The digestive track is used to absorb the nutrients from the food
Anus	The waste products of digestion are excreted through the anus

Sexual differences

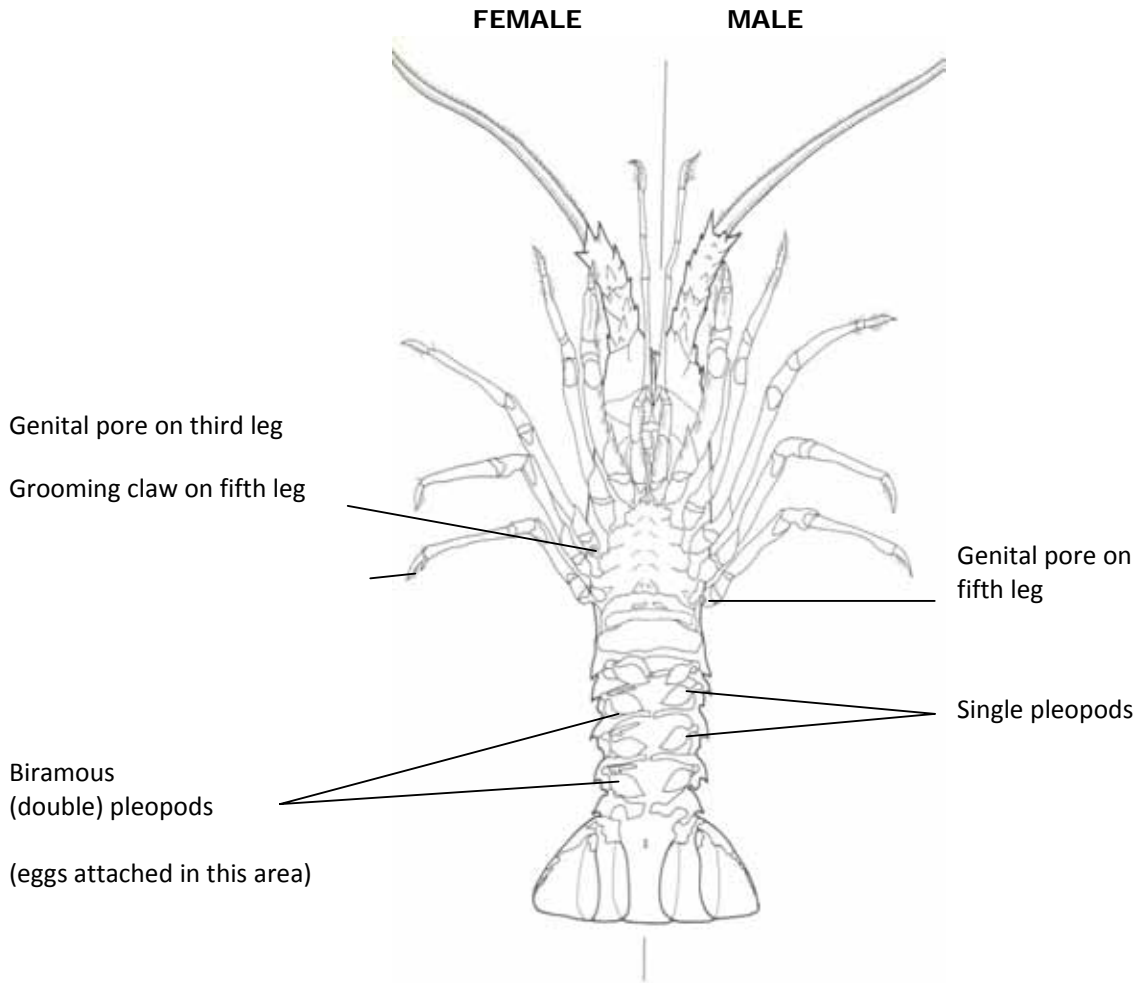


Illustration: P. James

Difference	Function
Genital pores	<p>Females. Positioned on the base of the 3rd walking leg for females so the eggs are extruded and pass through the sperm package the male deposits on her abdomen before attaching to the pleopods</p> <p>Males. Positioned on the base of the 5th walking leg for males so the sperm package is deposited below the female genital pores</p>
Grooming claw	<p>Present on the 5th leg of the female only, it is used for grooming the eggs when they are attached to the pleopods</p> <p>Not present on the males</p>
Pleopods	<p>Females have biramous (or double) pleopods. The innermost branches of the pleopods are covered with long hairs for the attachment of the eggs. The female keeps the eggs aerated by slowly beating her pleopods.</p> <p>Males have single pleopods</p>

Feeding, Reproductive Cycle and Life Cycle

Food and feeding

410. Lobsters feed on a wide range of small shellfish, crabs, starfish and kina, depending on local availability. They generally hold the prey with their front legs and crush it in their mandibles (or mouthparts).

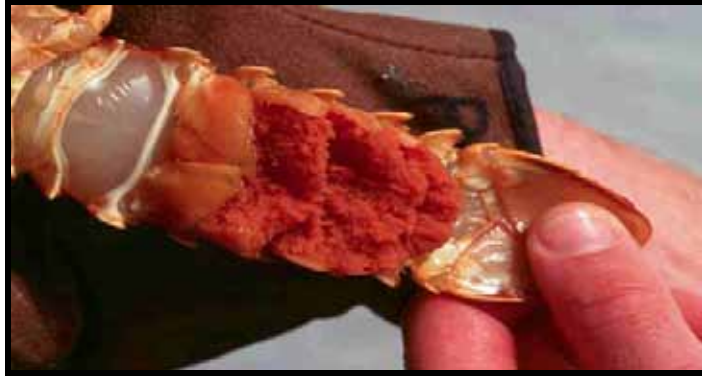


Photo: A Blacklock

Moulting and mating

411. Female lobsters can only mate when the carapace is soft (i.e. within a few weeks of moulting). Red rock lobsters moult as early as late February in southern waters, but not until late June in warmer northern waters, and shortly after moulting (2 hours to 63 days) do they mate [2]. Lobsters are selective about who they mate with; large males prefer to mate with large females and females also prefer the largest male available.
412. Once a mate has been selected the lobsters begin courtship which may last just a few minutes or several days. When they are ready to mate they rear up, belly to belly and embrace before toppling over with the female uppermost. The male then deposits a sperm package (or spermatophore) onto the belly of the female.
413. The sperm package begins to disintegrate immediately, so the female rapidly starts to extrude her eggs. Normally she will cling to a rock face head up and form a brood chamber with her tail, spreading the tail fans to cover the genital pores and the sperm mass. Eggs are extruded from the genital pores and fertilised as they pass through the sperm package before attaching to the long hairs on the pleopods, under the tail. Small females may extrude as few as 20,000 eggs while large females may produce up to half a million. The fertilised eggs are carried for between 3 and 5 months, before hatching.

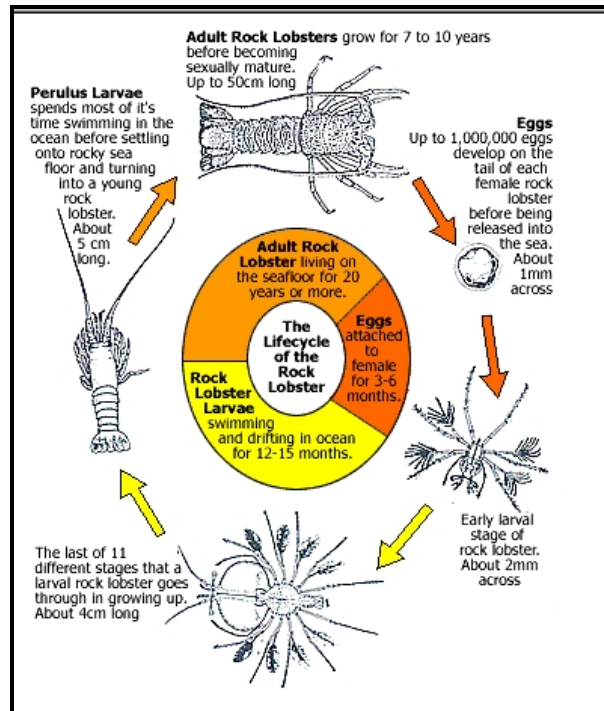
414. Large males become aggressive during the mating season, which usually results in one male per den. Females are also less likely to shelter together during mating when they are competing for the large males.



Berried female with newly deposited eggs under her tail

Photo: A. Blacklock

LIFE CYCLE OF RED ROCK LOBSTER



ROCK LOBSTER LIFE CYCLE Source: MFish 2005

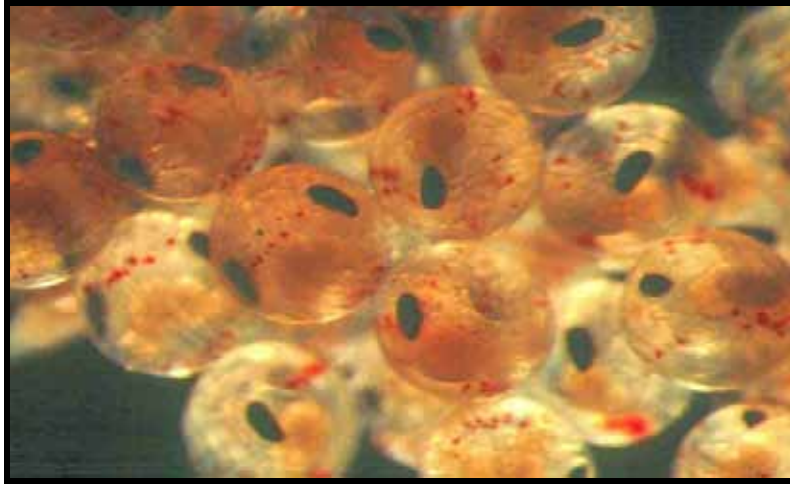
Life Cycle Summary

- Lobsters have a long and complex life history
- The adults mate and the females carry eggs (berried) for 3-5 months
- Larvae hatch and swim in the open ocean for 18-24 months, during which they undergo numerous moults and changes (11 phyllosoma stages)
- The puerulus stage settles and moults into the juvenile stage
- Juveniles mature and become adults after 4-5 years

Eggs and hatching

415. Females carry the eggs under the tail for 3-5 months. During this time the female keeps the eggs aerated by slowly beating the pleopods and groomed using small pincers on her rear

walking legs. The embryos in the eggs develop through a number of stages, developing prominent eyes and legs (below), before becoming ready for hatching [3].



Well developed eggs just prior to hatching

Photo: L. Tong

416. Hatching occurs at daybreak during the spring. The female stands on tips of her legs with her tail held upright into the water current. She vigorously beats her pleopods for a few seconds, which releases a swarm of the first larval stage (naupliosoma). The eggs hatch into spider-like larvae which drift in the water for 12 -15 months, growing to around 50 mm in length before returning to inshore areas to settle on the seafloor.

Larval stages

417. Naupliosoma larvae swim up to the light and within minutes moult into the transparent second stage Phyllosoma larva (below left). This small spider like creature has a body about 2 mm in length.
418. The phyllosoma stages are carried seaward by ocean currents and spend the next 18-24 months growing through eleven phyllosoma stages and seventeen instars, up to 1000 km from the shore. The long larval life and poor swimming of the phyllosomas mean that they get carried about by currents and caught up in eddies.

Phyllosoma Larva in 2 different stages

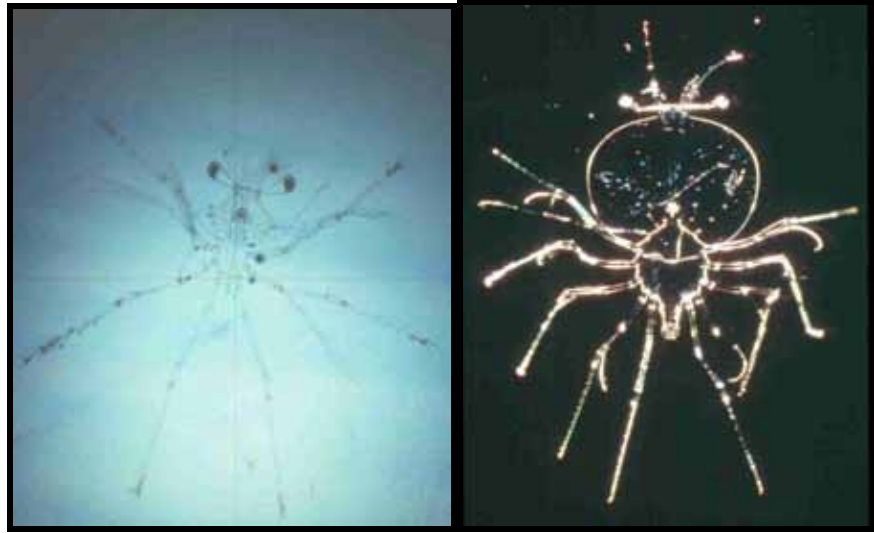


Photo: G. Moss

Photo: A. Blacklock

419. When they reach about 35-50 mm, the leaf-shaped phyllosomas (above right) metamorphose into the puerulus stage.
420. Pueruli look like small (25 mm) transparent juvenile lobsters (below). They are good swimmers and can swim up to 150 km to the shore. During this stage they do not feed and survive on fat stores laid down by the phyllosoma stages.



Puerulus stage

Photo: A. Blacklock

Settlement, juvenile stage

421. Pueruli that successfully reach the shore, settle into small holes and crevices on shallow reefs and within 2-3 weeks moult into the juvenile stage and start to feed. Juveniles mature and become adults after 4-5 years.

Moulting and growth

422. Lobsters have a hard shell (or 'exoskeleton') and in order to grow they must shed this shell (below) and replace it with a bigger one.



Intact moult from a juvenile lobster Photo: G. Moss

423. Before moulting ('ecdysis') the lobster begins to grow a new layer of exoskeleton beneath the old shell and begins to remove calcium from the old skeleton. When the lobster is ready to moult the membrane on the back of the lobster, between the carapace and the tail, splits and then the animal pulls itself out of the old shell. The lobster then takes up water, to swell up and enlarge the new shell, before re-depositing the calcium and hardening the new shell.
424. This process of shedding the shell (or 'moulting') occurs frequently in small lobsters (4-6 weeks) when they are growing rapidly but usually occurs once a year in adult lobsters. The amount of growth is dependent on the size of the lobster the temperature of the seawater in which it has been held and the amount and type of food it has eaten.

Migrations

425. In spring and early summer some juveniles migrate against the prevailing current. It is believed these migrations help counter the effect of downstream larval drift. Adult lobsters undertake seasonal inshore-offshore movements associated with moulting, breeding and feeding.

Size at onset of maturity

426. The size at onset of maturity for female rock lobsters, *J. edwardsii*, has been defined as the size or size class at which 50% of the rock lobsters in a sample are mature. Animals are regarded as mature if they are bearing external eggs attached to the pleopods or if there are well developed setae on the endopodites of the pleopods.

427. Immature females usually moult twice a year until maturity, then annually. Where size at 50% maturity is large, some females may begin moulting once a year before maturity.
428. The size at which 50% of females are mature varies considerably for *J. edwardsii* throughout New Zealand, from 72 mm Carapace Length (CL) near Gisborne to 121 mm CL in eastern Foveaux Strait. This size appears inversely related to water temperature. No data are available from the Chatham Islands.
429. Size at 50% female maturity in most areas is less than the minimum legal size of 60 mm tail width (TW) (approximately 93 - 98 mm CL). Most females from these areas breed at least once before reaching the minimum legal size. However, from Banks Peninsula through western Foveaux Strait (CRA 7 and part of CRA 8), size at 50% maturity is greater than the minimum legal size. The effects of this are not known, but these areas have sustained high catches over time.
430. At sexual maturity the female lobster's pleopods increase in size and the inner branch grows a fringe of pale hairs to which the eggs attach after mating. The males mature at about the same size but there are no obvious external changes. Large male red rock lobsters have been measured at 23 cm carapace length (54 cm body length) and weighing 5.4 kilograms. Females have reached 17 cm carapace length (45 cm body length) and weighing 2.3 kilograms [5].
431. Most mature *J. edwardsii* females moult and mate some time between February and May. Females carrying eggs occur in greatest numbers from April to October, though a few are found during any month of the year. Females bear eggs only once each year and most mature females carry eggs during the egg-bearing season. Successful reproduction requires mature male and female lobsters of similar size.
432. The number of eggs carried by *J. edwardsii* depends on size, ranging from about 125,000 for a female of 95 mm carapace length (CL) to about 540,000 for one of 170 mm CL.
433. Most mature female *S. verreauxi* moult between July and November, bear eggs during late September to January, and hatch the eggs from December to January. The number of eggs carried by *S. verreauxi* ranges from about 375,000 for a female of 152 mm CL to 2,000,000 for one of 230 mm CL.
434. Rock lobsters of both species develop through a series of stages from egg to adult. Fertilised eggs are attached to pleopods (swimmerets) on the underside of the female's tail. The eggs develop for 3 to 6 months and hatch as small nauplisoma larvae. Within a few days these metamorphose into phyllosoma larvae, which develop through 11 stages during the 10 to 20 months they spend in the ocean. The last phyllosoma stage metamorphoses into the puerulus larva, a strong swimmer that returns to the coast and moults into the first juvenile stage if it finds suitable substrate.

Larval Distribution and Recruitment

435. An extensive distribution of phyllosoma and puerulus larvae of *J. edwardsii* has been observed in areas along the east coast of the North and South Islands, and the Tasman Sea, to areas outside the EEZ boundary. Information on larval settlement patterns is available from several parts of the country.
436. Most late-stage phyllosoma larvae occur beyond the edge of the continental shelf to 1100 km from the coast. Larvae undergo diurnal vertical migration, moving into the top 150 m of the water column at night and dispersing in deeper water during the day. It is possible that late stage phyllosoma larvae delay metamorphosis to the puerulus stage, perhaps until they encounter an environmental cue such as lower salinity shelf water.
437. Puerulus larvae are most common in the plankton within the shelf edge. They are near the sea bottom during the day and rise in the water column at night. They have been observed to settle on the sea bed at depths to 10 m.
438. The puerulus settlement season varies with locality. Along the east coast of Northland and the Bay of Plenty the main settlement season is probably summer; from East Cape through Cook Strait settlement occurs in both summer and winter. Autumn appears to be the main settlement period in the north-east of the South Island; winter and spring are the main settlement seasons south of Banks Peninsula; year-round settlement is possible along the west coast of the South Island.
439. The highest larval settlements have been seen along the east coast of the North Island south of Matakaoa Point, the northeast and south coasts of the South Island and the north Taranaki coast.
440. Because of the long larval life, the origins of larvae are difficult to determine. Larvae hatched in one area may be retained in that area by local eddy systems carried to other areas by currents, or lost to New Zealand entirely. Eddy systems have been identified off the east coast North Island that may help to retain larvae within this area. However, for most areas larvae may originate a considerable distance from the settlement site.
441. The only known large breeding population of *S. verreauxi* is near Cape Reinga. The larval life is probably similar to that of *J. edwardsii*. The developing phyllosoma larvae are probably carried by the East Auckland Current towards the Bay of Plenty. The puerulus larvae probably settle out of the plankton at various sites along this coast. A few larvae may be transported south of East Cape, but most either settle out before reaching this area or are lost to the north-east, towards the Kermadec Trench.

Age and Growth

442. Rock lobsters, as do all crustaceans, increase in size by moulting. Growth rate is a function of both moulting frequency and moult increment. Because rock lobsters lack structures that

would allow them to be aged, growth has been estimated from size-frequency distributions and tagging experiments.

443. Estimates of the growth rates for small *J. edwardsii* are available from the Gisborne area and Stewart Island. Males and females in Gisborne both reach about 38 mm CL one year after settlement and about 58 mm CL after two years. At Stewart Island, after one, two and three years they have reached 33 mm, 52 mm, and 68 mm CL.
444. Growth rates of larger animals have been estimated for a number of areas. The estimates of growth per moult, moult frequency, and annual growth vary between areas and between the sexes for the same area. The estimates come from ongoing tag release and recapture studies across most rock lobster management areas.
445. In most areas moulting is seasonal, with immature and mature animals of both sexes having their own distinct periods, which may vary between areas. Smaller males (between about 70 mm and 80 mm CL) from most areas generally moult twice a year. Large males moult once each year; very large males may moult even less often.
446. Information on the growth rate of *S. verreauxi* is limited mainly to animals between 120 mm and 159 mm CL. Males and females between 120 mm and 139 mm CL moult at least once a year, between July and November, and perhaps twice, with an increment of about 7 mm CL per moult. Animals between 140 mm and 159 mm CL moult once a year between July and November, with an average increment of about 6.8 mm and 6.0 mm CL for males and females respectively.

Movements

447. For management, the most important movements would be large-scale migrations or inshore-offshore movements. Extensive tagging of *J. edwardsii* has been conducted in many areas. In most areas fewer than 5% of the returns have moved more than 5 km. Such areas include Tauroa Point, Banks Peninsula, Gisborne, Wellington, and Fiordland.
448. Movement patterns in southern New Zealand appear to involve two groups of animals: “run” rock lobsters that migrate over long distances, and “resident” rock lobsters that do not. In most studies, only up to 4% tagged lobsters moved significantly from the release site. However, when “run” lobsters were tagged, between 27.6% and 38.6% recaptures showed long-distance movements.
449. The long-distance movements of *J. edwardsii* tagged in southern New Zealand tend to be directional: southward along the Otago coast and the east coast of Stewart Island, westward through Foveaux Strait and northward along the west coast of Stewart Island and the Fiordland coast, in opposition to the prevailing current systems. These movements also appear to be seasonal, usually occurring off the Otago coast and through Foveaux Strait from September through November and along the Fiordland coast during November through January. Most migrating females are immature, moving from Otago and Foveaux

Strait, which have a large size at 50% maturity to Fiordland, with a smaller size at 50% maturity. These movements may be a “contranatant migration” in which animals migrate against the current that carries the larvae.

450. The long-distance movements of *S. verreauxi* in northern New Zealand also appear directional. All but two recaptures tagged at North Cape moved to the west or southwest, most to near Cape Reinga. Of the female recaptures, only 10% were mature when tagged, but 80% were mature when recaptured. Only 10% of the females tagged at North Cape had setae on the pleopods, but 80% had setae when recaptured. This may be another contranatant migration, with juveniles at about the time of maturation near North Cape moving towards Cape Reinga, where the only large breeding population of this species is known.
451. There may also be a return movement towards the north against the prevailing current system along the east coast of the North Island by juvenile *S. verreauxi*. Most of the sublegal lobsters and immature females tagged between Bream Bay and Mahia moved north or west before recapture. Large numbers of sublegal animals are found on the east coast south of North Cape, but some legal-sized mature females are also found in this area. Thus juveniles from this area may also move towards Cape Reinga just before attaining sexual maturity.

