Fisheries New Zealand
Tini a Tangaroa

Review of management procedures for spiny rock lobster (CRA 7 & 8), and review of CRA 8 sustainability measures for 2024/25

Fisheries New Zealand Discussion Paper No: 2023/26

ISBN No: 978-1-991120-44-1 (online)
ISSN No: 2624-0165 (online)

December 2023

Te Kāwanatanga o Aotearoa
New Zealand Government

Contents

Stocks being reviewed

Red or Spiny rock lobster[1]: (CRA 7) – Otago, and (CRA 8) – Southland, Fiordland, Stewart Island, & Auckland Islands

Red or Spiny rock lobster, Crayfish, Kōura papatea
Jasus edwardsii,

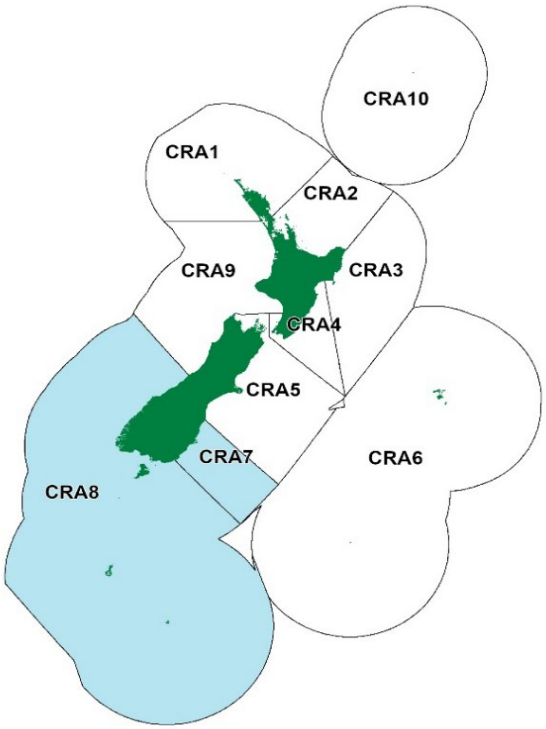

Figure 1: Quota Management Areas (QMAs) for spiny rock lobster, with CRA 7 and CRA 8 highlighted.

1 Why are we proposing a review?

1. Fisheries New Zealand (**FNZ**) with input from the National Rock Lobster Management Group (**NRLMG**) is reviewing the use of management procedures for spiny rock lobster in Quota Management Areas CRA 7 (Otago) and CRA 8 (Stewart Island, Southland, and Fiordland) (Figure 1). Fisheries New Zealand is also reviewing the catch limits (Total Allowable Catch (**TAC**) and Total Allowable Commercial Catch (**TACC**) and allowances in CRA 8 for the 1 April 2024 fishing year.

2. A management procedure is a set of 'decision rules' that can be used to guide the setting of commercial catch limits (TACCs) based on changes in abundance (measured by changes in commercial catch rates ('catch-per-unit-effort' or '**CPUE'**)). The use of management procedures allows FNZ to respond quickly to changes in stock abundance on an annual basis because there is a more settled approach to how to respond to different levels of abundance. Commercial stakeholders support the use of management procedures because they provide greater certainty about management processes that can be followed to achieve management goals (e.g., ensuring low sustainability risk, optimising economic yield, and minimising fluctuations in catch).[2]

3. Management procedures do not automatically predetermine or decide the catch limit settings for stocks. They help to guide in when and how catch limit reviews are considered. If a TAC or TACC change is required, this is still subject to the usual process of consultation and requires the Minister for Ocean and Fisheries' (**the Minister's**) decision via a sustainability round process. When reviews of catch limits are initiated FNZ still considers all of the best available

[1] Hereafter referred to as spiny rock lobster.

[2] The benefits and risks of using management procedures are outlined further below under heading 5 '*Proposed Management Procedures*'.

information in determining appropriate options for public consultation (which can include options to set the catch limits at a different level than is recommended by the management procedure if there is concern about the operation of the procedure). Following consultation, the Minister maintains discretion in deciding on catch limit settings that are considered to meet the statutory requirements of the Fisheries Act 1996 (**The Act**).