Stock units and fisheries

452. The rock lobster fisheries extend from the Three Kings Islands in the north to the Snares Islands in the south, and to the Chatham Islands in the east. The main fishery is for *J. edwardsii* (CRA), which accounts for nearly all landings. There are currently ten quota management areas for CRA although one (CRA 10) is only an administrative designation and no fishing of any consequence is carried out there.
453. *S. verreauxi*; (PHC) is caught mainly in the north of the North Island and there is only one quota management area for all New Zealand waters.
454. Preliminary morphometric studies conducted on run and resident lobsters near Stewart Island show that the two groups can be distinguished on the basis of the telson length to carapace length ratio, but such differences may be environmentally induced.
455. The lack of genetic differences among areas, the long larval phase and long-distance movements of adults in some areas all suggest a single *J. edwardsii* stock around the mainland.
456. Recent stock assessments have addressed individual CRA areas (CRA 7 and CRA 8 in 2006; CRA 4 in 2003 and 2005; CRA 3 in 2001, 2004 and 2008; CRA 5 in 2003; CRA 1 and CRA 2 in 2002).

457. For earlier assessments, the seven principle mainland areas were grouped on the basis of similarities in relation to size at maturity, the timing of biological cycles, and the perceived interchange between areas. CRA 7 and CRA 8 are designated the “NSS” sub-stock. CRA 1 and CRA 2 are called the “NSN”, and CRA 3, CRA 4, and CRA 5 are called the “NSC”.
458. Genetic and morphometric samples have not been collected at the Chatham Islands, and, because of their geographical isolation, the rock lobsters from this area are also treated as a separate stock for management purposes.
459. Genetic and morphometric samples have not been taken for *S. verreauxi*. Because of the limited distribution of mature females near Cape Reinga, and the highly directional movements of tagged animals to this area, the species is considered a single stock.

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Glossary of Terms

Term	Explanation
Carapace	The part of the shell that covers the head and body of the lobster
Carbon dioxide	The waste product of respiration it passes out of the gills. Carbon dioxide dissolves in water to form a weak acid
Compound eyes	An eye, like that of insects, made up of numerous separate light sensitive units.
Eddies	Currents of water that move in a circular motion, like giant whirlpools.
Exoskeleton	The hard external skeleton (or shell) of the lobster
Gregarious	Living together in groups
Maturity	When the lobster becomes an adult and is able to reproduce
Membrane	The skin covering a part of the body
Metamorphose	To undergo a complete change of physical form from the larval stage to the juvenile stage
Migrate	To move from one area or habitat to another
Moulting	The process of shedding the hard shell (or exoskeleton) in order to grow a new and bigger shell.
Naupliosoma	The first stage larva that hatches from the egg. It lasts only a few minutes before moulting into a phyllosoma
Phyllosoma	The majority of the larval stages of the lobster. Phyllosoma spend 18 months to 2 years floating (and swimming in the plankton).
Pueruli	The final larval stages of the lobster. Pueruli actively swim to shore to settle and become juvenile lobsters
Salinity	The amount of salt in the seawater. This can change in seawater with evaporation or inflow of freshwater from rain or rivers
Seamounts	Underwater mountains rising from the ocean floor

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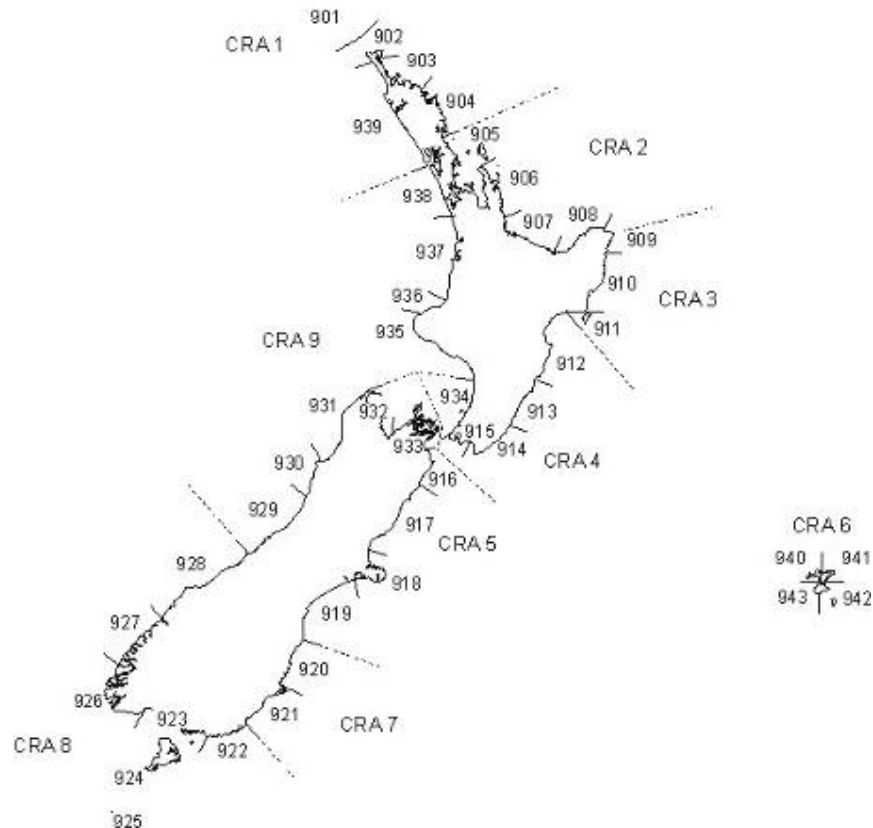
Additional Information can be found at: –

www.tagtracker.trophia.co.nz
www.nzrocklobster.co.nz
www.fish.govt.nz

STOCK SUMMARIES

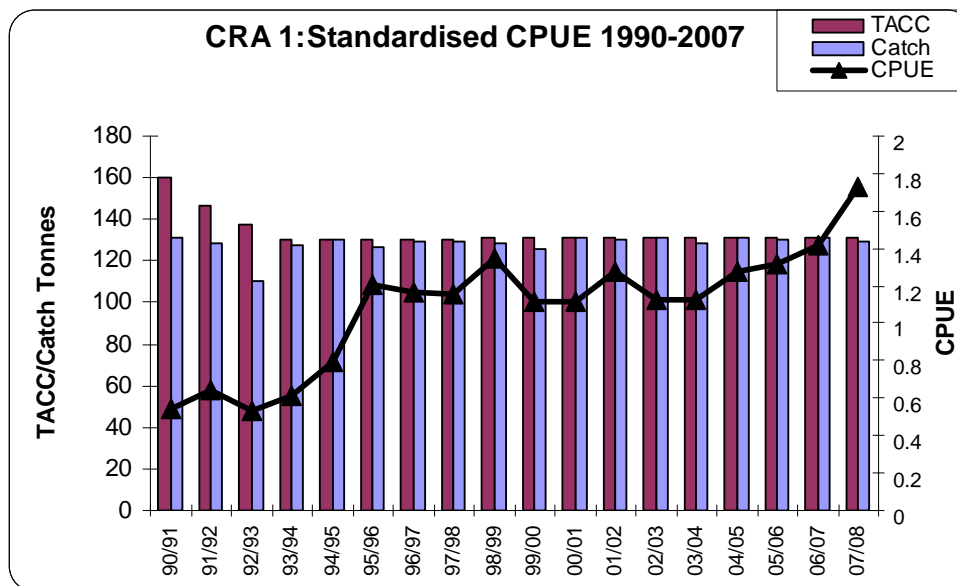
17. STOCK SUMMARIES

460. This section outlines the principal rock lobster fishing activities in each of the quota management areas and a brief summary of stock status taken from the most recent assessments.



Rock lobster fishery management areas (CRA 1 – CRA 9) and statistical areas used for commercial catch and effort reporting.

18. CRA 1

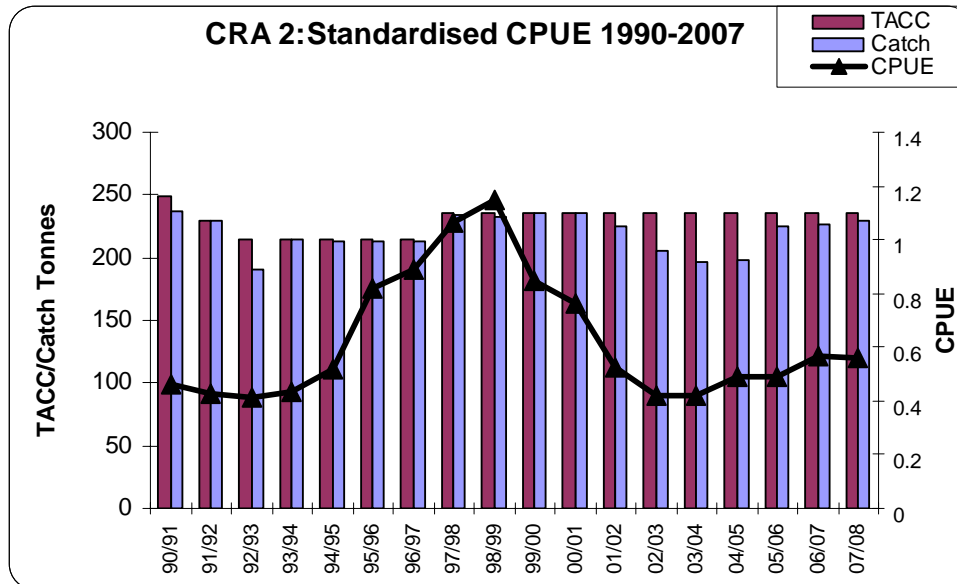


461. The CRA 1 fishery extends from the Kaipara Harbour on the west coast of the North Island around North Cape and then south to Waipu. The commercial fishery extends offshore to the Three Kings, but the bulk of the commercial harvest is taken from waters adjacent to the mainland. No TAC has been set for this fishery. The 130.46 tonnes TACC has remained unchanged since April 1993.
462. The 130.46 tonnes CRA 1 TACC is distributed amongst 23 quota share owners. Thirteen permit holders reported CRA 1 catches in 2007/08. The estimated landed value of the commercial catch was \$5.6 million (based on average port price paid to fishermen), making rock lobster an important contributor to the local and regional economy.
463. Amateur catch of rock lobster is estimated at 51 tonnes (MFish 1996). Diving using UBA is the predominant method used by amateur fishermen and women, although hand gathering, ring potting, and potting from vessels are also used.
464. Rock lobsters have cultural significance to local Maori and a large Maori population in the Northland region ensures that rock lobster retains significant customary value. No reliable estimates are available for customary catch. The progressive implementation of reporting procedures within the North Island Customary Regulations might assist in future evaluations of customary harvest for the CRA 1 fishery.
465. CRA 1 stock status is assessed using commercial catch and effort and quota monitoring report data. In addition, the CRA 1 commercial stakeholders group commissioned intensive catch sampling sequences for the fishery in the 1997/98 and 1998/99 seasons. Several tag,

release and recapture projects have been completed since 1996. The CRA 2006-01 research contract provides for catch sampling sequences to be done annually until 2010.

466. CRA 1 is part of the NSN substock that was assessed in 2002. The model results showed that the April 2001 stock abundance was higher than in the 1979-88 reference period. Projections at the end of a five year period (April 2006) had a median expected biomass near the 2001 level if catches were constrained to the levels used in the assessment.
467. The assessment noted that these projections should not be considered reliable much beyond two to three years but CPUE has stabilised or increased from 1999 to 2008 suggesting stable or increasing stock abundance.

19. CRA 2

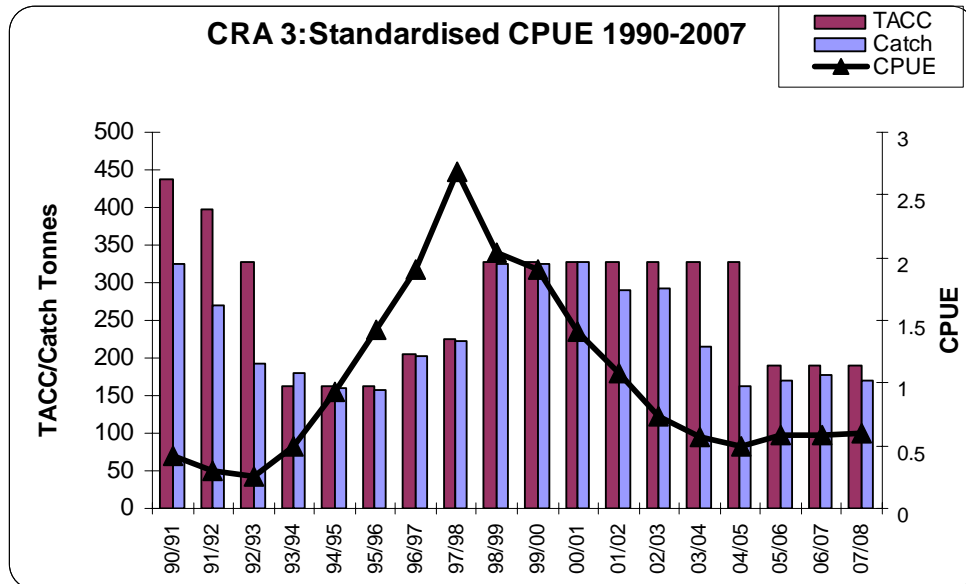


468. The CRA 2 fishery extends from Waipu through the Hauraki Gulf and Bay of Plenty to East Cape. The current 452.6 tonnes TAC for the fishery was set in 1997. The TAC is comprised of 140 tonnes for amateur catch, 16.5 tonnes for customary harvest and 60 tonnes for illegal removals. The current TACC is 236.1 tonnes.
469. The 236.1 tonnes TACC is distributed amongst 46 quota share owners. In 2007/08 there were 36 vessels reporting commercial catches. The main operating period for commercial vessels generally extends from June to January. The estimated landed value of the CRA 2 catch is \$10.9 million (based on average port price paid to fishermen) and the industry sustains a number of processing and export companies in Tauranga, Whitianga, and Auckland.
470. Amateur catch in this fishery is estimated at 140 tonnes (MFish 1996). Potting and diving are the preferred methods, and there is a large recreational charter vessel industry catering to the sector.
471. Customary catch is conservatively estimated at 16.5 tonnes. Anecdotal evidence in recent seasons suggests that the actual harvest may have been much greater. Rock lobsters have cultural significance to local Maori and a large Maori population in the Bay of Plenty region ensures that rock lobster retains significant customary value.
472. The CRA 2 Rock Lobster Company Ltd is the representative commercial stakeholder group for this region. The Company has made significant investments in rock lobster research since its formation in 1995, including a comprehensive vessel logbook programme, tag and

release projects, and sequences of intensive catch sampling to MFish standards and specifications. These data continue to be collected. ..The CRA 2 Company has recently invested in an Electronic Logbook trial intended to collect finer scale commercial catch and effort data.

- 473. Stock monitoring activities for the 2008/09 season include the continuation of logbook coverage, intensive catch sampling sequences within season, and tag recapture reporting. Similar coverage is contracted forward to 2010.
- 474. CRA 2 was assessed as part of the NSN substock in 2002. The model results suggested stock abundance in April 2001 was higher than in the 1979-88 reference period. Projections at the end of a five year period (to April 2006) had a median expected biomass near the 2001 level if catches were constrained to the levels used in the assessment. The assessment noted that these projections were less reliable than for CRA 1, as the uncertainty of future recruitment had more impact on the short term projected biomass.
- 475. CPUE in this fishery has been variable over time since 1979/80. CPUE for this fishery declined from 2001 to 2002, suggesting a decline in stock abundance, but then increased slightly in 2003, 2004, 2005, and again in 2006/07 and now appears to be stable and increasing.

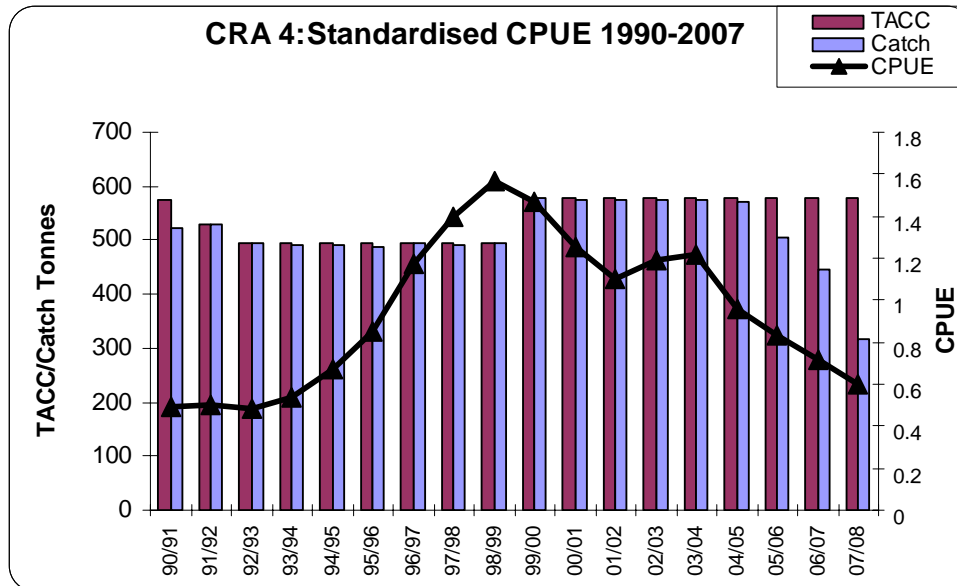
20. CRA 3



476. The CRA 3 fishery extends from East Cape south to the Wairoa River.
477. A stock assessment was carried out for CRA 3 during 2008. The assessment concluded that the CRA 3 stock is currently below the target stock size, Bref and is near Bmin. Under current catches and recent recruitments the assessment model predicts a 75% probability that stock size will decline over the next four years. On the basis of the projections the NRLMG is making recommendations to reduce CRA 3 catches to ensure sustainability.
478. The current 319 tonnes TAC is comprised of a 20 tonnes allowance for amateur catch, a 20 tonnes allowance for customary harvest, an 89 tonnes allowance for illegal removals and a TACC of 190 tonnes.
479. The TACC is distributed amongst 39 quota share owners. In 2007/08 CRA 3 landings were reported by 28 commercial vessels. There is significant Iwi involvement in quota share ownership and fishing. The commercial harvest has an approximate landed value of \$8.1 million (based on average port price paid to fishermen). There are two processing plants in Gisborne, and product is also shipped to Wellington, Tauranga and Auckland for processing and export.
480. Amateur catch is currently unknown but was estimated at 14 tonnes (RLFAWG 2001), although an allowance of 20 tonnes was again made in the 2005 TAC decision. Potting and hand gathering are the preferred amateur fishing methods.

481. Rock lobsters have great cultural significance to local Maori and there is a very high level of customary harvest activity. Customary removals are uncertain although an allowance of 20 tonnes was made in the 2005 TAC decision.
482. From May 2006 a multi-sector stakeholder group in Gisborne (the CRA 3 Multi-stakeholder Fishing Forum) has been working to develop a fisheries plan focussed on improving the status of the stock and addressing competing interests between extractive users. The CRA 3 Forum, assisted by MFish, produced a draft CRA 3 Fishery Plan in 2008.

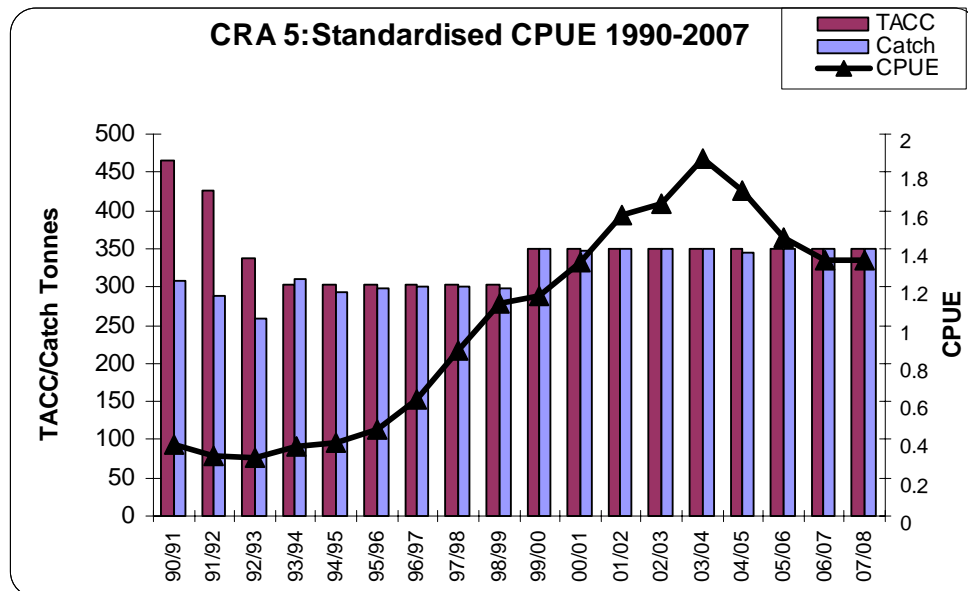
21. CRA 4



483. The CRA 4 fishery extends from the Wairoa River on the east coast, southwards along the Hawkes Bay, Wairarapa and Wellington coasts, through Cook Strait and north to the Manawatu River.
484. A CRA 4 TAC was first set in April 1999 and remains at 771 tonnes. In that 1999 decision, the TACC was increased from 495.3 tonnes to 576 tonnes. Before 1999 the TACC remained unchanged since April 1993. Within the TAC a total of 85 tonnes is allowed for amateur catch and 35 tonnes for customary catch. An allowance of 75 tonnes is made for illegal unreported removals. The most recent (2005) CRA 4 stock assessment is reported in detail in the RLFAGW 2005 Plenary Report.
485. In November 2005 the CRA 4 industry observed changes in stock abundance as measured by CPUE for AW period of the season. CPUE was closely monitored in the AW period of the 2006/07 season and in November of that year the CRA 4 industry sought and received science advice which resulted in the operation of a CRA 4 Management Procedure which set a voluntary commercial catch limit for the 2007/08 season which commenced on 01 April 2007. The limit was 339 tonnes, a 44% reduction to the CRA 4 ACE generated by the TACC.
486. The industry initiative was taken primarily to arrest further stock decline and to re-set the commercial catches to increase the size frequency distribution and abundance of lobsters at peak catching times when export market prices are most advantageous. The voluntary catch limit was implemented by way of an ACE “shelving” initiative.

487. The operation of the Management Procedure and the administrative management of the ACE shelving transactions which secure the commercial catch limit are overseen by the CRA 4 Industry Association (CRAMAC 4) and are coordinated by the NZ RLIC.
488. The CRA 4 Management Procedure was operated again in November 2007 and a new commercial catch limit confirmed for the 2008/09 season. The current commercial catch limit is 240 tonnes, a 60% reduction to the CRA 4 ACE generated by the TACC. In response to industry initiatives to constrain removals from the CRA 4 fishery, a consortium of recreational fishing clubs is promoting a voluntary reduction in the amateur daily bag limit from six to four rock lobsters.
489. The CRA 4 Management Procedure is intended to run for three more fishing years and be reviewed in the third. The Procedure has been operated in November 2008 and sets a commercial catch limit of 266 tonnes. The NRLMG is recommending that the Minister uses the procedure to guide the CRA 4 TAC and TACC decision effective 01 April 2009.
490. The current 576 tonnes TACC is distributed amongst 86 quota share owners. The CRA 4 fleet comprised 53 vessels in 2007/08. With the implementation of the voluntary commercial catch reduction in April 2007 and 2008, the "pool" of ACE available to the CRA 4 fleet was considerably reduced and vessel numbers have declined in the current season. The majority of vessels in the fleet operate from coastal bases in isolated rural areas on the Hawkes Bay and Wairarapa coastline. The CRA 4 commercial catch supports several processing and export operations in Napier and Wellington, and Auckland.
491. The amateur catch is estimated at 73 tonnes (MFish 1996). Potting and hand gathering are the preferred methods for amateur fishers in this area. As in most CRA areas, the majority of amateur catch is taken in the summer months. The region sustains a recreational fishing and dive charter industry during those months.
492. Zone 5 Big Game Fishing Council amateur fishing clubs have recently implemented a voluntary daily bag limit reduction (from 6 lobsters per person per day to 4) to support the voluntary commercial reductions and efforts to increase abundance in the fishery. This initiative has been supported by the Te Kupenga Whiturauroa a Maui Kaitiaki Forum.
493. Aggregate customary harvest estimates for CRA 4 are not available, but the reporting requirements associated with the implementation of the North Island Customary Regulations should enable more informed decision making in future.
494. A comprehensive stock monitoring programme has been established in the CRA 4 fishery. There is a long time series of intensive catch sampling data from Napier, Castlepoint, Cape Palliser, and the Wellington south coast. This series was extended in the current season with a total of 32 sample days completed for the period May 2008 to January 2009 and further stock monitoring activities are confirmed through to 2010. Puerulus settlement is also monitored at several sites within CRA 4.

22. CRA 5

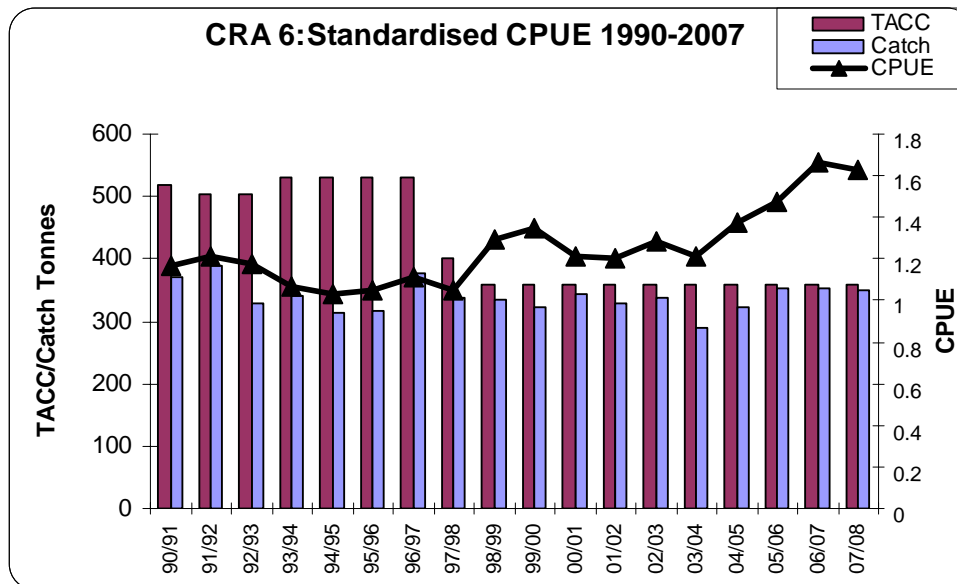


495. The CRA 5 fishery extends from the western side of the Marlborough Sounds across to Cape Jackson and then southwards to Banks Peninsula. There are three distinct regions of commercial fishing — Picton/Port Underwood, Ward-Kaikoura-Motunau, and Banks Peninsula, although a small number of commercial vessels work the area from Nelson through to D'Urville Island. The bulk of the commercial catch is taken from the area bounded by Tory Channel in the north and Motunau in the south.
496. The 2003 stock assessment for CRA 5 is reported in detail in the RLFAWG 2003 Plenary Report. The current TAC of 467 tonnes was set in April 1999 and has been unchanged since. In that decision 40 tonnes was allowed for amateur catch and 40 tonnes for customary catch. The TACC was increased from 303.7 tonnes to 350 tonnes. The allowance for illegal unreported removals is 37 tonnes.
497. Amateur catch is estimated at 35 tonnes (MFish 1996). The preferred methods for amateur fishing are potting and diving with UBA. Recreational rock lobster fishing and the dive charter industry are both growing in the region. Dive clubs in the region have actively reported tag recapture information and maintain an ongoing interest in the regional research programme.
498. There are low estimates of customary harvest in CRA 5.
499. There are 43 quota share owners in CRA 5. The fleet comprised 28 vessels reporting catch in 2007/08. Many commercial vessels work off beaches between Port Underwood and Motunau. The landed value of the commercial catch was estimated at \$17 million in 2007

(based on average port price paid to fishermen), and the fishery supports processing and export facilities in Ward, Kaikoura, and Christchurch

500. The CRA 5 industry members, through membership of their commercial stakeholder group CRAMAC 5, have encouraged and facilitated an ongoing dialogue with amateur fishing and dive clubs and with Iwi groups in the region. The responses to the process have been extremely encouraging in terms of future co-operative research and management initiatives.
501. CRA 5 has an intensive stock-monitoring regime in place. Intensive catch sampling and tag and release projects have been done as Fisheries Required Services, and CRAMAC 5 operates an extensive Vessel Logbook programme that provides data to the stock assessment process. Similar levels of stock monitoring are confirmed through to 2010.

23. CRA 6

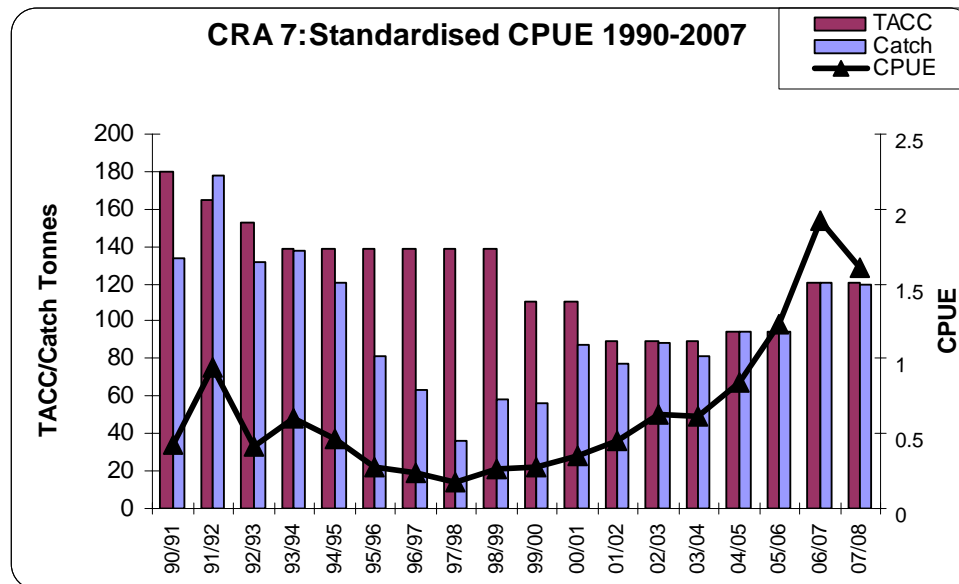


502. The region designated as CRA 6 is geographically very large, being all waters within a 200 nautical mile radius of the Chatham Islands and Bounty Islands, but the area being fished is restricted to a relatively narrow coastal margin adjacent to the Chatham Islands coastline.
503. The fishery is unique in that despite declines in landing and CPUE from historical levels; the lobsters caught generally comprise much larger size classes than are found in mainland fisheries. The reasons for the decline in catch and CPUE are unknown, and length frequencies of the landed catch have changed little since the development of this fishery. Previous RLFAGW reports have noted that the CRA 6 data are consistent with a stock model in which the biomass being fished is much smaller than the biomass of the contributing stock.
504. The abundance of the standing stock in CRA 6 is likely to be more dependent on immigration of larger lobsters into the area than it is on recruitment and growth. This reduces the likely effectiveness of management interventions.
505. For the 1998/99 fishing year a TAC of 370 tonnes was set. A total of 6 tonnes was set aside for amateur catch and 4 tonnes was provided for customary catch. The TACC was reduced from 400 tonnes to 360 tonnes in response to Mfish concerns over declining landings and declining CPUE. The TAC and TACC remain unchanged since April 1998 and CPUE has stabilised and continues to show incremental improvement.
506. CRA 6 is unique in that unlike all other CRA management areas, two harvest methods are allowed for commercial fishing. The bulk of the TACC is landed from vessels using pots, but

there are limited numbers of method concessions issued for the fishery and divers take large quantities of lobsters in the summer months.

507. There are 48 CRA 6 quota share owners. Mainland New Zealand interests own the majority of quota. There are currently 36 vessels reporting CRA 6 landings and the number of divers is unknown although only 11 of the original method exemptions issued to qualifying persons between 1990 and 1993 were current during 2005-06. Additional divers operate under the authority of permits in the name of the consent holders.
508. The landed value of the commercial catch in 2006/07 was approximately \$12.8 million (based on average port price paid to fishermen). The fishery supplies processing and export facilities on the Chatham Islands and in Auckland, Wellington, and Christchurch.
509. The CRA 6 Industry Association established a Fishermen's Office at Waitangi in May 2000 and the NZ RLIC contracted an administrative officer trained by FishServe to co-ordinate the distribution and collation of Catch Effort Landing Returns and Monthly Harvest Reports for delivery to FishServe and to provide a range of additional administrative services to the Chatham Islands seafood industry.
510. There is no major research programme currently underway for the fishery because all previous research initiatives — intensive catch sampling, tagging, and juvenile abundance surveys — have delivered similar results. There are also high costs associated with research co-ordinated from the mainland. However, the CRA 6 Industry Association is managing a Vessel Logbook programme, such as used in CRA 2, CRA 5, and CRA 8, to collect size frequency and abundance information.

24. CRA 7

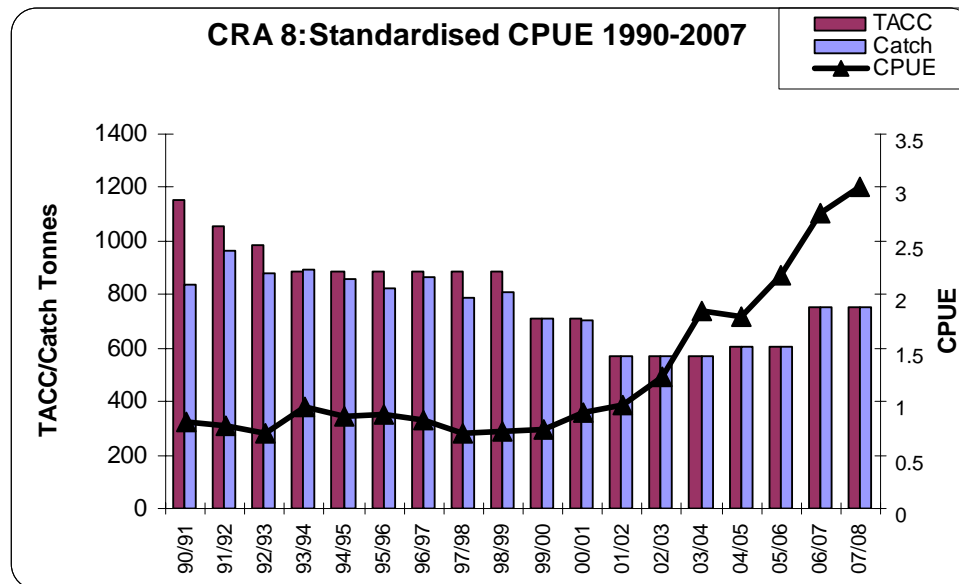


511. The CRA 7 fishery extends from the Waitaki River south along the Otago coastline to Long Point.
512. The CRA 7 fishery is one of the two fisheries that comprise the NSS sub-stock that until 2007 was used for assessment purposes. CRA 8 is the other. The TAC and allowances within the TAC are now set for CRA 7 by the operation of a management procedure which was implemented in 2008.
513. The CRA 7 TAC is currently 143.9 tonnes. A total of 10 tonnes was provided for customary catch, 5 tonnes was set aside for amateur catch and 5 tonnes for illegal unreported removals. The TACC was set at 123.9 tonnes.
514. There are 33 CRA 7 quota share owners. In the 2007/08 season 14 commercial vessels reported CRA 7 landings. The landed value of the catch is estimated at \$4.2 million (based on average port price paid to fishermen). The CRA 7 catch is processed and exported or sold to the domestic market by several Dunedin and Christchurch fishing companies.
515. The most recent estimates of recreational rock lobster catches from CRA 7 are less than 5 tonnes. There are no recent estimates of customary removals but for assessment purposes removals are estimated at 1 tonne for customary and 1 tonne for illegal unreported.
516. Stock monitoring coverage in CRA 7 comprises a scheduled sequence of 18 observer sampling days across all Statistical Areas in every season and during 2007 a rock lobster tag

and release programme was updated with 3000 tags deployed between June and September.

- 517. The CRA 7 commercial season runs from 20th June to 19th November inclusive and the MLS is a tail length of 127 mm for both male and female lobsters. The fishery is open to amateur fishing all year with a MLS regime of 54 mm TW for males and 60 mm TW for females.
- 518. The CRA 7 fishery is unique in that there is a 'buffer zone', closed to commercial rock lobster fishing which was incorporated into a regional harvest initiative agreed by amateur and commercial users in 1993 in response to concerns over sustainability of the stock.

25. CRA 8

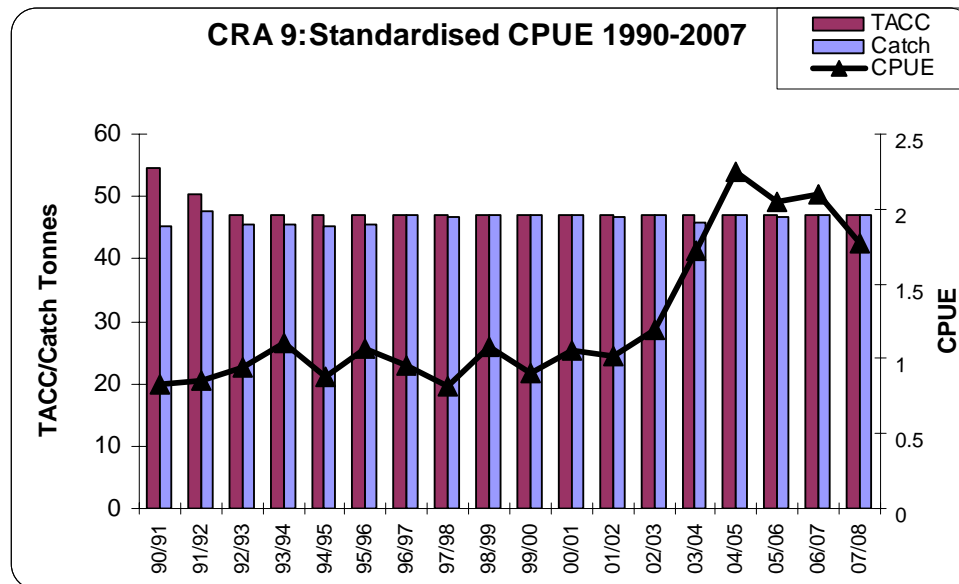


519. The CRA 8 fishery is the largest mainland fishery geographically. The region extends from Long Point south to Stewart Island and the Snares, the islands and coastline of Foveaux Strait, and then northwards along the Fiordland coastline to Bruce Bay. The CRA 8 fishery is included with CRA 7 in the NSS assessment and management procedure analysis.
520. A TAC of 1053 tonnes was set in the 2008/09 fishing year. A total of 29 tonnes was set aside for amateur catch and 30 tonnes was provided for customary catch. The TACC was set at 966 tonnes. The TAC adjustment was undertaken in response to the triggering of the harvest control rule in the CRA 8 Management Procedure.
521. Amateur catch is estimated at 16 tonnes (MFish 1996). The preferred methods for amateur fishing are potting and diving with UBA. There are no reliable estimates of customary catches.
522. There are 104 CRA 8 quota share owners. In the 2007/08 season there were 57 commercial vessels reporting CRA 8 landings. The CRA 8 fleet operates in the most remote coastal areas of South Westland and Fiordland. The value of the landed catch is estimated to be in excess of \$42 million (based on average port price paid to fishermen). The industry supplies processing and export operations in Te Anau, Riverton, Stewart Island, Invercargill, Bluff, Christchurch, and Wellington.
523. The CRA 8 Industry has developed and implemented codes of practice in relation to use and disposal of fishing gear and refuse, and as a founding member of the Guardians of Fiordland

Fisheries, has contributed to an extensive code of practice for the waters adjacent to the World Heritage area.

524. The CRA 8 Management Committee Inc. is the commercial stakeholder organisation for the fishery. The committee employs a Chief Executive. The committee fully funded an extensive Voluntary Logbook programme until 1998 when it was incorporated as a Fisheries Research Service.

26. CRA 9



525. The CRA 9 fishery is geographically large but has the smallest TACC of any region (with the exception of CRA 10). The fishery extends from north of Bruce Bay to the Kaipara Harbour but commercial lobster fishing is constrained to the north-west coast of the South Island and the area between Patea and Kawhia, in particular the Taranaki coastline. No TAC has been set for this fishery and the 47 tonnes TACC has remained unchanged since 1992.
526. There are no estimates of amateur or customary catch for the CRA 9 fishery.
527. There are sixteen CRA 9 quota share owners. In the 2007/08 season seven commercial vessels reported CRA 9 landings. The estimated value of the landed catch is \$2.4 million (based on average port price paid to fishermen). The industry supplies processing and export operations in Marlborough, Nelson, New Plymouth, Wellington, and Auckland.
528. No stock assessment has been made for the CRA 9 fishery. CPUE was consistent over many years and has shown a significant increase then stabilised since 2001/02. The TACC has constrained commercial landings in every season from 1990, and CPUE has been stable or increasing over the same period suggesting a stable or increasing stock.

27. PACKHORSE ROCK LOBSTER – PHC

529. The packhorse rock lobster management area extends to all of New Zealand.
530. The TACC for this fishery was set at 30 tonnes in 1990, but was increased to 40 tonnes in 1992 as a result of appeals. Historically the fishery has been primarily an incidental catch for many commercial rock lobster fishermen in the Northland/Auckland and Bay of Plenty regions. However several fishermen did successfully target the species prior to 1990 and dependent on environmental conditions others have attempted to do so in several seasons since.
531. Because of different biology and behaviour of this species, the MLS is set at 216 mm tail length. Prohibitions on the taking of berried female lobsters apply. In addition, a large area of water to the north-east of North Cape was closed to commercial rock lobster fishing on a year-round basis in 1977 in an apparent effort to protect what was then thought to be a large concentration of sub-legal PHC rock lobsters.
532. Commercial catches have fluctuated since 1990, reaching a peak of 25 tonnes in two recent seasons, the highest commercial catches since the 1995/96 season. The more recent reported commercial landings are:

Season	PHC Commercial Landings (tonnes)
1999-00	12.6
2000-01	9.8
2001-02	7.8
2002-03	8.6
2003-04	16.4
2004-05	20.8
2005-06	25.0
2006-07	25.4
2007-08	n/a

Table 9: Packhorse Lobster Commercial Landings

533. It is thought that the shortfall of catch against quota reflects the low levels of target effort being directed at the fishery which is known to have variations in abundance possibly determined by weather and sea temperatures.
534. In 2003/04 an estimated 24 commercial vessels reported PHC catch. Less than five are known to be target fishing the species, all of these are operating in either CRA 1 or CRA 2. The value of the landed catch is estimated to be in excess of \$500,000.

535. There are no estimates of amateur catches for the species but divers using UBA are known to target PHC in Northland and the Bay of Plenty as “trophy” fish. There are no estimates of customary harvest.

28. SUMMARY OF ROCK LOBSTER FISHERIES REGULATIONS

536. The following is a summary of the important regulations governing the rock lobster fishery. This is not exhaustive and concentrates on the catching sector rather than on processing or related activities.
537. Differential minimum legal sizes (MLS) apply to *J. edwardsii*.
- a) The general MLS is 54 mm tail width (TW) for male rock lobsters and 60 mm TW for females, and this is the standard measure for amateur fishing in all areas.
 - b) In the Otago area (between the Waitaki River and Nugget Point), the MLS for commercial fishing is 127 mm tail length (TL).
 - c) In Southland the MLS for commercial fishing is 54 mm TW for males and 57 mm TW for females.
 - d) In the Gisborne-East Coast region the commercial fishing MLS for males is 52mm TW for the months of June, July and August only and reverts to 54 mm TW for the remainder of the fishing year. The MLS for female rock lobsters is 60 mm TW year around.
538. For each of those regions the MLS differentials are linked to the TACCs based on yield estimates that have been determined by stock assessments.
539. The minimum legal size for *S. verreauxi* (Packhorse) is 216 mm TL throughout New Zealand.
540. The taking of rock lobsters with external eggs attached, the removal of those eggs, and the removal of the pleopods (or swimmerets) from the ventral surface of the tail are prohibited.
541. The taking of rock lobsters in the soft shell stage is prohibited.
542. Rock lobsters must be undamaged and able to be measured.
543. Rock lobsters must be landed whole and alive, except in the Southland (CRA 8) fishery area, where tails may be separated from the bodies at sea and the tails only landed subject to stringent hygiene, handling and reporting requirements.
544. There are three regulatory closed seasons:

- a) All commercial rock lobster fishing is prohibited at the Chatham Islands (CRA 6) from 1 March to 30 April.
- b) *Jasus edwardsii* less than 54/60 mm TW, but at least 127 mm tail length are permitted to be taken in Otago (CRA 7) only from 20th June to 19th November inclusive and the fishery is closed to commercial fishing for the remainder of the fishing year.
- c) For commercial fishing there is a one month (May) regulatory closure in CRA 3 and a one month voluntary closure (15th December to 15th January inclusive). CRA 3 commercial stakeholders extended the voluntary closure to encompass September 1st to January 15th in the current fishing year.

545. There are seven small closed areas on the North and South Islands, which are described in the Rock Lobster Regulations. There are several regulated area closures in force on the Chatham Islands. In addition, all fishing is excluded from areas designated as marine reserves and mataitai (See Annex 1).

546. Commercial fishermen must meet prescribed standards and specifications before taking rock lobsters:

- a) It is a requirement for a commercial fisherman to own a minimum quantity of ACE for the target stock before taking rock lobsters. All catch taken must be balanced with ACE for the stock. Failure to do so can result in financial penalties and permit revocation.
- b) Commercial fishermen can only sell catch to Licensed Fish Receivers, and they in turn can only buy product from legitimate commercial fishermen.
- c) Commercial fishing can only be undertaken from a registered fishing vessel.