4. Spiny rock lobster (*Jasus edwardsii*) supports important shared fisheries. Spiny rock lobsters are a taonga for tāngata whenua, a popular species for recreational fishers to catch, and support valuable export markets, regionally important industries, and employment. They are also ecologically important predators in New Zealand's rocky reef ecosystems, feeding on a wide range of prey.

5. The CRA 7 and CRA 8 stocks are thought to be interrelated (see heading 3.1 *'Biology'* below). Because of this, they are assessed together. The status of both stocks is assessed by a fully quantitative stock assessment, and by rapid assessment updates which are conducted annually between the full assessments. There is no agreed management target for either of these stocks, but the default 40% SSB_0 (unfished spawning stock biomass[3]) target of the Harvest Strategy Standard (**HSS**)[4] is being applied for the combined stocks and for CRA 8 (see heading 4 *'Status of the stocks'* for further detail).

6. The most recent fully quantitative stock assessment for CRA 7 and CRA 8 was completed in 2021. It determined that the combined stocks were above the previously agreed B_{MSY} reference level (the biomass, or weight of fish, which produces the maximum sustainable yield (**MSY**)[5]). The assessment projected that biomass would increase further between 2021 and 2025 and stay well above the reference level. Based on that assessment, in 2022 the total and commercial catch limits (TACs and TACCs) of both stocks were increased, with a ~7% TAC increase for CRA 7 and a ~13% TAC increase for CRA 8.[6]

7. Rapid assessment updates have subsequently been conducted for both CRA 7 and CRA 8, with the most recent update being completed in 2023. The 2023 rapid assessment update incorporated the most recent data into the 2021 base case stock assessment model. This rapid assessment update of the 2021 full assessment reflects the best available information on the abundance of spiny rock lobster in CRA 7 and CRA 8.

8. The 2023 rapid assessment update indicated that spiny rock lobster biomass in CRA 7 and CRA 8 has increased in recent years. The combined biomass of these stocks is now estimated to be at 54% SSB_0 which is above the default management target of 40% SSB_0. The biomass of CRA 8 is also estimated to be above the default management target at a level of 62% SSB_0.[7] The status of CRA 7 in relation to the default management target of 40% SSB_0 cannot be reliably estimated (see heading 4 *'Status of the stocks'*). However, the best available information suggests that CRA 7 is likely to be at or above 40% SSB_0 and is likely to increase in abundance in the near future. The proposals presented in this paper are based on this information from the 2023 rapid assessment update and outputs from management procedures.

9. In 2023, updated CPUE series were approved for CRA 7 and CRA 8, which has allowed for the possibility for management procedures to be re-instated in both fisheries. Fisheries New Zealand is now seeking feedback on the use of these management procedures. The management procedures for CRA 7 and for CRA 8 are separate. For CRA 7, the proposed

[3] SSB_0, the spawning stock biomass, is the biomass of sexually mature females only. This includes females that are sexually mature but smaller than the minimum legal size (i.e., not able to be caught).

[4] The HSS is a policy statement of best practice in relation to the setting of fishery and stock targets and limits for fish stocks in New Zealand's QMS. It is intended to provide guidance on how fisheries law will be applied in practice, by establishing a consistent and transparent framework for decision-making to achieve the objective of providing for utilisation of New Zealand's QMS species while ensuring sustainability. Heading 9.2 of this paper provides more information on the relevance of the HSS.

[5] Maximum Sustainable Yield (***MSY***) is the greatest yield that can be achieved over time while maintaining the stock's productive capacity, having regard to the population dynamics of the stock and any environmental factors that influence the stock.

[6] The relevant Minister's decision letter and advice paper can be found on FNZ's website at: https://www.mpi.govt.nz/consultations/review-of-sustainability-measures-2022-april-round/

[7] The status of CRA 8 is estimated by assessing Region 2 (Fiordland) of the stock assessment model because the majority (>80%) of commercial harvest for CRA 8 occurs in Region 2.

management procedure is the same as the procedure which applied to CRA 7 prior to 2021. The proposed management procedure for CRA 8 is new, as it has been developed from previously unused logbook CPUE data (see heading 5 '*Proposed management procedures*) (Table 1 and Table 2).

10. Fisheries New Zealand is not proposing any changes to the TAC, allowances, or TACC of CRA 7 for 1 April 2024 because, based on the results of the 2023 rapid assessment update, the current settings appear to remain appropriate. The management procedure for CRA 7 also does not recommend a TACC change.

11. The 2023 rapid update assessment and new management procedure for CRA 8 indicate that there is an opportunity for increased commercial utilisation of the stock. In line with this, FNZ is proposing options to either apply a small increase to the TAC of CRA 8 to align with current recreational harvest or apply a moderate increase (148 tonnes) to the TAC to provide for increased utilisation from 1 April 2024 in line with the management procedure (Table 2). The *status quo* is not proposed as an option for CRA 8 because the best available estimates of current recreational harvest are higher than the recreational allowance and biomass trends in CRA 8 suggest that the allowance can be sustainably increased to align with current harvest. If the Minister chose to increase the TAC of CRA 8, it would be varied under section 13(2)(a) of the Act.

2 Summary of proposed options

12. The proposed options for the CRA 7 management procedure are outlined in Table 1 below. A description of the specifications and output of the management procedure are given under heading 5.4 *''CRA 7 management procedure proposed for 2024'* and in Figure 7.

Table 1: Proposed management procedure options for CRA 7.

CRA 7 management procedure options	
Option 1	*Reject the use of the proposed management procedure.*
Option 2	*Confirm the use of the proposed management procedure.*

13. Option 1 would reject the use of the previous management procedure for CRA 7, while Option 2 would confirm its reinstatement in the management of CRA 7 until 2027/28 (which is when the next full stock assessment is scheduled), or until reviewed earlier. Regardless of whether the management procedure is adopted for the CRA 7 fishery, FNZ is not proposing any changes to the TAC settings of CRA 7 for the upcoming 1 April 2024 fishing year. The current settings appear to be appropriate based on the 2023 rapid assessment update. The CRA 7 management procedure also does not recommend a TACC change based on application of the most recent CPUE data. However, FNZ welcomes feedback and submissions on the use of the proposed management procedure for CRA 7.

14. The proposed management procedure and TAC options for CRA 8 are summarised in Table 2. A description of the specifications and output of the management procedure are given under heading 5.5 *''CRA 8 management procedure proposed for 2024'* and in Figure 8.

Table 2: Proposed management procedure and TAC options for CRA 8 from 1 April 2024 (figures are all in tonnes).

Option	TAC	TACC	Allowances		
			Customary Māori	Recreational	Other mortality caused by fishing
Current settings	1,453	1,251	30	33	139
Option 1 *(Reject the use of the new management procedure. Set the TAC, allowances, and TACC as follows)*	1,459 (↑ 6)	1,251	30	39 (↑ 6)	139
Option 2 *(Confirm the use the new management procedure. Set the TAC, allowances, and TACC as follows)*	1,601 (↑ 148)	1,392 (↑ 141)	30	39 (↑ 6)	140 (↑ 1)

15. Two options are proposed for CRA 8. Option 1 would reject the use of the new CRA 8 management procedure and would apply an increase of six tonnes to the TAC and recreational allowance to align the settings with new estimates of recreational harvest. Option 2 for CRA 8 would accept the use of the new management procedure and in line with the procedure, would apply an increase to the TAC of 148 tonnes in response to recent increases in CPUE. This would include an increase of six tonnes to the recreational allowance to align with new estimates of recreational harvest, an increase of one tonne to the allowance for other mortality caused by fishing, and an increase of 141 tonnes to the TACC to support increased commercial utilisation.

16. Fisheries New Zealand welcomes feedback and submissions on the options proposed, or any alternatives.

3 About the stocks

3.1 Biology[8]

3.1.1 Distribution and movement

17. Spiny rock lobsters, *Jasus edwardsii*, are distributed around New Zealand and Southern Australia. They are mainly found on reef habitat, though sometimes form aggregations on sand (Kelly et al., 1999). They are known to inhabit depths of up to 200 m, but their overall depth distribution around New Zealand is not well understood.

18. Adult spiny rock lobsters are generally considered to have a small home range once settled (i.e., less than 5 km). However, they also exhibit patterns of movement at various life stages. This includes movement into shallow water seasonally for moulting and mating, and females moving to the edges of reefs to spawn their eggs. Some migrations consist of large numbers of spiny rock lobsters moving together.