547. There are various requirements and restrictions governing fishing methods used by commercial fishermen:

- a) The permitted method for taking rock lobsters is potting; rock lobsters taken as a by-catch from other fishing methods must be returned to the sea alive;
- b) The taking of rock lobsters by free diving is permitted to a small number of qualifying persons in the CRA 6 fishery;
- c) All pots and floats must be labelled with the vessel registration number;

- d) All pots must be fitted with Regulation escape gaps, intended to reduce sub-legal handling and predation mortalities.

548. Amateur fishermen are permitted to catch rock lobster by any fishing method, except for the use of baited nets and explosives, but are prohibited from selling their catch. Amateurs use potting, diving (freediving and underwater breathing apparatus - UBA), and handgathering to harvest rock lobsters, but they are restricted to a limit of six legal rock lobsters per person per day other than in Fiordland and amateur pot limits also apply – 3 pots per person to a maximum of six pots on any one vessel. Otherwise amateurs are governed by the same regulations pertaining to escapement and the state of landed lobsters as commercial fishermen.

549. Other than a regulatory prohibition on any commercial transactions related to customary take, rules pertaining to customary harvest are determined by the relevant Iwi authority but in general must ensure the sustainable utilisation of stocks.



29. MANAGEMENT PROCEDURE SPECIFICATIONS

CRA 7 AND CRA 8 MANAGEMENT PROCEDURE SPECIFICATIONS

550. Both the CRA 7 and CRA 8 proposed management procedures specify that:
- a) the output variable is TAC (tonnes) and that standardised CPUE (kg/pot) is to be used as the input variable,
 - b) standardised CPUE is to be based on the autumn–winter (AW: April–September) season of the current fishing year and the spring–summer (SS: October–March) season of the previous fishing year, and
 - c) CPUE is to be standardised according to the recent usage described in annual Fishery Assessment Reports (FARs), using a data extract obtained in November to ensure that sufficient data from the most recent AW season have been entered.

CRA 7 Management Procedure Specifications

551. For CRA 7, the proposed management procedure is specified as follows:
- a) The TAC is to be set at 100 times the standardised CPUE (Figure 9);
 - d) The management procedure is to be evaluated every year (no “latent year”);
 - e) If the procedure results in a TAC that changes by less than 5%, no change will be made; and
 - f) If the procedure results in a TAC that changes by more than 50%, the TAC will be changed by 50% only.

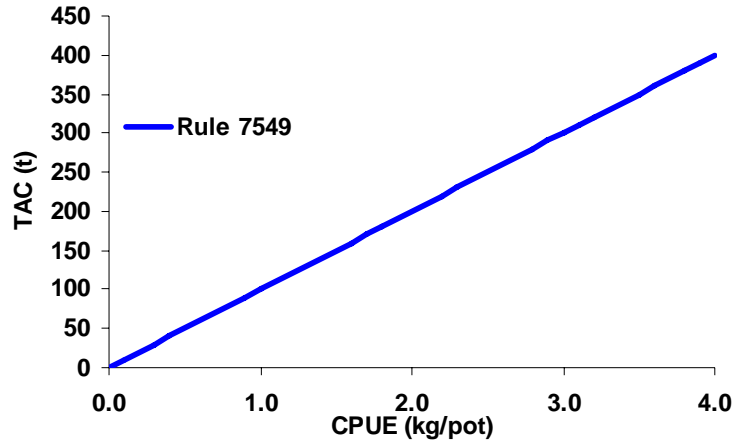


Figure 9: CRA 7 management procedure

CRA 8 Management Procedure Specifications

552. For CRA 8, the proposed management procedure is specified as follows:

553. The relation between CPUE, indicated by C_y , and TAC, indicated by T_{y+1} , is given in Figure 10:

$$T_{y+1} = \begin{cases} h - s_1(p_1 - C_y) \frac{h}{p_1}, & C_y < p_1, \\ h, & p_1 \leq C_y \leq p_2, \\ h + s_2(C_y - p_2) \frac{h}{p_1}, & C_y > p_2. \end{cases}$$

Figure 10

a) The parameters referred to in the equations above for this management procedure are:

h	p_1	p_2	s_1	s_2
1053	1.9	3.2	1.2	0.16

Figure 11

b) The management procedure is to be evaluated every year (no “latent year”);

- c) If the procedure results in a TAC which changes by less than 5%, no change will be made;
- d) There is no limit to the amount by which a TAC may change.

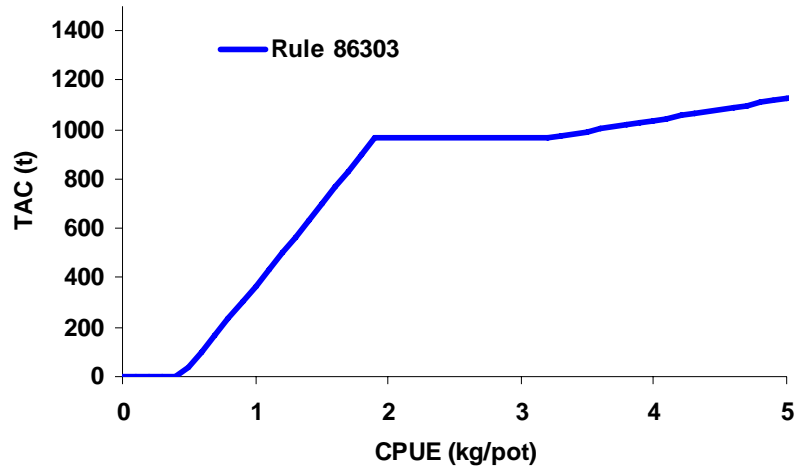


Figure 12: CRA 8 Management Procedure

- 554. Management procedures should not remain in place for longer than about five years without a review, because in five years the operating model used to evaluate management procedures will be obsolete, and fishery performance should be re-evaluated. Such a review was written into the 2002 NSS Management Procedure (Bentley et al. 2003). The NRLMG recommends that a review of these management procedures take place in 2012.

CRA 4 Management Procedure Specifications

- 555. After a stock assessment for CRA 4 (Breen et al. 2006), a large set of management procedure evaluations was done, using an operating model based on the CRA 4 assessment model (Breen & Kim 2006b).
- 556. The 2005-06 catch in CRA 4 was 504 t; this was less than the TACC of 577 t. In the latter part of 2006 it was obvious that the catch for 2006-07 would be even further below the TACC in the event it turned out to be 445 t). A series of industry meetings discussed options that included adoption of a management procedure or decision rule that would specify annually how much ACE should be voluntarily shelved.
- 557. The Breen & Kim (2006b) study was used as the basis for choosing a management procedure. One of the obvious requirements, not considered by Breen & Kim, was that the 2007-08 catch limit should be set low enough that it actually constrained the catch. A rule

was chosen that specified a low catch limit (321 t) when using the most recent CPUE estimate. This rule, E170 (Figure 13), is specified as follows:

$$SCC_{y+1} = 500 \left(\frac{I_y}{0.9} \right)^{1.4}$$

Figure 13

where SCC is the specified commercial catch limit and I is standardised CPUE from the most recent AW season. There is no latent year⁸; the maximum allowable change is 75% and the minimum change is 5%.

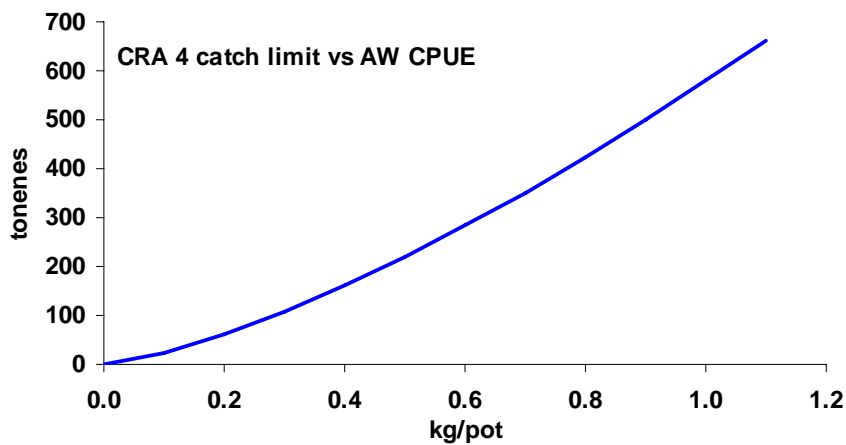


Figure 14: The CRA 4 Management Procedure.

- 558. Table 9 below shows the history of the rule. In late 2006, the rule delivered a specified catch limit of 321 t. Not all quota owners shelved the requisite ACE, resulting in an operational limit of 339 t, a 41% reduction from the TACC.
- 559. In late 2007, the rule delivered a specified catch limit of 229 t. Not all quota owners shelved the requisite ACE, resulting in an operational limit of 245 t, a 57% reduction from the TACC.

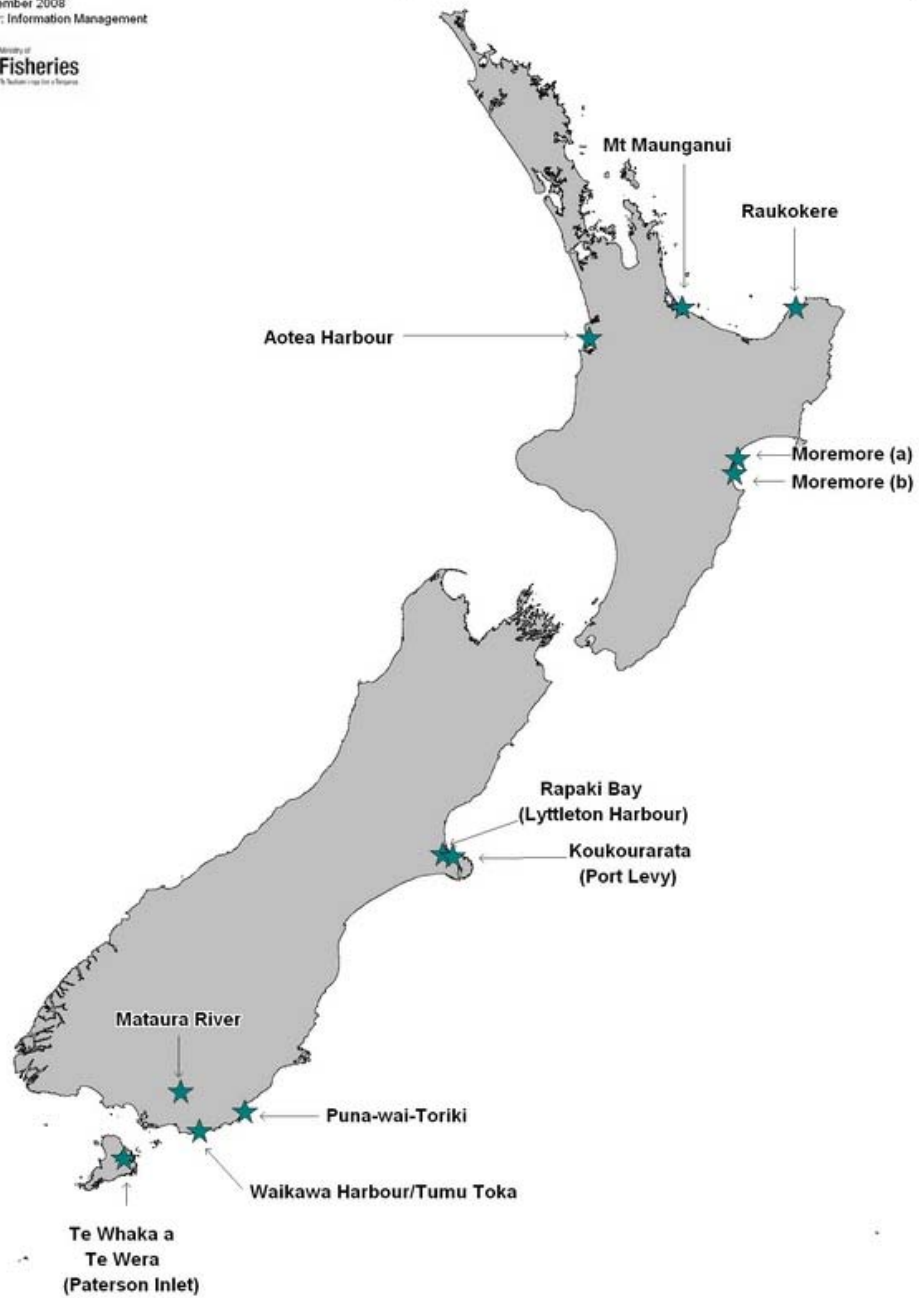
Table 9

year	applied to fishing year	AW CPUE	rule result	operational limit
2006	2007-08	0.656	321.1	339
2007	2008-09	0.515	228.9	240
2008		0.573	265.9	

⁸ The original MPEs described by Breen & Kim (2006b) used an asymmetric latent year, under a decrease could be made, but not an increase, in a year following a change. The latent year was dropped before a rule was adopted, at the request of NZ RLIC Ltd., after examination of the performance of the rule without a latent year.

Gazetted Mātaitai Reserves December 2008

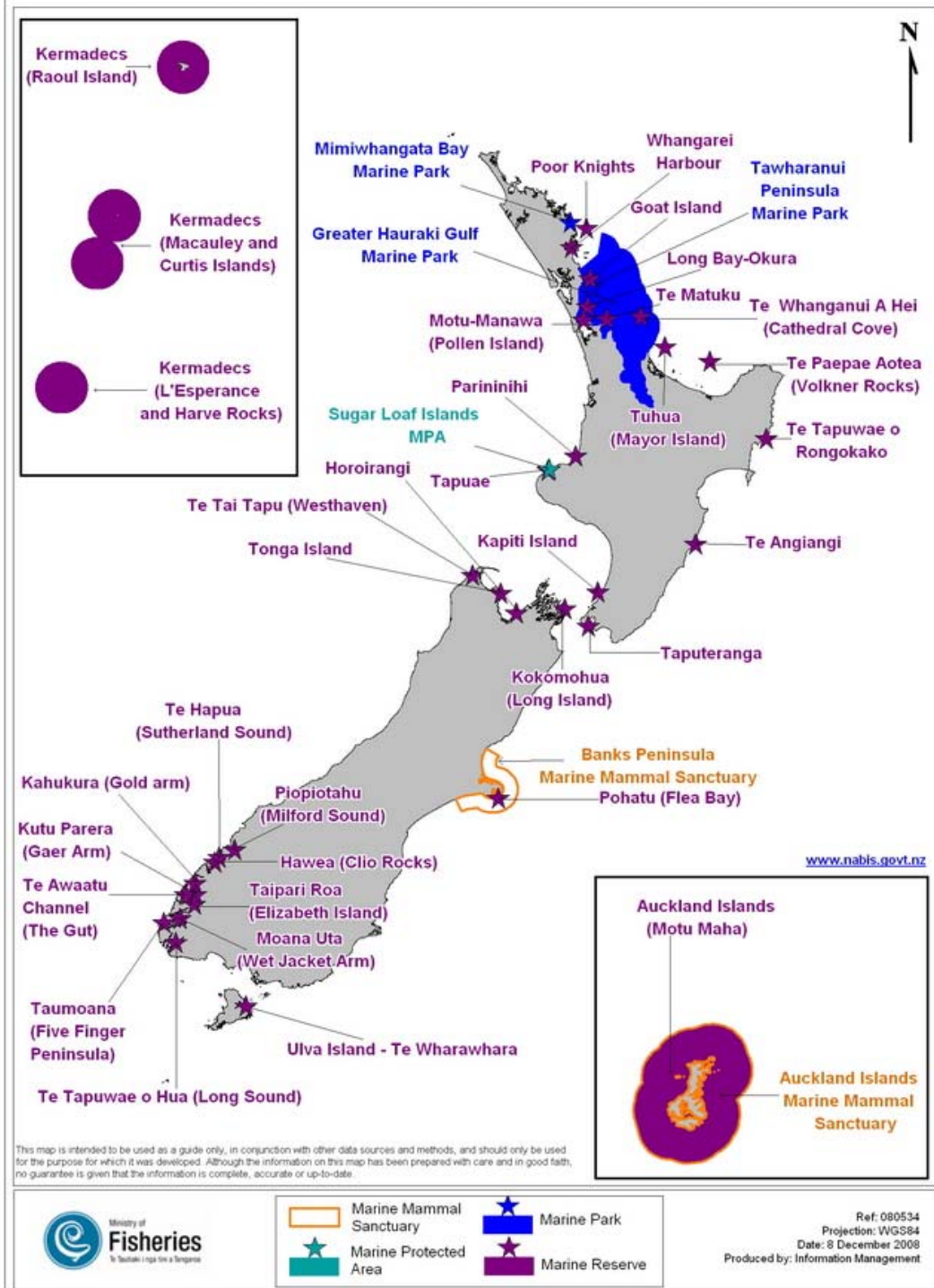
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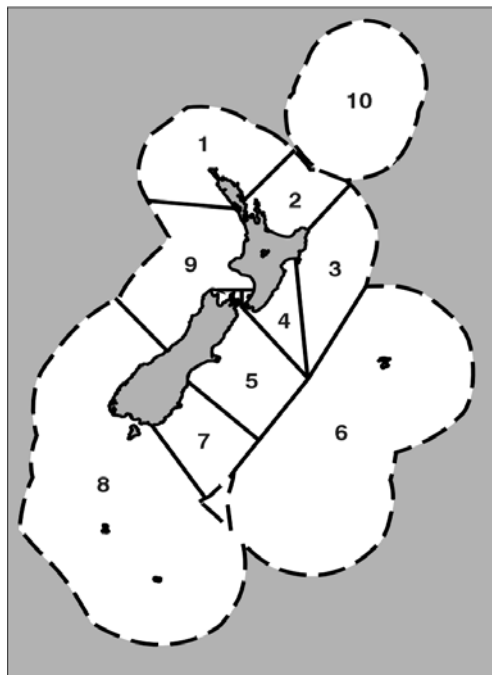
Marine Protected Areas December 2008



31. ANNEX 2: MID-YEAR STOCK ASSESSMENT PLENARY REPORT

ROCK LOBSTER (CRA and PHC)

(*Jasus edwardsii*, *Sagmariasus verreauxi*)



1. FISHERY SUMMARY

Two species of rock lobsters are taken in New Zealand coastal waters. The red rock lobster (*Jasus edwardsii*) supports nearly all the landings and is caught all around the North and South Islands, Stewart Island and the Chatham Islands. The packhorse rock lobster (*Sagmariasus verreauxi*) is taken mainly in the north of the North Island. Packhorse lobsters (PHC) grow to a much larger size than do red rock lobsters (CRA) and have different shell colouration and shape.

The rock lobster fisheries were brought into the Quota Management System (QMS) on 1 April 1990, when Total Allowable Commercial Catches (TACCs) were set for each Quota Management Area (QMA) shown above. Before this, rock lobster fishing was managed by input controls, including minimum legal size (MLS) regulations, a prohibition on the taking of berried females and soft-shelled lobsters, and some local area closures. Most of the input controls have been retained, but the limited entry provisions were removed and allocation of individual transferable quota (ITQ) was made to the previous licence holders based on catch history.

Historically, three rock lobster stocks were recognised for stock assessment purposes:

- NSI – the North and South Island (including Stewart Island) red rock lobster stock
- CHI – the Chatham Islands red rock lobster stock
- PHC – the New Zealand packhorse rock lobster stock

In 1994, the Rock Lobster Fishery Assessment Working Group (RLFAWG) agreed to divide the NSI stock into three substocks:

- NSN – the northern stocks CRA 1 and 2
- NSC – the central stocks CRA 3, 4 and 5
- NSS – the southern stocks CRA 7 and 8

CRA 9 has not been assigned to a substock. Since 2001, assessments have generally been carried out at the fishstock level, i.e. for CRA 1, CRA 2 &c.

Time series of commercial landings and catch per unit effort (CPUE) data are provided for stocks NSI, NSN, NSC, NSS and CHI for comparison with earlier years. The fishing year runs from 1 April to 31 March.

The NSI stock is composed of the CRA QMAs 1–5 and 7–9, each being a separate Fishstock with a separate TACC. The sum of the TACCs for the NSI stock was set at 3 275 t for the year commencing 1 April 1990. This total was reduced in each year until 1993–94 to reach 2 382 t (taking into account some increases in individual ITQs resulting from appeals over catch histories by fishers). The total TACC for the NSI stock then fluctuated at a level of 2 300 to 2 400 t to the 2005–06 season, when the NSI TACC dropped to 2 229 t through a reduction to the CRA 3 TACC from 327 t to 190 t (Table 1). The CRA 3 TACC dropped at the same time from 453 t to 319 t. The total NSI TACC increased in 2006–07 to 2 407 t through increases to the CRA 7 and CRA 8 TACCs from the operation of the NSS Decision Rule in 2005. The CRA 4 stakeholders took voluntary reductions in their effective TACC by agreeing to a shelving of ACE (annual catch entitlement) in both 2007 and 2008. The TACCs and TACs for CRA 7 and CRA 8 were increased again on 1 April 2008 through the operation of a revised decision rule which was evaluated and approved in late 2007 and early 2008 (Table 1). The total New Zealand TACC for rock lobster in 2008–09 is 2 981 t, the highest it has been since 1992–93.

The TACC for the CHI stock (CRA 6) was set at 518 t in 1990 but increased through appeals to 531 t by the beginning of the 1993–94 fishing year (Table 1). The CHI TACC was subsequently reduced to 400 t in 1997–98 and to 360 t in 1998–99. CRA 10 comprises the Kermadec Islands, and has a nominal TACC of 0.086 t. The TACC for PHC increased from 27 t in 1990 to its current value of 40.3 t at the beginning of the 1993–94 fishing year following appeals.

TACs (Total Allowable Catch including non-commercial catches) were set for the first time in 1997–98 for three CRA QMAs (Table 1). Setting TACs is a requirement under the Fisheries Act 1996 and consequently TACs have been set since 1997–98 whenever adjustments have been made to the TACCs.

The MLS in the commercial fishery for red rock lobster is based on tail width (TW), except in the Otago fishery. For Otago (CRA 7), the MLS is a tail length (TL) of 127 mm, which applies to both sexes during the period 21 June to 19 November, the primary commercial season. The female MLS in all other rock lobster QMAs except Southern (CRA 8) has been 60 mm TW since mid-1992. For Southern (CRA 8), the female MLS has been 57 mm TW since 1990. The male MLS has been 54 mm TW since 1988, except in Otago (MLS described above) and Gisborne (CRA 3) where it is 52 mm TW for the June–August period.

Special conditions have applied to the Gisborne (CRA 3) fishery from April 1993. During June, July and August, commercial fishers are permitted to retain males at least 52 mm TW but females cannot be landed. These measures changed the commercial CRA 3 fishery to a mainly winter fishery for male lobsters from 1993 to 2002. The fishery was closed to all users from September to the end of November from 1993. This changed in 2000, when the beginning date for the closure was changed to 1 October. In 2002 the closed season was shortened further and CRA 3 now remains officially closed to commercial fishers only in May. Commercial fishers in 2008–09 have closed, by voluntary agreement, Statistical Areas 909 and 910 from 01 September to mid-January and Statistical Area 911 from mid-December to mid-January.

For recreational fishers, the red rock lobster MLS has been 54 mm TW for males since 1990 and 60 mm TW for females since 1992 in all areas of NZ. The commercial and recreational MLS measure for packhorse rock lobster is 216 mm TL for both sexes.

Commercial fisheries

Table 1 provides a summary by fishing year of the reported commercial catches, TACCs and TACs by Fishstock (CRA). The Quota Management Reports (QMRs) and their replacement Monthly Harvest Reports (MHRs; since 1 October 2001) provide the most accurate information on landings. Other sources of annual catch estimates include the Licensed Fish Receiver Returns (LFRRs) and the Catch, Effort, and Landing Returns (CELRs). In recent years, landings reported by LFRRs have been close to the QMR totals (Table 2 in Starr 2007).

Table 1. Reported commercial catch (t) from QMRs or MHRs (after 1 October 2001), commercial TACC (t) and total TAC (t) (where this quantity has been set) for *Jasus edwardsii* by rock lobster CRA for each fishing year since the species was included in the QMS on 1 April 1990. -:TAC not set for QMA; N/A: catch not available (current fishing year)

Fishing Year	CRA 1			CRA 2			CRA 3		
	Catch	TACC	TAC	Catch	TACC	TAC	Catch	TACC	TAC
1990-91	131.1	160.1	-	237.6	249.5	-	324.1	437.1	-
1991-92	128.3	146.8	-	229.7	229.4	-	268.8	397.7	-
1992-93	110.5	137.4	-	190.3	214.6	-	191.5	327.5	-
1993-94	127.4	130.5	-	214.9	214.6	-	179.5	163.7	-
1994-95	130.0	130.5	-	212.8	214.6	-	160.7	163.7	-
1995-96	126.7	130.5	-	212.5	214.6	-	156.9	163.7	-
1996-97	129.4	130.5	-	213.2	214.6	-	203.5	204.7	-
1997-98	129.3	130.5	-	234.4	236.1	452.6	223.4	224.9	379.4
1998-99	128.7	131.1	-	232.3	236.1	452.6	325.7	327.0	453.0
1999-00	125.7	131.1	-	235.1	236.1	452.6	326.1	327.0	453.0
2000-01	130.9	131.1	-	235.4	236.1	452.6	328.1	327.0	453.0
2001-02	130.6	131.1	-	225.0	236.1	452.6	289.9	327.0	453.0
2002-03	130.8	131.1	-	205.7	236.1	452.6	291.3	327.0	453.0
2003-04	128.7	131.1	-	196.0	236.1	452.6	215.9	327.0	453.0
2004-05	130.8	131.1	-	197.3	236.1	452.6	162.0	327.0	453.0
2005-06	130.5	131.1	-	225.2	236.1	452.6	170.1	190.0	319.0
2006-07	130.8	131.1	-	226.7	236.1	452.6	178.7	190.0	319.0
2007-08	129.6	131.1	-	229.7	236.1	452.6	171.0	190.0	319.0
2008-09	N/A	131.1	-	N/A	236.1	452.6	N/A	190.0	319.0
Fishing Year	CRA 4			CRA 5			CRA 6		
	Catch	TACC	TAC	Catch	TACC	TAC	Catch	TACC	TAC
1990-91	523.2	576.3	-	308.6	465.2	-	369.7	518.2	-
1991-92	530.5	529.8	-	287.4	426.8	-	388.3	503.0	-
1992-93	495.7	495.7	-	258.8	336.9	-	329.4	503.0	-
1993-94	492.0	495.7	-	311.0	303.2	-	341.8	530.6	-
1994-95	490.4	495.7	-	293.9	303.2	-	312.5	530.6	-
1995-96	487.2	495.7	-	297.6	303.2	-	315.3	530.6	-
1996-97	493.6	495.7	-	300.3	303.2	-	378.3	530.6	-
1997-98	490.4	495.7	-	299.6	303.2	-	338.7	400.0	480.0
1998-99	493.3	495.7	-	298.2	303.2	-	334.2	360.0	370.0
1999-00	576.5	577.0	771.0	349.5	350.0	467.0	322.4	360.0	370.0
2000-01	573.8	577.0	771.0	347.4	350.0	467.0	342.7	360.0	370.0
2001-02	574.1	577.0	771.0	349.1	350.0	467.0	328.7	360.0	370.0
2002-03	575.7	577.0	771.0	348.7	350.0	467.0	336.3	360.0	370.0
2003-04	575.7	577.0	771.0	349.9	350.0	467.0	290.4	360.0	370.0
2004-05	569.9	577.0	771.0	345.1	350.0	467.0	323.0	360.0	370.0
2005-06	504.1	577.0	771.0	349.5	350.0	467.0	351.7	360.0	370.0
2006-07	444.6	577.0	771.0	349.8	350.0	467.0	352.1	360.0	370.0
2007-08	315.2	577.0	771.0	349.8	350.0	467.0	350.0	360.0	370.0
2008-09	N/A	577.0	771.0	N/A	350.0	467.0	N/A	360.0	370.0
Fishing Year	CRA 7			CRA 8					
	Catch	TACC	TAC	Catch	TACC	TAC			
1990-91	133.4	179.4	-	834.5	1152.4	-			
1991-92	177.7	164.7	-	962.7	1054.6	-			
1992-93	131.6	153.1	-	876.5	986.8	-			
1993-94	138.1	138.7	-	896.1	888.1	-			
1994-95	120.3	138.7	-	855.6	888.1	-			
1995-96	81.3	138.7	-	825.6	888.1	-			
1996-97	62.9	138.7	-	862.4	888.1	-			
1997-98	36.0	138.7	-	785.6	888.1	-			
1998-99	58.6	138.7	-	808.1	888.1	-			
1999-00	56.5	111.0	131.0	709.8	711.0	798.0			
2000-01	87.2	111.0	131.0	703.4	711.0	798.0			
2001-02	76.9	89.0	109.0	572.1	568.0	655.0			
2002-03	88.6	89.0	109.0	567.1	568.0	655.0			
2003-04	81.4	89.0	109.0	567.6	568.0	655.0			
2004-05	94.2	94.9	114.9	603.0	603.4	690.4			
2005-06	95.0	94.9	114.9	603.2	603.4	690.4			
2006-07	120.2	120.2	140.2	754.9	755.2	842.2			
2007-08	120.1	120.2	140.2	752.4	755.2	842.2			
2008-09	N/A	123.9	143.9	N/A	966.0	1053.0			

Table 1 (cont.): Reported commercial catch (t), TACC and TAC for CRA 9 and for all New Zealand. -:TAC not set for QMA; N/A: catch not available (current fishing year) [¹all totals exclude CRA 10 and CRA EEZ]

<u>Fishing Year</u>	<u>CRA 9</u>			<u>Total</u>		
	<u>Catch</u>	<u>TACC</u>	<u>TAC</u>	<u>Catch¹</u>	<u>TACC¹</u>	<u>TAC¹</u>
1990-91	45.3	54.7	-	2907.4	3793.0	-
1991-92	47.5	50.2	-	3020.9	3502.9	-
1992-93	45.7	47.0	-	2629.9	3201.9	-
1993-94	45.5	47.0	-	2746.2	2912.1	-
1994-95	45.2	47.0	-	2621.5	2912.1	-
1995-96	45.4	47.0	-	2548.6	2912.1	-
1996-97	46.9	47.0	-	2690.5	2953.1	-
1997-98	46.7	47.0	-	2584.2	2864.1	1312.0
1998-99	46.9	47.0	-	2726.0	2926.8	1275.6
1999-00	47.0	47.0	-	2748.5	2850.2	3442.6
2000-01	47.0	47.0	-	2795.9	2850.2	3442.6
2001-02	46.8	47.0	-	2593.0	2685.2	3277.6
2002-03	47.0	47.0	-	2591.1	2685.2	3277.6
2003-04	45.9	47.0	-	2451.5	2685.2	3277.6
2004-05	47.0	47.0	-	2472.3	2726.4	3318.8
2005-06	46.6	47.0	-	2475.8	2589.4	3184.8
2006-07	47.0	47.0	-	2604.8	2766.6	3362.0
2007-08	47.0	47.0	-	2464.8	2766.6	3362.0
2008-09	N/A	47.0	-	N/A	2981.0	3576.5

Problems with rock lobster commercial catch and effort data

There are two types of data on the Catch Effort Landing Return (CELR) form: the top part of each form contains the fishing effort and an estimated catch associated with that effort. The bottom part of the form contains the actual landed catch, which may span several records of effort. Estimated catches from the top part of the CELR form may show differences from the catch totals on the bottom part of the form, particularly in some QMAs such as CRA 5 and CRA 8 (Vignaux & Kendrick 1998; Bentley et al. 2005). Substantial discrepancies were identified in 1997 between the estimated and weighed catches in CRA 5 (Vignaux & Kendrick 1998) and were attributed to fishers including all rock lobster catch in the estimated total, including those returned to the sea. This led to an overestimate of CPUE, but this problem appeared to be confined to CRA 5 which was quickly remedied by providing additional instruction to fishers on how to properly complete the forms.

After 1998, all CELR catch data have been modified to reflect the actual landed catch (bottom of form) rather than the estimated catch (top of form). This resulted in changes to the CPUE values compared to those reported before 1998.

In 2003, it was concluded that the method used to correct estimated to landed catch (“Method C1”, Bentley et al. 2005) was biased because it dropped trips with no reported landings, leading to estimates of CPUE which were too high. In some areas, this bias was getting worse because of an increasing trend of passing catches through holding pots to maximise the value of the catch. The catch/effort data system operated by MFish makes no attempt to link catch derived from the effort expended on a trip with the landings recorded from the trip. Therefore, catches from previous trips, held in holding pots, can be combined with landings from the active trip, which in turn means that tracing capture from the fishing event to the landing event for the same lobster is not possible under the current system.

The catch and effort data used in these analyses have been calculated using a revised procedure since 2003. This procedure sums all landings and effort for a vessel within a calendar month and allocates the landings to statistical areas based on the reported area distribution of the estimated catches. The revised method assumes that landings from holding pots tend to even out at the month level. However, in some areas there are vessel/month combinations with no landings, indicating that the problem has not been completely solved by this approach. In these instances, the method is modified by dropping all data for the vessel in the month with zero landings and the following month; it is thought that a method that excludes uncertain data is preferable to one that might incorrectly reallocate landings. This method is described as “Method B4” in Bentley et al. (2005).

The arithmetic CPUE estimates in Tables 2 and 3 have been subjected to the same error screening as those used for standardised CPUE analysis. For arithmetic estimates, CPUE is calculated from the sum of catch divided by the sum of pots for each stock, sub-stock or CRA Fishstock by fishing year.

Another potential problem with assuming CPUE indices are proportional to abundance has been identified by the RLFAWG Group. Fishers may sort their catch, discarding parts not expected to provide a reasonable economic return. This “high-grading” (permitted by legislation) could lead to biases in the estimated CPUE, relative to previous years when sorting did not occur, if fishermen do not report the catch they could legally have retained. The practice has become more prevalent in recent years, especially in areas where rock lobster abundance has increased. The RLFAWG agreed to identify this issue for further investigation.

Jasus edwardsii, NSI stock

NSI landings were relatively stable from about 1960 until the late 1980s, when they declined (Table 2). CPUE was around 1.0 kg per potlift in the late 1970s and early 1980s, and decreased slowly until the late 1980s. Catch per pot lift in NSI declined to 0.48 kg in 1992–93 and has since recovered to levels near 1.0 kg per potlift (Table 2).

Table 2. Reported commercial landings (t) to 31 March 2008 and CPUE (kg/potlift) for *Jasus edwardsii* NSI and CHI stocks, and NSN, NSC and NSS substocks, for the 1979–80 to 2007–08 fishing years. Sources of data: catch and CPUE data from 1979–80 to 1985–86 from the QMS-held FSU data; catch data from 1986–87 to 2007–08 from QMR or MHR reports held by the Ministry of Fisheries (total catches in 1986–87 and 1987–88 have been divided among substocks using the FSU data because the QMR did not report individual CRA areas in those years); CPUE data from 1986–87 to 1988–89 from the QMS-held FSU data; CPUE data from 1989–90 to 2007–08 from the CELR data held by the Ministry of Fisheries corrected for actual landings. See Booth et al. (1994) for a discussion of problems with the QMS-held FSU data.

Fishing Year	NSI Substocks						NSI Total		CHI	
	NSN (CRA1 & 2)		NSC (CRA3, 4 & 5)		NSS (CRA7 & 8)		CRA 1–5 & CRA 7–9		CRA6	
	Landings	CPUE	Landings	CPUE	Landings	CPUE	Landings	CPUE	Landings	CPUE
1979–80	408	0.57	1 386	0.85	2 129	1.58	4 012	1.06	400	2.33
1980–81	626	0.69	1 719	0.88	1 761	1.49	4 203	1.02	356	2.18
1981–82	574	0.66	1 664	0.85	1 663	1.48	3 973	0.99	465	2.19
1982–83	549	0.59	2 213	0.91	1 632	1.35	4 453	0.96	472	1.78
1983–84	506	0.55	2 303	0.85	1 634	1.09	4 514	0.87	548	1.73
1984–85	482	0.51	2 294	0.76	1 741	1.09	4 598	0.82	492	1.35
1985–86	556	0.54	2 227	0.71	2 185	1.21	5 048	0.83	604	1.41
1986–87	486	0.48	2 144	0.72	1 927	1.07	4 650	0.79	580	1.66
1987–88	442	0.45	1 781	0.57	1 961	1.12	4 277	0.72	448	1.48
1988–89	401	0.45	1 399	0.51	1 262	0.80	3 087	0.58	450	1.40
1989–90	427	0.55	1 457	0.53	1 352	0.81	3 262	0.62	318	1.34
1990–91	369	0.55	1 156	0.46	968	0.75	2 538	0.56	370	1.38
1991–92	358	0.49	1 087	0.41	1 140	0.82	2 633	0.54	388	1.31
1992–93	301	0.44	946	0.40	1 008	0.62	2 300	0.48	329	1.15
1993–94	342	0.51	983	0.49	1 034	0.87	2 404	0.61	342	1.08
1994–95	343	0.61	945	0.60	976	0.79	2 309	0.67	313	1.07
1995–96	339	0.78	942	0.73	907	0.76	2 233	0.76	315	1.09
1996–97	343	0.87	997	0.88	925	0.74	2 312	0.83	378	1.02
1997–98	364	0.88	1 013	1.15	822	0.66	2 246	0.87	339	0.88
1998–99	361	0.97	1 117	1.22	867	0.71	2 392	0.95	334	1.17
1999–00	361	0.83	1 252	1.24	766	0.73	2 426	0.97	322	1.19
2000–01	366	0.84	1 249	1.21	791	0.81	2 453	0.99	343	1.15
2001–02	356	0.71	1 213	1.08	649	0.82	2 264	0.91	329	1.15
2002–03	336	0.59	1 216	1.01	656	0.94	2 255	0.89	336	1.16
2003–04	325	0.59	1 142	1.05	649	1.31	2 161	0.99	290	1.10
2004–05	328	0.60	1 077	0.95	697	1.36	2 149	0.96	323	1.23
2005–06	356	0.60	1 024	0.90	698	1.62	2 124	0.97	352	1.36
2006–07	358	0.70	973	0.76	875	2.07	2 253	1.00	352	1.45
2007–08	359	0.72	836	0.76	873	2.19	2 115	1.04	350	1.53

Jasus edwardsii, NSN substock

Landings in the NSN substock were high in the early 1980s but CPUE was less than 1.0 kg per potlift. Both measures gradually declined into the early 1990s. Catch per pot lift was around 0.7 kg in the early 1980s but the period from 1986–87 to 1992–93 had catch rates around 0.5 kg (Table 2). From 1994, CPUE increased to levels considerably higher than those observed at the beginning

of the time series, peaking in 1998–99 at 0.97 kg per potlift. CPUE levels in CRA 1 and CRA 2 differ: CRA 1 maintained higher catch rates since the late 1990s while CRA 2 declined to less than 0.5 kg/potlift in 2002–03 and has since remained near that level (Table 3). The combined NSN catch rate has increased from 0.6 to 0.72 kg per potlift in 2007–08.

Jasus edwardsii, NSC substock

Landings in the NSC substock were very high to the mid 1980s, exceeding 2 000 t for five fishing years in succession. During that time, CPUE dropped from 0.9 kg/potlift to 0.7 kg/potlift (Table 2). Commercial catches then gradually decreased to below 1 000 t and CPUE dropped to below 0.5 kg per potlift by the early 1990s. From 1993–94, CPUE increased to a peak of 1.24 kg/potlift in 1999–00 (Table 2). CPUE dropped to near 1.0 kg per potlift in 2002–03, and dropped to 0.76 kg/potlift in 2006–07 and 2007–08. This is still higher than the levels observed from 1987–88 to 1995–96. Trends in CPUE have differed between the three component QMAs in the NSC, with CRA 3 CPUE peaking in 1997–98, CRA 4 in 1998–99, and CRA 5 in 2003–04 (Table 3).

Jasus edwardsii, NSS substock

Catches and CPUE were high for this substock: greater than 1 500 t per fishing year, with CPUE well over 1.0 kg per potlift throughout most of the 1980s. However, both measures gradually declined during that period, dropping below 1 000 t and below 1.0 kg per potlift by the early- to mid-1990s (Table 2). CPUE has been increasing since 1997–98 and is now above 2.0 kg per potlift for the two most recent fishing years (Table 2). Catches are relatively low in CRA 7 compared with those in other areas, but CPUE has been rising in both QMAs, with CPUE currently at the highest level in both QMAs since recording began (Table 3).

Jasus edwardsii, Westland/Taranaki (CRA 9)

Catch per pot lift fluctuated near 0.9 kg per potlift between 1998–99 and 2001–02, then increased to above 2 kg per potlift in 2004–05 and 2005–06, and has since decreased to just below 2 kg per potlift (Table 3).

Jasus edwardsii, CHI stock

CPUE in the CHI fishery was higher than in the other New Zealand CRA areas in the 1980s (Table 2). However, CPUE since the mid-1980s has declined to levels similar to those in other CRA QMAs (Table 3). CPUE dropped to 1.1 kg/potlift in 2003–04, and since increased to over 1.5 kg/potlift in 2007–08. Landings were around 400 to 500 t per fishing year in the 1980s but fell below 400 t per year in the 1990s. The reasons for the decline in catch and in CPUE are unknown. Size frequencies of lobsters in the landed catch have changed little since the development of this fishery.

Table 3. Estimated arithmetic CPUE (kg/potlift) for each CRA quota management area for the ten most recent fishing years. Data are from the Ministry of Fisheries CELR database and estimated catches have been corrected by the amount of fish landed from the bottom part of the form (see Section 1 in text for explanation).

QMA	Fishing year									
	1998–99	1999–2000	2000–01	2001–02	2002–03	2003–04	2004–05	2005–06	2006–07	2007–08
CRA 1	1.04	1.09	1.17	1.30	1.20	1.22	1.24	1.14	1.32	1.64
CRA 2	0.93	0.73	0.73	0.56	0.44	0.43	0.45	0.47	0.55	0.54
CRA 3	1.63	1.56	1.19	0.95	0.73	0.63	0.52	0.62	0.58	0.60
CRA 4	1.31	1.27	1.26	1.06	1.09	1.14	1.00	0.88	0.66	0.60
CRA 5	0.89	1.00	1.16	1.27	1.27	1.42	1.27	1.18	1.18	1.19
CRA 6	1.17	1.19	1.15	1.15	1.16	1.10	1.23	1.36	1.45	1.53
CRA 7	0.30	0.22	0.35	0.46	0.52	0.58	0.75	1.12	1.59	1.31
CRA 8	0.79	0.84	0.98	0.92	1.11	1.67	1.58	1.75	2.19	2.47
CRA 9	0.92	0.88	0.93	0.82	1.11	1.63	2.14	2.22	1.94	1.85

Sagmariasus verreauxi, PHC stock

QMS-reported catches of the PHC stock halved between 1998–99 and 2001–02 but have since increased (Table 4). Reasons for low level of landings relative to the TACC (40 t) are unknown.

Table 4. Reported landings of *Sagmariasus verreauxi* from 1990–91 to 2006–07. Data from QMR or MHR (after 1 Oct 2001). N/A: not available

Year	Landings (t)	Year	Landings (t)
1990–91	7.4	1999–00	12.6
1991–92	23.6	2000–01	9.8
1992–93	11.1	2001–02	7.8
1993–94	5.7	2002–03	8.6
1994–95	7.9	2003–04	16.4
1995–96	23.8	2004–05	20.8
1996–97	16.9	2005–06	25.0
1997–98	16.2	2006–07	25.4
1998–99	16.2	2007–08	N/A

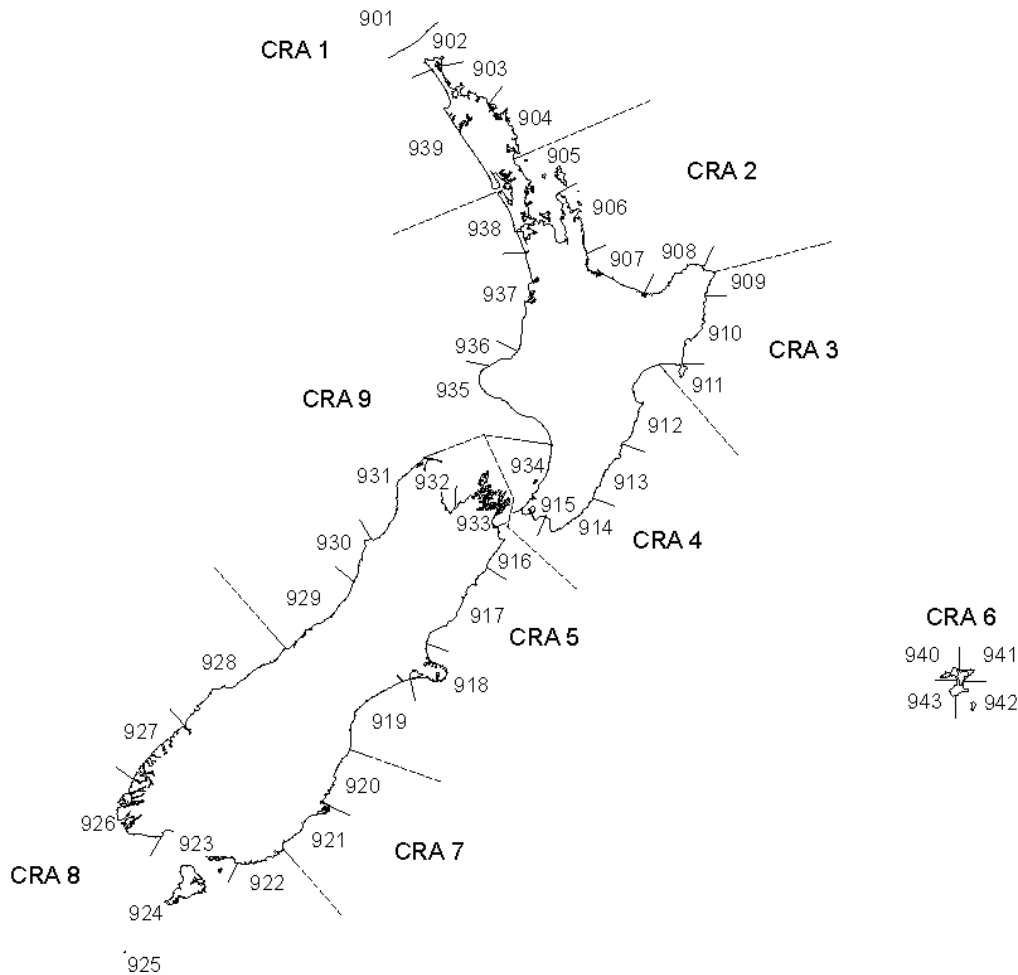


Figure 1. Rock lobster statistical areas as reported on CELR forms. *Jasus edwardsii* CPUE by statistical area

Table 5 shows the CPUE for the most recent six years within each CRA area for each rock lobster

statistical area reported on the CELR forms (Figure 1). The values of CPUE and the trends in the fisheries vary within and between CRA areas.

Table 5. Arithmetic CPUE (kg/potlift) for each statistical area for the six most recent fishing years. Data are from the Ministry of Fisheries CELR database and estimated catches have been corrected by the amount of fish landed from the bottom part of the form (see Section 1 in text for explanation). – value withheld because fewer than three vessels were fishing or no fishing.

CRA	Stat Area	2002/03	2003/04	2004/05	2005/06	2006/07	2007/08	CRA	Stat Area	2002/03	2003/04	2004/05	2005/06	2006/07	2007/08
1	901	2.05	–	3.48	3.21	2.88	3.29	6	940	0.99	0.76	0.89	0.91	1.03	1.15
1	902	3.04	3.29	2.01	2.19	–	1.97	6	941	1.31	1.40	1.58	1.72	1.93	2.04
1	903	0.72	0.79	1.14	0.81	1.17	1.12	6	942	1.18	0.99	1.04	1.51	1.95	1.41
1	904	0.36	0.36	0.58	–	–	0.56	6	943	1.15	1.18	0.99	1.04	1.51	1.95
1	939	1.12	1.15	1.14	1.30	1.25	1.38	7	920	0.45	0.45	0.55	0.83	1.27	1.14
2	905	0.48	0.56	0.61	0.51	0.61	0.57	7	921	1.07	1.88	1.61	1.81	2.12	1.81
2	906	0.36	0.36	0.40	0.49	0.53	0.57	8	922	–	–	–	–	–	–
2	907	0.49	0.46	0.47	0.47	0.56	0.60	8	923	–	2.75	2.46	4.27	2.02	3.82
2	908	0.53	0.46	0.44	0.43	0.55	0.43	8	924	1.34	2.34	1.93	3.08	3.90	2.79
3	909	0.81	0.88	0.82	0.82	0.99	1.02	8	925	–	1.57	1.15	–	–	2.87
3	910	0.55	0.60	0.55	0.59	0.48	0.60	8	926	1.29	1.92	1.74	1.93	2.41	1.99
3	911	0.93	0.60	0.43	0.61	0.62	0.52	8	927	0.93	1.56	1.43	1.21	1.56	2.21
4	912	1.08	1.10	0.77	0.60	0.58	0.66	8	928	0.75	0.94	1.15	1.52	2.13	3.99
4	913	1.18	1.36	1.20	0.94	0.76	0.71	9	929	–	–	–	–	–	–
4	914	1.02	1.08	1.06	0.94	0.57	0.47	9	930	–	1.79	–	–	2.94	–
4	915	1.21	0.90	0.70	0.81	0.76	0.79	9	931	0.88	0.86	0.87	0.70	0.68	0.68
4	934	1.21	2.21	2.30	2.15	1.69	1.76	9	935	–	–	–	1.58	–	–
5	916	2.25	2.36	2.21	1.90	1.68	1.73	9	936	–	–	–	–	–	–
5	917	0.96	1.18	1.00	0.98	1.09	1.19	9	937	0.96	0.81	0.69	0.57	0.78	1.08
5	918	1.31	1.38	1.37	1.72	–	–	9	938	–	–	–	–	–	–
5	919	0.45	0.45	0.55	0.83	1.27	1.14	–	–	–	–	–	–	–	–
5	932	–	–	–	–	–	–	–	–	–	–	–	–	–	–
5	933	–	–	–	–	1.55	0.81	–	–	–	–	–	–	–	–

Recreational fisheries

Recreational catches have been estimated from a series of regional and national surveys based on telephone interviews and a sub-sample of diarists. Each survey estimated the New Zealand recreational catch by scaling up the reported catch in numbers by diarists with the ratio of diarists to the total estimated New Zealand population. The catch in numbers was then converted to catch in weight using mean weights of recruited lobsters observed in the appropriate catch sampling or voluntary logbook programs during the survey years. Results for rock lobster from each of these recreational surveys – South region (1991–92), Central region (1992–93), North region (1993–94), the 1996 National Diary Survey, and the 1999–2000 National survey – are presented in Table 6.

Table 6. All available estimates of recreational rock lobster harvest (in numbers and in tonnes by QMA, where available) from regional telephone and diary surveys in 1992, 1993, 1994, 1996, 2000 and 2001 (Bradford 1997, 1998; Teirney et al. 1997). Data were provided by the chairman of the Recreational Fisheries Fishery Assessment Working Group (Peter Todd, MFish; pers. comm.)

QMA/FMA	Number	c.v. (%)	Nominal point estimate (t)
Recreational Harvest South Region 1 Sept 1991 to 30 Nov 1992			
CRA5	65,000	31	40
CRA7	8,000	29	7
CRA8	29,000	28	21
Recreational Harvest Central Region 1992–93			
CRA1	1,000		
CRA2	4,000		
CRA3	8,000		
CRA4	65,000	21	40
CRA5	11,000	32	10
CRA8	1,000		
Northern Region Survey 1993–94			
CRA1	56,000	29	38
CRA2	133,000	29	82
CRA9	6,000		
1996 Survey			
CRA1	74,000	18	51
CRA2	223,000	10	138
CRA3	27,000		
CRA4	118,000	14	73

QMA/FMA	Number	c.v. (%)	Nominal point estimate (t)
CRA5	41,000	16	35
CRA7	3,000		
CRA8	22,000	20	16
CRA9	26,000		
2000 Survey			
CRA1	107,000	59	102.3
CRA2	324,000	26	235.9
CRA3	270,000	40	212.4
CRA4	371,000	24	310.9
CRA5	151,000	34	122.3
CRA7	1,000	63	1.3
CRA8	13,000	33	23.3
CRA9	65,000	64	52.8
2001 Roll Over Survey			
CRA1	161,000	68	153.5
CRA2	331,000	27	241.4
CRA3	215,000	48	168.7
CRA4	419,000	22	350.5
CRA5	226,000	22	182.4
CRA7	10,000	67	9.4
CRA8	29,000	43	50.9
CRA9	34,000	68	27.7

In previous assessments, the RLFAGW has not accepted results from the 1999–2000 national survey and the subsequent “roll-over” survey (Table 6), both of which tended to have higher catch estimates in most of the CRA QMAs when compared to the earlier surveys. For 2008, the RLFAGW agreed to use a fixed estimate of recreational catch of 20 000 kg in the CRA 3 assessment, reasoning that this total is greater than the 1996 estimate when converted into weight and with the Section 111 landings added (see below; Table 7). As has been the practice in previous assessments, catch in weight was estimated using the mean weight for lobsters taken from the commercial sampling data for the relevant year or years, calculated using the recreational MLS (Table 7). The RLFAGW has little confidence in these estimates of recreational catch.

Table 7. Information used to estimate recreational catch for CRA 3.

	CRA 3
Available catch estimates (in numbers of lobsters)	
1992	8000
1996	27000
2000	270000
2001	215000
Calculation of recreational catch by weight	
1996 numbers	27000
1996 SS mean weight (kg)	0.533
1996 estimated catch (kg)	14390
2000/2001 average numbers	242500
2000/2001 SS mean weight (kg)	0.543
2000/2001 estimated average catch (kg)	131754
Section 111 reported landings	
Maximum reported landings (kg)	1167
Total estimated recreational catch	20000

Recreational landings made by commercial vessels under the provisions of Section 111 of the Fisheries Act 1996 were not added to the survey recreational catch estimates. These were identified as greenweight landings which used the destination code “F” in the MFish landing data. The maximum annual value in this category between 1989–90 and 2007–08 was 1 167 kg for CRA 3.

The RLFAGW agreed in 2008 to use a single recreational catch value of 20 t for all years used in the assessment.

Māori customary fisheries

The Ministry of Fisheries provided preliminary estimates of the Māori customary catch for some fishstocks for the 1995–96 fishing year. Updates of these estimates are not available. The estimates for the 1995–96 fishing year were: CRA 1, 2.0 t; CRA 2, 16.5 t; CRA 8, 0.2 t; CRA 9, 2.0 t; and PHC 1, 0.5 t.

MFish provided collated returns for harvest taken under customary authorisations for CRA 3 (Table 8). These values should be considered minimum estimates of the actual catch as they include only catches that were authorised and then subsequently indicated as being taken. When these catch reports in numbers of lobsters were converted to weight, the annual estimates for CRA 3 were less than 10 t (Table 8).

The RLFAGW agreed in 2008 to use a single customary catch value of 20 t for all years used in the assessment. The RLFAGW has little confidence in these estimates.

Table 8. Estimates (kg) of CRA 3 catch based on lobster permits issued under Section 27A of the Amateur Fishing Regulations plus the CRA 3 catch under the kaimoana Regulations. A mean weight of 0.40 kg/lobster was used to convert from numbers to weight. This is the mean weight from all 2003 to 2007 samples (both sexes combined across all size categories). Source: letter from Alicia McKinnon (MFish) to P.A. Breen, 23 September 2008.

Year	Section 27A	Kaimoana	Total
2003–04	7136	0	7136
2004–05	5530	56	5586
2005–06	5212	80	5293
2006–07	3992	365	4357
2007–08	4893	4671	9564

Illegal catches

For the years 1945–1973 and 1981–82 to 1989–90, unreported or illegal catch is estimated based on the average ratio of annual exports of rock lobster relative to the reported catch in each year from 1974 to 1980. This ratio is calculated for each QMA by assuming that the exports are distributed by QMA in the same proportion as the reported catches. This ratio for CRA 3 (1.16) was applied as a constant multiplier to the reported legal catch in each of the years without export information. Illegal catch for the years 1974 to 1980 is taken from unpublished estimates of discrepancies between reported catch totals and total exported weight (McKoy pers. comm.).

Ministry of Fisheries Compliance staff have supplied illegal catch estimates for CRA 3 over a number of years, with the last available estimate for 2003–04 (Table 9). Values for years without estimates were obtained by interpolation. The 2003–04 estimate is considered by MFish to be the most credible estimate for current illegal catch in CRA 3¹.

Table 9. Estimates of illegal catches (t) for CRA 3 used in the 2004 and 2008 assessments. The estimates by category from 1994–95 onwards were provided by Aoife Martin (MFish Compliance, letter to P.A. Breen 17 August 2004). Estimates for 1990–91 and 1992–93 are historical estimates provided by MFish Compliance. Grey shaded cells were used to estimate proportion (0.045) of illegal catch eventually reported through legal channels.

	Illegal			Poaching	Total
	Recreational Take	Customary Take	Commercial Take		
1990–91	–	–	–	–	288
1992–93	–	–	–	–	250
1994–95	24	13	5	–	42
1995–96	–	–	–	63	63
1996–97	–	–	20	64	84
1997–98	–	–	4	60	64
1998–99	7.5	9	4	70	90.5
1999–00	8	–	–	128	136
2000–01	5	–	3	70	78
2001–02	5	–	–	70	75
2002–03	5	–	–	70	75
2003–04	5	–	0	84.5	89.5 ¹
2004–05	–	–	–	–	89.5 ¹
2005–06	–	–	–	–	89.5 ¹
2006–07	–	–	–	–	89.5 ¹
2007–08	–	–	–	–	89.5

¹ (letter from Alicia McKinnon (MFish) to P.A. Breen, 23 September 2008)

In the past, MFish Compliance has provided estimates of the amount of illegal catch that subsequently was reported against quota. An estimate of this quantity is required to avoid counting the same catch twice. Catches shaded in Table 9 were assumed to be estimates of the commercial catches that eventually were reported through legal channels (missing values were assigned a value of 0.0). This proportion was applied to all illegal catch estimates from 1990–91 and subtracted from the legal commercial catch for the same years.

The RLFAGW members have little confidence in the estimates of illegal catch, as the estimates cannot be verified.

Other sources of mortality

Other sources of mortality include handling mortality caused by the return of under-sized and berried female lobsters to the water, and predation by octopus and other predators within pots. Although these cannot be quantified, the assessment assumes that handling mortality is 10%.

2. BIOLOGY

They cannot be aged, at least easily or in high numbers, but rock lobsters are thought to be relatively slow-growing and long-lived. *J. edwardsii* and *S. verreauxi* occur both in New Zealand and southern Australia. The following summary applies only to *J. edwardsii* in New Zealand.

Sexual maturity in females is reached at about 34–77 mm TW (about 60–120 mm carapace length), depending on locality. In CRA 3, 50% maturity appears to be realised near 40 mm TW. Most females in the south and southeast of the South Island do not breed before reaching MLS.

Mating takes place after moulting in autumn, and the eggs hatch in spring into the short-lived naupliosoma larvae. Most of the phyllosoma larval development takes place in oceanic waters tens to hundreds of kilometres offshore over at least 12 months. Near the edge of the continental shelf the final-stage phyllosoma metamorphoses into the settling stage, the puerulus. Puerulus settlement takes place mainly at depths less than 20 m, but not uniformly over time or between regions. Settlement indices measured on collectors can fluctuate widely from year to year.

Long-distance migrations of rock lobsters have been observed in some areas. During spring and early summer, variable proportions of usually small males and immature females move various distances against the current from the east and south coasts of the South Island towards Fiordland and south Westland.

Values used for some biological parameters in the CRA 3 stock assessment are shown in Table 10.

Table 10. Values used for some biological parameters.

1. Natural mortality (M)¹

<u>Area</u>	<u>Both Sexes</u>
CRA 1, 2, 3, 4, 5	0.12
NSS	0.12

¹ This value was used as the mean of an informative prior; M was estimated as a parameter of the model.

2. Fecundity = a TW^b (TW in mm) (Breen & Kendrick 1998)²

<u>Area</u>	<u>a</u>	<u>b</u>
NSN	0.21	2.95
CRA 4 & CRA 5	0.86	2.91
NSS	0.06	3.18

² Fecundity has not been used by post-1999 assessment models.

3. Weight = a TW^b (weight in kg, TW in mm) (Breen & Kendrick, Ministry of Fisheries unpublished data)

<u>Area</u>	<u>Females</u>		<u>Males</u>	
	<u>a</u>	<u>b</u>	<u>a</u>	<u>b</u>
CRA 1, 2, 3, 4, 5	1.30 E-05	2.5452	4.16 E-06	2.9354
NSS	1.04 E-05	2.6323	3.39 E-06	2.9665

Growth modelling

The primary source of information for growth is tag-recapture data. Lobsters have been caught, measured, tagged and released, then recaptured and re-measured at some later time (and in some instances re-released and re-recaptured later).

Since 1998, the length-based model has been used to estimate the expected increment-at-size, which is represented stochastically by growth transition matrices for each sex. Growth increments-at-size are assumed to be normally distributed with means and variances determined from the growth model. The transition matrices contain the probabilities that a lobster will move into specific size bins given its initial size.

The growth model contains parameters for expected increment at 50 mm and 80 mm TW, a shape parameter (1 = linear), the c.v. of the increment for each sex, the minimum standard deviation and the observation error. This model is over-parameterised if all parameters are estimated, so the last two parameters are usually fixed.

Since 2006, the growth model applied to the tag-recapture data has been a continuous model – giving a predicted growth increment for any time at liberty greater than 30 days – whereas the older versions assumed specific moulting periods between which growth did not occur. For the current model, tag-recapture records from lobsters at liberty for fewer than 30 days are excluded. Some other basic data grooming is performed, but the robust likelihood fitting model precludes the need for extensive grooming of outliers. Growth parameters are estimated simultaneously with other parameters of the assessment model in an integrated way, so that growth estimates might be affected by the size frequency and CPUE data as well as the tag-recapture data.

For CRA 3, data are available from 1975–1981 and 1995–2006. Equivalent data are also available from a PhD project (Freeman 2008) from areas outside the Te Tapuwae o Rongokako marine reserve near Gisborne, and these data were used, with permission, in the stock assessment. For the 2008 assessment, it was discovered that growth rates based on the 1995–2006 data were significantly lower than those based on the 1975–1981 data. There is no obvious reason for the change in growth rates and an analysis of the CRA 5 tag recaptures did not show this decrease. Growth estimation in the 2008 assessment treated the older and newer data as two discrete data sets, and estimated growth for these periods separately as described below.

(b) Settlement indices

Annual levels of puerulus settlement have been estimated since 1979 or later at sites in Gisborne, Castlepoint, Napier, Wellington, Kaikoura, Moeraki, Halfmoon Bay, Chalky Inlet and Jackson Head.

The standardised settlement data for Gisborne to the end of 2007 show a strong settlement pulse in 1992–94, then lower settlement from 1995–2002, with very low settlement in 1999, and strongly varying settlement after 2002. Settlement is correlated among sites. Table 11 provides the Gisborne standardised settlement indices that were evaluated in the CRA 3 stock assessment in 2008.

Table 11. Puerulus settlement indices for CRA 3. Source: A. McKenzie, NIWA.

Year	Arithmetic	Standardised	Upper Bound	Lower Bound	Standard Error
1991	1.88	1.44	2.73	0.76	0.33
1992	3.18	2.04	3.01	1.38	0.20
1993	2.42	1.52	2.24	1.04	0.20
1994	2.90	2.83	4.00	2.00	0.18
1995	1.00	1.07	1.55	0.74	0.19
1996	0.77	0.99	1.46	0.67	0.20
1997	0.98	1.05	1.52	0.72	0.19
1998	1.30	1.43	2.03	1.00	0.18
1999	0.09	0.10	0.19	0.05	0.36
2000	0.84	0.93	1.35	0.64	0.19
2001	1.10	1.24	1.78	0.87	0.18
2002	0.96	1.09	1.58	0.76	0.19

Year	Arithmetic	Standardised	Upper Bound	Lower Bound	Standard Error
2003	1.70	2.14	3.03	1.51	0.18
2004	0.69	0.75	1.11	0.51	0.20
2005	2.23	2.44	3.42	1.73	0.17
2006	0.35	0.37	0.58	0.23	0.23
2007	0.34	0.29	0.52	0.16	0.30

3. STOCKS AND AREAS

There is no evidence for genetic subdivision of lobster stocks within New Zealand based on biochemical genetic and mtDNA studies. The observed long-distance migrations in some areas and the long larval life probably result in genetic homogeneity among areas. Gene flow at some level probably occurs to New Zealand from populations in Australia (Chiswell et al. 2003).

Subdivision of the NSI stock on other than genetic grounds has been considered (Booth & Breen 1992; Bentley & Starr 2001). There are geographic discontinuities in the prevalence of antennal banding, size at onset of maturity in females, migratory behaviour, fishery catch and effort patterns, phyllosoma abundance patterns and puerulus settlement levels. These observations have led to division of the NSI stock into three substocks (NSN, NSC, and NSS) for assessment. Cluster analysis based on similarities in CPUE trends between rock lobster statistical areas provides support for the current stock definitions (Bentley & Starr 2001).

Although considered separately for stock assessment purposes, the CHI stock (CRA 6) also appears to be genetically the same as the NSI stock. It may depend upon the NSI stock as a source of recruitment, but changes in abundance within the CHI stock are unlikely to affect the NSI stock.

Sagmariasus verreauxi forms one stock centred in northern New Zealand, and may be genetically subdivided from populations of the same species in Australia.

4. DECISION RULES AND MANAGEMENT PROCEDURE

This section presents evaluations of the NSN and NSC rock lobster decision rules and the CRA 7 and CRA 8 management procedures for the 2009–10 fishing year, based on CPUE data extracted in September and November 2008.

Data preparation procedures

For decision rule analyses, the data were extracted using method “B4” (Bentley et al. 2005) and aggregated by fishing year, month, rock lobster statistical area and vessel. The standardisation procedure (Maunder & Starr 1995) uses month, statistical area and fishing year as explanatory variables. The data were restricted to the appropriate QMAs for each analysis and all data were used except for coded vessel number 4548, which has been consistently dropped from the NSN analysis. The decision rule comparisons for the NSN and NSC are based on the exponents of year coefficients calculated by the regression model, which uses $\ln(\text{catch}/\text{potlifts})$ as the dependent variable and bases the test for a significant change on the calculated standard error for each coefficient. The coefficients in these regressions are calculated relative to the fishing year with the smallest standard error.

The NSN and NSC decision rules use annual standardised CPUE indices based on the fishing year. The CRA 7 and CRA 8 management procedures both use the most recent annual standardised CPUE estimates from CRA 7 or CRA 8 respectively. The year used as the basis for this straddles the fishing year. It comprises the most recent AW season and the preceding SS season (whereas the fishing year comprises the SS season and the preceding AW season).

The analysis follows the suggestion of Francis (1999) and calculates “canonical” coefficients and

standard errors for each year, allowing the calculation of standard errors for every coefficient, including the base year coefficient. A further refinement is to scale each standardised index by the geometric mean of the simple arithmetic CPUE indices (the summed catch divided by summed effort for each fishing year). The geometric mean CPUE is preferred to the arithmetic mean because it is less affected by outliers than the arithmetic mean. This procedure scales the standardised indices to CPUE levels consistent with those observed by fishermen.

Decision Rule for NSN and NSC

The decision rule described by Breen *et al.* (1994) was modified by the National Rock Lobster Management Group (NRLMG) for the NSN and NSC substocks to allow consideration of TAC increases. The original decision rule required that a substock be assessed whenever a “standardised CPUE analysis” (Maunder & Starr 1995) showed a “significant” decrease in the CPUE for a given year relative to the CPUE estimate for 1992–93. A year index is considered “significantly different” from the 1992–93 year index if their standard-error bars do not overlap.

Table 12. Decision rule indices for 1992–93 and 2007–08 fishing years (1 April to 31 March) for the NSN and NSC substocks. The index is the year effect from a standardised CPUE analysis using 1984–85 and 1982–83 as base years for the NSN and NSC respectively. The table also shows the upper and lower bounds, which are the index plus and minus one standard error respectively. The final column indicates the significance of change between the two years (* = significant increase).

<u>Substock</u>	<u>1992–93</u>	<u>1992–93</u>	<u>1992–93</u>	<u>2007–08</u>	<u>2007–08</u>	<u>2007–08</u>	<u>Result</u>
	<u>Index</u>	<u>Lower</u>	<u>Upper</u>	<u>Index</u>	<u>Lower</u>	<u>Upper</u>	
NSN	0.970	0.936	1.004	1.739	1.667	1.814	*
NSC	0.395	0.387	0.403	0.819	0.797	0.841	*

NSN

The standardised CPUE for the NSN substock increased steadily between the 1992–93 and 1998–99 fishing years (Figure 2). There were four consecutive years of decrease between 1998–99 and 2002–03, but this trend appears to have reversed and the standardised indices since 2004–05 show increases relative to 2003–04. The increase in the NSN series relative to the 2003–04 fishing year extends to both components of the NSN (CRA 1 and CRA 2). Figure 3 shows that the standardised index and the simple arithmetic mean show similar trends and that both are above the low abundance observed in the late 1980s and early 1990s.

Under the NSN decision rule, the 2007-08 CPUE is significantly above the 1992-93 CPUE (Table 12).

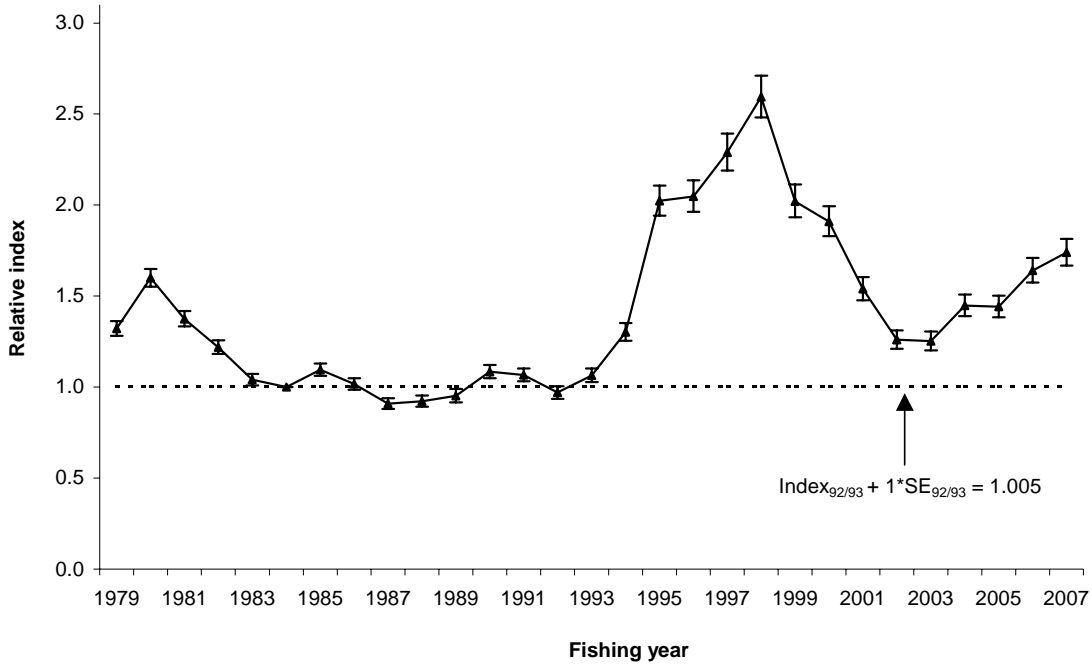


Figure 2. Values of the year index from the standardised CPUE analysis for the NSN substock showing plus and minus one standard error for each year. Horizontal line shows the upper bound of the 1992–93 standardised index which is the threshold for triggering this decision rule. Each year index is relative to the 1984-85 fishing year (the year with the lowest standard error).

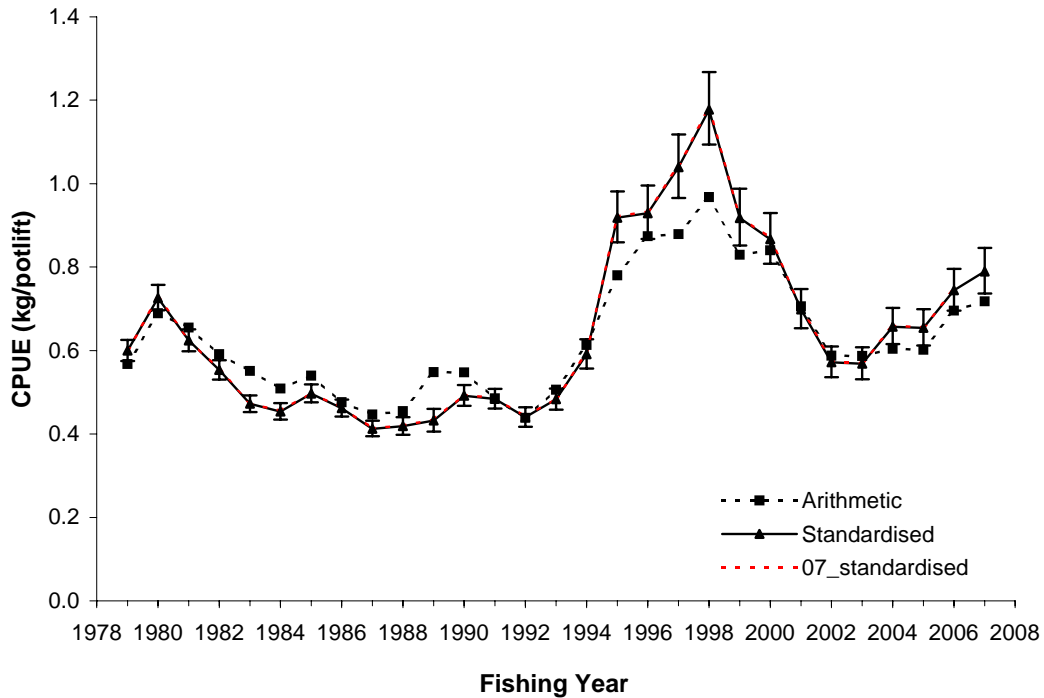


Figure 3. Values for the NSN standardised annual CPUE indices compared with the mean arithmetic annual CPUE (sum of annual catch divided by sum of potlifts). The standardised series is scaled to the geometric mean of the arithmetic annual CPUE (kg/potlift). Also shown is the equivalent standardised series calculated in September 2007.

NSC

As in the NSN substock, standardised CPUE for the NSC substock increased steadily between the 1992–93 and 1998–99 fishing years (Figure 4). Since then, there has been a continuous drop in CPUE to a level 50% below the 1998–99 peak. This decline has occurred in all three components of the NSC (CRA 3, CRA 4 and CRA 5), although CRA 4 is the only QMA showing a declining trend for the entire period to 2007–08. Both CRA 3 and CRA 5 have stopped declining, with CRA 3 having a flat trend since 2004–05 and CRA 5 flattening in 2007–08. CRA 5 only began its decline from a peak in 2003–04 while CRA 3 and CRA 4 started declining sooner. As was noted for the NSN substock, the standardised index for 2007–08 remains above the lowest level which was observed in 1992–93.

Figure 5 compares the standardised index with the simple arithmetic mean: both show similar trends and remain above the low abundance seen in 1992–93. The unstandardised index is lower than the standardised index for this substock, probably reflecting the switch to a winter fishery with generally lower catch rates. It is likely that the standardisation model interprets the relatively high catch rates in these winter months as indicative of higher abundance.

Under the decision rule, the 2007-08 CPUE is significantly above the 1992-93 CPUE (Table 12).

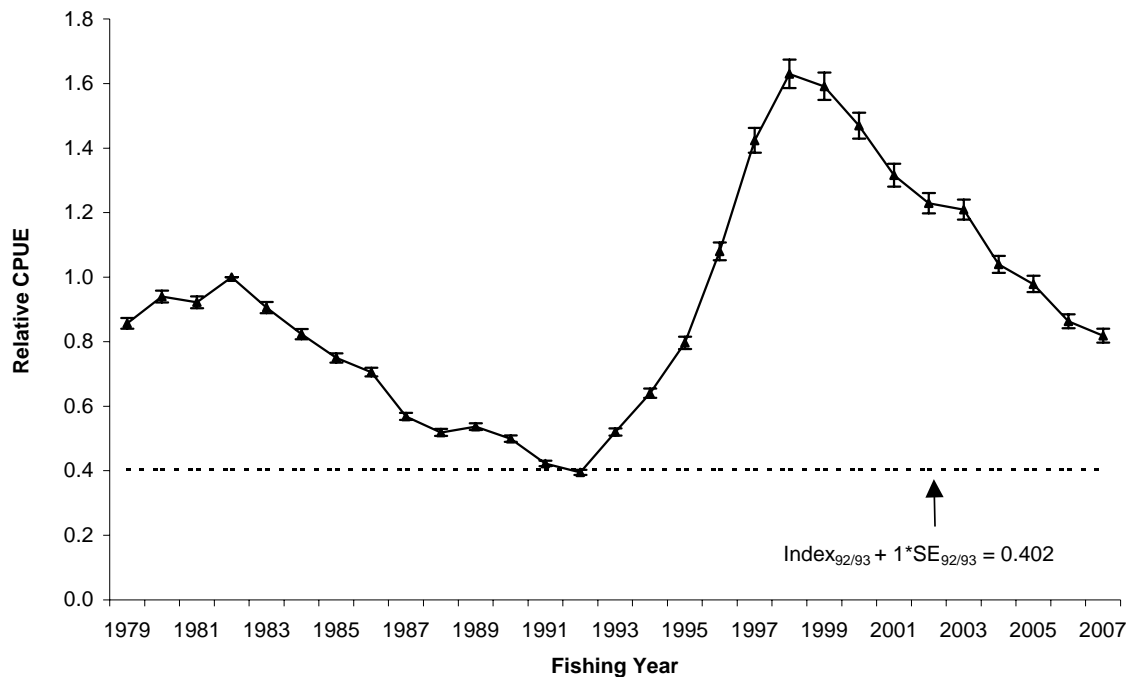


Figure 4. Values of the year index from the standardised CPUE analysis for the NSC substock showing plus and minus one standard error for each year. Horizontal line shows the upper bound of the 1992–93 standardised index which is the threshold for triggering this decision rule. Each year index is relative to the 1982–83 fishing year (the year with the lowest standard error).

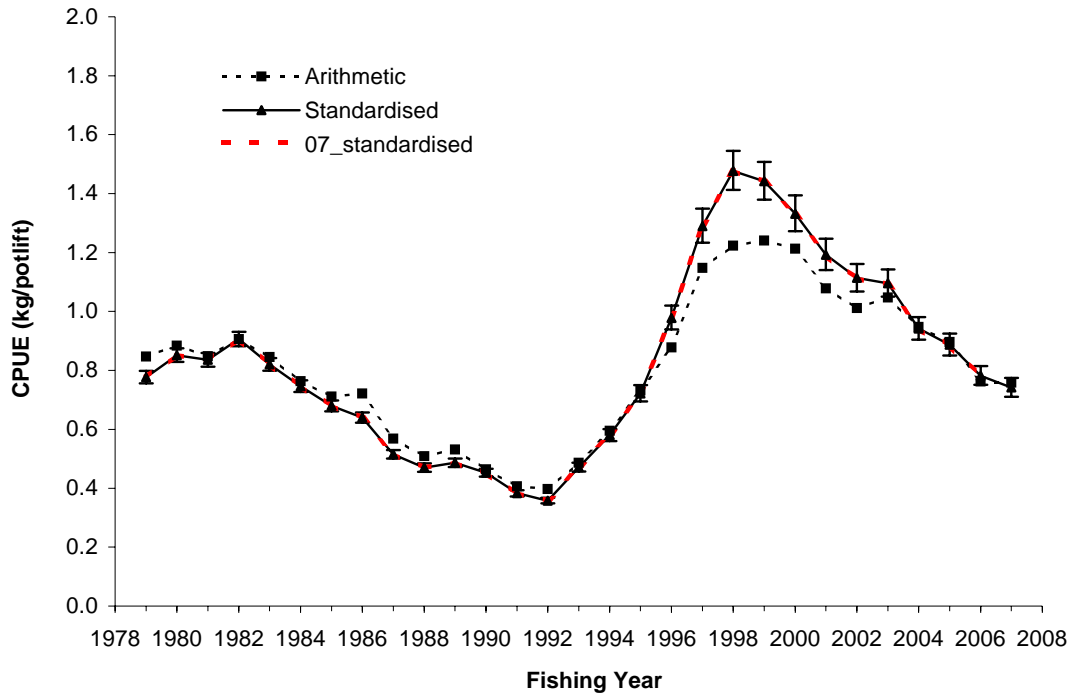


Figure 5. Values for the NSC standardised annual CPUE indices compared with the mean arithmetic annual CPUE (sum of annual catch divided by sum of potlifts). The standardised series is scaled to the geometric mean of the arithmetic annual CPUE (kg/potlift). Also shown is the equivalent standardised series calculated in September 2007.

Management Procedures for CRA 7 and CRA 8

Since 1996 both CRA 7 and CRA 8 areas have been managed using decision rules based on the observed CPUE in the fishery. The management procedure have been revised over the years, most recently in 2007 when a separate management procedure was accepted by the Minister for each of CRA 7 and CRA 8 for the 2008–09 fishing year.

Both management procedures use the most recent standardised CPUE estimate as input. However, this analysis differs from those published in Starr (2007) as they encompass a non-standard fishing year, extending from 1 October to 30 September, thus bringing in 6 months of the active fishing year into the calculation. By using only the most recent CPUE observation, the new management procedure contrasts with the previous NSS procedure that used the most recent three years of estimates. Both new management procedures produce a TAC value in every year which also contrasts with the NSS procedure that incorporated a “latent year”, whereby TAC changes could not be made in two consecutive years.

The CRA 7 management procedure is shown in Figure 6. The rule gives TAC as a simple function of CPUE. The rule is

$$TAC_{y+1} = 100I_y$$

where TAC_{y+1} is the rule’s specified TAC for the next year and I_y is standardised CPUE from the most recent 12 months, 1 October to 30 September (not the fishing year as shown in Table 3).

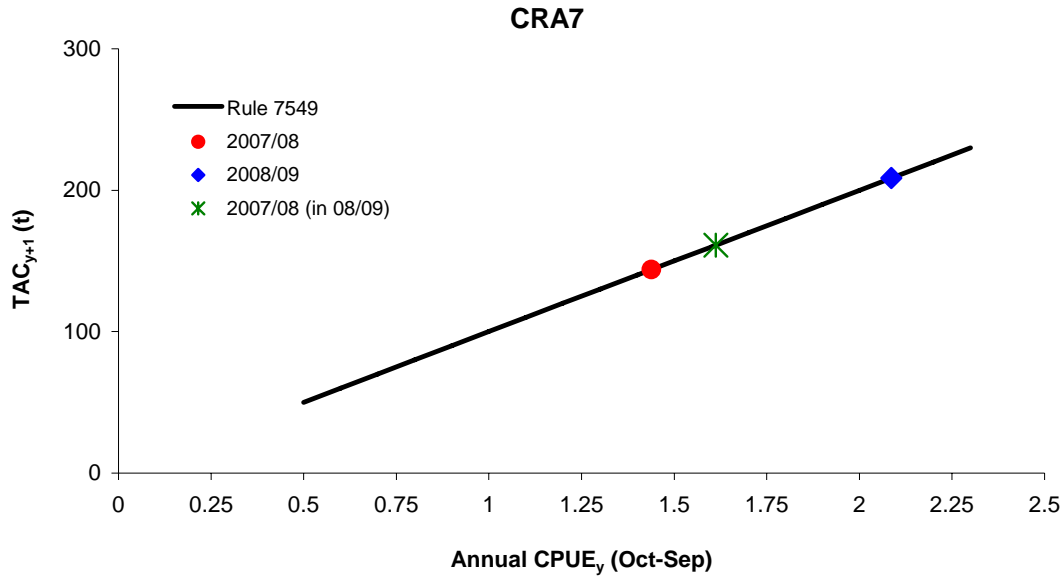


Figure 6: Graphical representation of the CRA 7 management procedure, showing TAC in the next year as a function of CPUE in the current year, showing the 2008–09 CPUE value (2.09 kg/pot lift). Also shown are the 2007–08 CPUE values, one calculated in December 2007 and the most recent from the end of October 2008.

The CRA 8 management procedure is shown in Figure 7. This rule gives a TAC which is not a simple linear function of CPUE: instead, TAC is constant over a wide range of CPUE; it decreases at a faster rate than CPUE when CPUE is below a threshold and it increases slowly when CPUE is above a threshold. The plateau affords stability of TACC that was a high desideratum of the CRA 8 commercial industry.

Formally, this rule is given by:

$$TAC_{y+1} = \begin{cases} \max\left(0, \left(1053 - 1.2(1.9 - I_y) \frac{1053}{1.9}\right)\right), & I_y < 1.9, \\ 1053, & 1.9 \leq I_y \leq 3.2, \\ 1053 + 0.16(I_y - 3.2) \frac{1053}{1.9}, & I_y > 3.2. \end{cases}$$

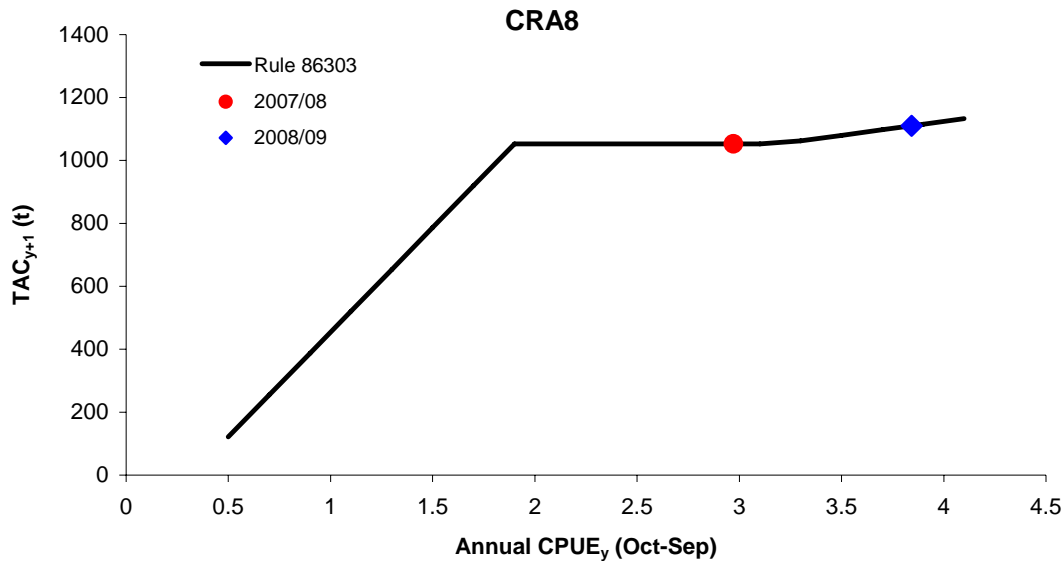


Figure 7: Graphical representation of the CRA 8 management procedure, showing TAC in the next year as a function of CPUE in the current year, showing the 2007–08 and 2008–09 CPUE values

Implementation of CRA 7 and CRA 8 harvest control rules for 2008

The most recent annual standardised CPUE estimate for CRA 7 is 2.09 kg/pot for the period 1 October 2007 to 30 September 2008. Under the CRA 7 management procedure, this gives a TAC of 209 t. The current TAC for CRA 7 is 143.9 t.

The most recent annual standardised CPUE estimate for CRA 8 is 3.84 kg/pot for the period 1 October 2007 to 30 September 2008. Under the CRA 8 management procedure, this gives a TAC of 1110 t. The current TAC for CRA 8 is 1053 t.

5. STOCK ASSESSMENT

A new multi-stock length-based model (MSLM) (Haist et al. 2009) was developed in 2006 as an extension to the length-based model previously used for rock lobster stock assessments. MSLM changed the growth model used to make predicted increments in tag-recapture data, and extended the model in several ways:

- MSLM allows several regions to be modelled simultaneously: separate parameters can be estimated for each region or common parameters can be estimated and shared by the regions;
- dynamics allow for movement among regions;
- fishing mortality dynamics can be finite (as in the older model) or instantaneous;
- density-dependent growth can be modelled;
- the time step can be variable;
- a stock-recruit relation can be modelled;
- the fishery selectivity sub-model has two options;
- likelihoods have a variety of options.

This model was used as a single-stock model for the 2008 assessment of CRA 3. In a simple preliminary trial, the new model was able to reasonably match the MPD results from the 2004 CRA 3 assessment when fitted to the same data.

Catch histories for CRA 3 were agreed by the RLFAGW. Other input data to the model included:

- tag-recapture data from 1975–1981 and from 1995–2006,
- standardised CPUE from 1979–2007,
- historical catch rate data from 1963–1973; and
- length frequency data from commercial catches (log book and catch sampling data) from 1989 to 2007.

Because the predicted growth rates were different for the 1975–1981 and 1995–2006 datasets, the RLFAWG agreed that it would be inappropriate to fit the model to the combined tag-recapture dataset (as had been done in the 2004 CRA 3 assessment). Two approaches were used instead. First, the model was altered to permit fitting to the two tag-recapture datasets separately. This alteration was not a formal generalised change to MSLM, but rather was a one-off change to produce a specialised CRA 3 assessment model. In this version, the growth transition matrix for years up to and including 1981 was based on the 1975–1981 tagging dataset (plus whatever contribution was made by other data sets). The growth transition matrix for years from 1995 onwards was based on the 1995–2006 tagging dataset (plus whatever contribution was made by other datasets). The growth transition matrix for the intervening years, 1982–1994, was based on an interpolation of the growth transition matrices estimated for the earlier and later periods. The sensitivity of the model predictions to the specified transition years was also examined.

In this version of the model, the size classes represented by the model were specified differently to deal with a technical problem introduced by the new growth rate handling. The midpoint of the first size bin in the model was increased from 31 mm to 45 mm, and the recruiting cohort mean size was increased to midpoint 47 mm from 33 mm. This was done to avoid growth model misspecification in the small size classes for which there are no observations.

In the second approach, the model was fitted to data from 1983 onwards, using only the 1995–2006 tag-recapture data. This approach was rejected by the RLFAWG, based on the diagnostics of the model and the value of some of the parameters in the results, and will not be described further.

The start date for the accepted model was 1945, with an annual time step through 1973 and then switching to a seasonal model from 1974 onward: autumn/winter (AW), extending from April to September, and spring/summer (SS), extending from October to March. The last fishing year in the minimisations was 2007, and projections were made through 2012 (five years). Two selectivity epochs were modelled, with the change made in 1993 to capture regulation shifts for the pot escape gaps. Recruitment deviations were estimated from 1945 through 2004. Maximum vulnerability was assumed to be for males in the SS season. A marine reserve was modelled, beginning in 1999 and alienating 10% of the habitat. The model was fit to CPUE, the historical catch rate series, length frequency (LF) data and the two tag-recapture datasets. No pre-recruit index was fit, and the puerulus settlement index was fit in a separate randomisation trial.

A log-normal prior was specified for M , with mean 0.12 and c.v. of 0.4. A normal prior was specified for the recruitment deviations in log space, with mean 0 and standard deviation 0.4. Priors for all other parameters were specified as uniform distributions with wide bounds.

Other model options used in the reference case were:

- the dynamics option was set to instantaneous;
- selectivity was set to the double normal form used in previous assessments;
- movements were turned off;
- the relation between CPUE and biomass was fixed to linear;
- maturity parameters were fixed at values estimated outside the model;
- the growth c.v. was fixed to 0.5 to stabilise the analysis;
- the right-hand limb of the selectivity curve was fixed to 200 as in previous assessments;
- dataset weights were adjusted to attempt to obtain standard deviations of normalised residuals of 1.0 or medians of absolute residuals of 0.67.

The RLFAWG considered results from the mode of the joint posterior distribution (MPD) results and the results of 13 sets of MPD sensitivity trials:

- altering the specification of the growth transition period,
- varying the transition period between tag data sets,
- using finite dynamics instead of instantaneous,
- varying start year and initial exploitation rate,
- estimating the relation between CPUE and biomass,
- estimating the CV of predicted growth increments,
- estimating maturity parameters,
- fixing the size at maximum selectivity for females to 60,
- fixing M to 0.12 (the mean of the prior),
- removing data sets one at a time
- estimating the right-hand limb of selectivity for both sexes and epochs,
- ignoring the marine reserve,
- fitting to puerulus settlement data and
- adding uncertainty to NSL catches as requested by the WG

Most base case results showed limited sensitivity to these trials, with some notable exceptions being the removal of CPUE data or, to a lesser extent, removal of tag-recapture data. The indicator ratios were reasonably stable, but some sensitivity was observed to model starts after 1945 with different assumed values for initial exploitation rate. Overall, it was not possible to draw strong conclusions from the sensitivity trials, given that the median and mean of the assessment posterior distributions moved a considerable distance from the MPD estimates.

The assessment itself was based on Markov chain – Monte Carlo (McMC) simulation results. We started the simulation at the base case MPD, and made a chain of three million, with samples saved every 1000 samples, for a sample size of 3000. From the joint posterior distribution of parameter estimates, forward projections were made through 2012. In these projections, catches were assumed to remain constant at their 2007 values, except that the TACC of 190 t was used for commercial catch (which is about 20 t greater than the 2007 commercial catch). The 2007 commercial catch seasonal split was used. Recruitment was re-sampled from 1995-2004, and the estimates for 2005–2007 were overwritten. These projections are sensitive to the period chosen from which to re-sample recruitment, because recruitment trends are different over different periods. The most recent ten years' estimates are considered the best information about likely future recruitments in the short term.

The RLFAWG agreed on a set of indicators. Some of these were based on beginning of season AW vulnerable biomass: the biomass legally and functionally available to the fishery, taking MLS, female maturity, selectivity-at-size and seasonal vulnerability into account. The limit indicator B_{min} was defined as the nadir of the vulnerable biomass trajectory (using current MLS), 1945-2007. Current biomass, B_{2008} , was taken as vulnerable biomass in AW 2008, and projected biomass, B_{2012} , was taken from AW 2012.

A biomass indicator associated with MSY or maximum yield, B_{msy} , was calculated by doing deterministic forward projections for 50 years, using the mean of estimated recruitments from 1979-2004. This period was chosen to represent the recruitments that were estimated from adequate data, and represents the best available information about likely long-term average recruitment. These MSY and B_{msy} calculations are sensitive to the period chosen to represent the mean recruitment, which varies substantially over the range of the period available, causing variation in estimated B_{msy} . It was agreed to hold the non size-limited (NSL) catches (customary and illegal) constant at their assumed 2007 values and to vary the SL fishery mortality rate F to maximise the annual size-limited (SL) catch, and to record the associated AW biomass.

MSY was the maximum yield (the sum of AW and SS “size-limited” [SL] catches) found by searching across a range of multipliers (from 0.1 to 2.5) on the AW and SS F values that were estimated for

2007 for the SL catch for each of the 3000 samples from the joint posterior distribution. The model used a Newton-Raphson algorithm to find the NSL fishery mortality rates. The AW vulnerable biomass associated with the MSY was taken to be B_{msy} . If the MSY were still increasing with the highest F multiplier, the MSY and B_{msy} obtained with that multiplier were used. The multiplier, F_{mult} , was also reported as an indicator. The MSY and B_{msy} calculations were based on the growth parameters estimated from the second (1996–2006) tag dataset.

We also used as indicators the exploitation rate associated with the SL catch from 2007 and 2012: $USL2007$ and $USL2012$ respectively. At the request of the National Rock Lobster Management Group we also compared projected CPUE with an arbitrary target of 0.75 kg/potlift.

The assessment was based on the medians of posterior distributions of these indicators, the posterior distributions of ratios of these indicators, and probabilities that various propositions were true in the posterior distributions.

The primary diagnostics used to evaluate the convergence of the McMC were the appearance of the traces, running quantiles and moving means. The trace for M was not as well mixed as one could hope to see and showed some drift throughout the run, with higher values towards the end. The running quantile plots for many estimated parameters also showed a drift through the run, suggesting poor convergence, and a trend to move well away from the MPD estimate. Diagnostic plots of the indicators, however, tended to be more acceptable than those of the parameters.

The posterior trajectory of vulnerable biomass by season from 1976 (Figure 8) shows a nadir near 1989, a strong increase in the 1990s followed by a sharp decrease, and variable projections with an decreasing median. The trajectory of biomass from 1945 to 1960 is difficult to explain as there were only low catches throughout this period; the model output shows low recruitments estimated for these years.

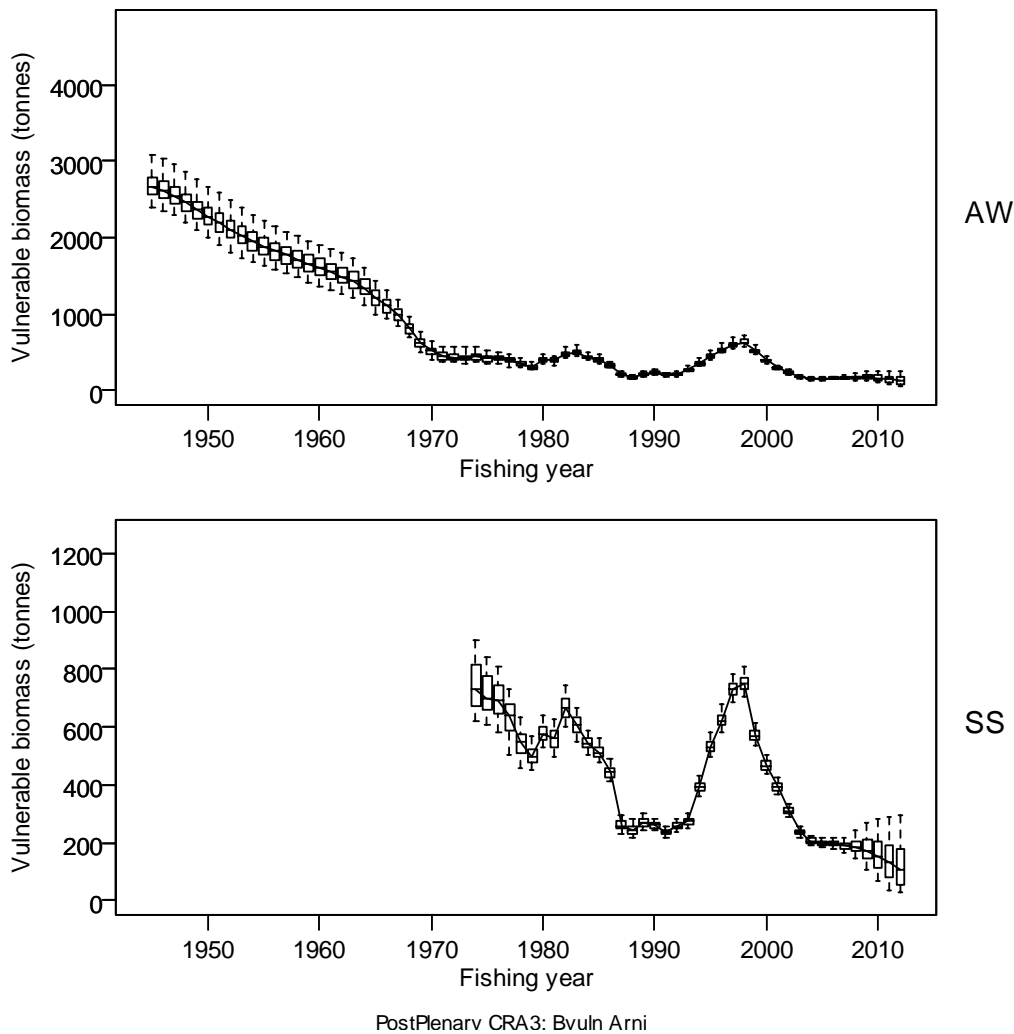


Figure 8: The posterior trajectory of vulnerable biomass, by season, from the CRA 3 base case MCMC simulations, including the projections from 2008-12. For each year the horizontal line represents the median, the box spans the 25th and 75th percentiles and the dashed whiskers span the 5th and 95th percentiles. Values in the AW panel before 1974 reference a complete year rather than the AW season.

The assessment results are summarised in Table 13. B_{msy} and MSY from the base case were calculated with growth estimates based on the later and slower growth dataset. Current biomass (2008) was above B_{min} in 83% of runs, and the median result was 11% above B_{min} . Current biomass was above B_{msy} in less than 1% of runs, and the median result was half B_{msy} . Current exploitation rate was about 55%.

Biomass increased in only 25% of projections, and the median decrease was 25%. Projected biomass had a median of 124 t, but uncertainty around this was high, with a 5% to 95% range of 65 to 256 t. B_{2012} was above B_{min} in 36% of runs, and the median result was 83% of B_{min} . B_{2012} was greater than B_{msy} in less than 1% of runs, and the median was 37% of B_{msy} .

Projected CPUE had a median of 0.5 kg/potlift, and only 20% of runs exceeded 0.75 kg/potlift. The mean F multiplier associated with MSY was about 75% of current F .

These results suggest a stock that is near B_{min} and well below B_{msy} . Under current catches and recent

recruitments the model predicted a 75% probability of biomass decrease over four years.

Table 13: Quantities of interest to the assessment from the model base case McMCs. *USL* is the exploitation rate that produces the size-limited catch. All biomass values are in tonnes and represent the beginning of season AW vulnerable biomass.

	indicator	type	value	5%	95%
biomass	<i>Bmin</i>	median	149.1	134.4	172.2
	<i>B2008</i>	median	167.1	135.1	218.7
	<i>B2012</i>	median	123.7	64.9	255.6
	<i>Bmsy</i>	median	330.4	301.2	378.1
CPUE	<i>CPUEcurr</i>	median	0.662	0.547	0.835
	<i>CPUE2012</i>	median	0.492	0.260	0.989
	<i>CPUEmsy</i>	median	1.314	1.178	1.476
yield	<i>MSY</i>	median	300.4	291.2	310.2
biomass ratios	<i>B2008/Bmin</i>	median	1.114	0.936	1.400
	<i>B2008/Bmsy</i>	median	0.505	0.406	0.643
	<i>B2012/B2008</i>	median	0.746	0.424	1.347
	<i>B2012/Bmin</i>	median	0.831	0.445	1.662
	<i>B2012/Bmsy</i>	median	0.372	0.195	0.759
fishing mortality	<i>USL2007</i>	median	0.550	0.461	0.621
	<i>USL2012</i>	median	0.811	0.392	1.546
	<i>USL2012/USL2007</i>	median	1.478	0.733	2.761
	<i>Fmult</i>	mean	0.727		
probabilities	<i>P(2008>Bmin)</i>	mean	82.5%		
	<i>P(B2008>Bmsy)</i>	mean	0.0%		
	<i>P(B2012>B2008)</i>	mean	24.5%		
	<i>P(B2012>Bmin)</i>	mean	36.5%		
	<i>P(B2012>Bmsy)</i>	mean	0.5%		
	<i>P(CPUE2012>0.75)</i>	mean	19.0%		
	<i>P(USL2012>USL2007)</i>	mean	78.9%		

Projections were made with alternative levels of SL catch (commercial plus recreational) with the NSL catch (illegal and customary) held constant. These were 5-year projections made in the same way as the base case projections described above, and were made at the request of the Plenary for the guidance of the NRLMG, stakeholders and MFish.

Table 14: results of 5-year projections with alternative SL catch levels.

SL catch (t)	206.0	185.4	164.8	144.2	123.6	82.4	41.2	0.01
% of current catch	100%	90%	80%	70%	60%	40%	20%	0%
<i>B2012</i>	123.7	160.9	195.3	229.0	262.0	328.6	396.6	463.6
<i>B2012/Bmin</i>	0.831	1.073	1.307	1.532	1.754	2.199	2.645	3.090
<i>B2012/B2008</i>	0.746	0.948	1.151	1.346	1.548	1.942	2.340	2.740
<i>B2012/Bmsy</i>	0.372	0.481	0.586	0.688	0.788	0.989	1.191	1.394
<i>CPUE2012</i>	0.492	0.639	0.775	0.910	1.041	1.303	1.566	1.832
<i>P(B2012>Bmin)</i>	36.5%	57.0%	77.4%	92.4%	98.2%	100.0%	100.0%	100.0%
<i>P(B2012>B2008)</i>	24.5%	44.4%	67.6%	88.7%	97.7%	100.0%	100.0%	100.0%
<i>P(B2012>Bmsy)</i>	0.5%	1.4%	4.0%	9.0%	18.5%	47.8%	83.6%	98.3%
<i>P(CPUE2012>0.75)</i>	19.0%	34.6%	53.7%	73.5%	89.1%	99.1%	100.0%	100.0%

6. YIELD ESTIMATES

Estimation of Maximum Constant Yield (MCY)

Jasus edwardsii, all stocks

MCY was not estimated.

Sagmariasus verreauxi, PHC stock

MCY was estimated using the equation $MCY = cY_{av}$ (Method 4). Mean annual landings for 1979–96 were 20.0 t. The best estimate of M is 0.1, so the value of c was set at 0.9.

$$MCY = cY_{av} = 0.9 * 20 = 18 \text{ t}$$

It is not possible to assess the level of risk to the stock of harvesting the population at the estimated MCY value.

Estimation of Current Annual Yield (CAY)

Jasus edwardsii, all stocks

CAY was not estimated for any stock.

Sagmariasus verreauxi, PHC stock

CAY was not estimated because no biomass estimates are available for this stock.

7. STATUS OF THE STOCKS

Jasus edwardsii, NSN substock

CRA 1

The stock assessment of CRA 1 was not updated in 2008. The 2002 model results suggested that 2001–02 stock abundance was higher than in the 1979–88 reference period, with low exploitation rates under levels of catch used in the assessment. Those levels of catch appeared to be sustainable, because model projections at the end of the 5-year projection period had a median expected biomass near the 2001–02 biomass.

However, the projections showed increasing uncertainty on an annual basis and should not be considered reliable much beyond two to three years. Because the projections were made under the assumption of constant catches fixed at levels used in the assessment (commercial 129.2 t, amateur 47.2 t; customary 10 t; unreported illegal 72 t.), an increase in catch levels would result in an increased probability of a decrease in biomass.

Model results seemed robust to the range of assumptions examined in the sensitivity trials, and also showed good retrospective performance. In particular, the effect of assuming a higher non-commercial catch history in the model resulted in similar 2001 and projected stock status.

CRA 2

The stock assessment of CRA 2 was not updated in 2008. The 2002 model results suggested that 2001–02 stock abundance was higher than in the 1979–88 reference period, with exploitation rates of 20–25% in each season under catch levels used in the assessment. Model results seemed robust to the range of assumptions examined in the sensitivity trials. In particular, the effect of assuming a

higher non-commercial catch history in the model resulted in similar 2001 and projected stock status.

The 2001–02 levels of catch as used in the assessment (commercial 225 t, amateur 122.6 t, customary 10 t, illegal 88 t.) appeared to be sustainable, because model projections at the end of the 5-year projection period had a median expected biomass near the 2001–02 biomass. However, in this stock, the projections should be considered less reliable than for CRA 1, because the uncertainty of future recruitment has more short-term effect on projected biomass. Because the projections were made under the assumption of constant catches fixed at the levels used in the assessment, an increase in levels would result in an increased probability of a decrease in biomass.

***Jasus edwardsii*, NSC substock**

CRA 3

The stock assessment of CRA 3 was updated in 2008, using a purpose-built modification of the new multi-stock, length-based Bayesian model. Model results suggest that stock abundance at the start of 2008–09 was probably above the minimum biomass estimated over the course of the fishery (*B_{min}*). A *B_{msy}* reference point was calculated for the first time but the utility of this reference point requires further discussion and investigation. Current biomass was estimated to be roughly half *B_{msy}*, suggested a depleted stock compared with the estimated *B_{msy}*. Current fishing mortality is approximately 27% higher than *F_{msy}*. Projections made for five years with the 2007 levels of catch (but using the TACC for projected commercial catch) produced a median 25% decrease in model biomass.

Model results were reasonably robust to the range of assumptions examined in the MPD sensitivity trials. In particular, altering assumptions with respect to non-commercial catch histories in the model resulted in similar current stock status. However, it was not possible to draw strong conclusions from the sensitivity trials, given that the median and mean of the assessment posterior distributions moved a considerable distance from the MPD estimates.

The quality of the Markov chain – Monte Carlo simulations was not high. The running quantile plots for many estimated parameters showed a drift through the run, suggesting poor convergence, and a trend to move well away from the MPD estimate. Diagnostic plots of the indicators, however, tended to be more acceptable than those of the parameters.

CRA 4

The stock assessment of CRA 4 was not updated in 2008. The 2005 model results suggest that stock abundance in 2005–06 was higher than in the 1979–88 reference period. Exploitation rate peaked in the late 1980s to early 1990s in the spring-summer fishery, and recent exploitation rate was between 20% and 30% of the size-limited catch. 2006 levels of catch produced a median 6% reduction in model biomass over three years to a level that usually remained higher than the reference levels.

Model results were robust to the range of assumptions examined in the sensitivity trials, including the assumption of domed selectivity and a non-linear CPUE fit. The model also showed stable retrospective performance. In particular, the effect of doubling the non-commercial catch histories in the model resulted in similar current stock status and similar projection results. The base case was chosen after extensive exploration of model runs that showed sensitivity to data weighting assumptions. This suggested that other credible model structures may exist.

CRA 5

The stock assessment of CRA 5 was not updated in 2008. The 2003 model results suggested that 2002–03 vulnerable biomass was higher than in the 1979–88 reference period, with moderate exploitation rates under levels of catch used in the model. With the 2002–03 assumed levels of catch, model projections at the end of the 5-year projection period showed a median biomass

smaller than the 2002–03 biomass, but still well above the reference levels. The 2002–03 vulnerable biomass was estimated to be greater than at any time in the last 20 years and the decrease was expected to be modest.

These projections showed increasing uncertainty on an annual basis and should not be considered reliable beyond two to three years. Because the projections were made under the assumption of constant catches fixed at 2002–03 levels, an increase in catch levels would result in an increased probability of a decrease in biomass and likely lower future biomass.

Model results seemed robust to the range of assumptions examined in the sensitivity trials, and also showed reasonable retrospective performance. The effect of higher alternative non-commercial catch histories in the model resulted in similar 2002 stock status but quite different projected stock status.

***Jasus edwardsii*, NSS substock**

In 2006, CRA 7 and CRA 8 were modelled simultaneously as separate stocks within a new multi-stock model. The assessment was not finalised in the time available; however, both stocks showed increasing CPUE to levels not seen since the 1980s. CPUE in CRA8 in 2006 was well above the target set for the rebuilt stock (1.9 kg per potlift). This indicated that it was time to develop a management strategy designed to maintain stock biomass, and this was done in 2007.

The 2007 management procedure for CRA 7 triggered a 3.7 t increase in the TAC for CRA 7, which was implemented at the beginning of the 2008–09 fishing year. The 2007 management procedure for CRA 8 triggered a 211 t increase in the TAC for CRA 8, which was implemented at the beginning of the 2008–09 fishing year. In 2008 these management procedures indicate further increases in the TAC. For CRA 7, implementation of the harvest control rule for the 2009-10 fishing year would see the TAC increase from 143.9 to 209 t, while in CRA 8 the TAC would increase from 1053 to 1110 t.

***Jasus edwardsii*, CHI stock**

The stock assessment for this substock has not been updated since 1996. The status of this stock is uncertain. Catches have been less than the TACC since 1990, although the shortfall was only 10 t in 2007-08. CPUE showed a declining trend from 1979/1980 to 1997/1998 but increased to 2004 and has been stable since then. These observations suggest a roughly stable standing stock after an initial fishing down period. However, size frequency distributions in the lobster catch had not changed when they were examined in the mid 1990s, with a continuing high frequency of large lobsters. Large lobsters would have been expected to disappear from a stock declining under fishing pressure. This apparent discrepancy could be caused by immigration of large lobsters into the area being fished. The models investigated assume a constant level of annual productivity which is independent of the standing stock.

Commercial removals in the 2007–08 fishing year (350 t) were within the range of estimates for MCY (300–380 t), and close to the current TACC (360 t). The current TAC (370 t) lies within the range of the estimated MCY.

***Sagmariasus verreauxi*, PHC stock**

The status of this stock is unknown.

Summary of yield estimates (t), TACCs and TACs (t), and reported 2007-08 commercial landings. The yield estimates for CRA 6 are the range of yield estimates from a simple production model. (–, not available).

Fishstock	QMA	Yield Estimate	2007–08 TACC	2007–08 Landings	2008–09 TACC	2008–09 TAC

CRA 1	Northland	–	131.1	129.6	131.1	–
CRA 2	Bay of Plenty	–	236.1	229.7	236.1	452.6
CRA 3	Gisborne	–	190.0	171.0	190.0	319.0
CRA 4	Wairarapa–Hawke Bay	–	577.0	315.2	577.0	771.0
CRA 5	Canterbury–Marlborough	–	350.0	349.8	350.0	467.0
CRA 6	Chatham Islands	300–380	360.0	350.0	360.0	370.0
CRA 7	Otago	–	120.2	120.1	123.9	143.9
CRA 8	Southern	–	755.2	752.4	966.0	1 053.0
CRA 9	Westland–Taranaki	–	47.0	47.0	47.0	–
CRA 10	Kermadec	–	0.0	0.0	0.0	–
Total			2 766.6	2 464.8	2 981.0	3 576.5
PHC 1	All QMAs	18	40.3		40.3	

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