19. Long-distance migrations (>100 km) of spiny rock lobsters have been observed within CRA 7 and CRA 8, between Otago and Stewart Island and Fiordland (Kendrick & Bentley, 2003). During spring and early summer, variable proportions of usually small males and immature females move against the current from the east and south coasts of the South Island towards Fiordland and south Westland (i.e., out of CRA 7 into western regions of CRA 8; (Annala, 1983)). Tagging data suggests that females in CRA 7 migrate to CRA 8 Fiordland statistical areas prior to reaching maturity (McKoy, 1983). This is supported by the observation that mature females are largely absent from catches in CRA 7 and the Southland/Stewart Island statistical areas of CRA 8 (McKoy, 1983).

3.1.2 Growth, maturity, and reproduction

20. Spiny rock lobsters are thought to be relatively slow-growing and long-lived. Individuals in Australia are considered to live at least 20 years (Linnane et al., 2021). Size at maturity varies between locations and ranges from 34 mm to 77 mm tail width (**TW**) for females across New Zealand (Annala et al., 1980). Female spiny rock lobsters in CRA 8 mature at a relatively large size (approximately 60 mm TW) compared to those in other Quota Management Areas (i.e., 40 mm TW in CRA 3 and CRA 4).

21. Female spiny rock lobsters produce eggs once a year and can produce between 40,000 to 600,000 eggs in a single reproductive event, with larger females producing more eggs than smaller individuals (Green et al., 2009). Eggs incubate for 3 to 4 months on the underside of the female's tail, held in place by small hairs (Kelly et al., 1999).

22. Mating occurs after moulting in autumn and eggs hatch into larvae in spring. Larval development can last 12 to 24 months and occurs far offshore (Bradford et al., 2014, Chiswell & Booth, 2008). Because of the long larval life of spiny rock lobsters, 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. For most areas, larvae may originate a considerable distance from the settlement site.

[8] Information in this section references the FNZ Fisheries Assessment Plenary 2023, except where cited otherwise.

3.1.3 Predator-prey interactions

23. Spiny rock lobsters are ecologically important predators in New Zealand's rocky reef ecosystems, where they can exert top-down regulation of prey populations (see heading 9.1 '*Interdependence of stocks'* below; Pinkerton et al., 2008, Pinkerton et al., 2015). They consume a broad range of prey, including molluscs, crustaceans, annelid worms, macroalgae, echinoderms, sponges, bryozoans, fish, foraminifera, and brachiopods (MacDiarmid et al., 2013). They prefer soft-sediment bivalves over rocky reef prey and make nocturnal foraging movements away from the reef (Flood, 2021). Their feeding rates vary seasonally in relation to moulting and reproductive cycles (Kelly et al., 1999).

24. Spiny rock lobsters can also consume kina (sea urchins, *Evechinus chloroticus*). While urchins are not a preferred prey item for lobsters (Flood, 2021), there is evidence that lobsters are important predators for larger urchins (Andrew & MacDiarmid, 1991, Shears & Babcock, 2003). Based on research from north-eastern New Zealand, spiny rock lobsters and other predators can have a significant role in mitigating the occurrence of sea urchin (kina) barrens[9] (Doheny et al., 2023).

25. The ecological role spiny rock lobsters play in sea urchin abundance, and hence the occurrence of sea urchin (kina) barrens, is discussed further under ' heading 8.4.3 '*Habitats of particular significance for fisheries management' and* heading 9.1 *'Interdependence of stocks'*.

26. Predation on spiny rock lobsters is known from a variety of fish species. Published scientific observations support predation upon small to medium spiny rock lobsters by octopus, rig, blue cod, grouper, southern dogfish, seals, and by other rock lobsters (MacDiarmid et al., 2013).

3.2 Fishery characteristics

27. CRA 7 extends from the Waitaki River south along the Otago coastline to Long Point (Figure 1). CRA 8 is the largest New Zealand spiny rock lobster fishery, extending from Long Point south to Stewart Island and the Snares Islands, the islands and coastline of Foveaux Strait, and then northwards along the Fiordland coastline to Bruce Bay (Figure 1).

28. Spiny rock lobsters in CRA 7 and CRA 8 are predominantly caught by commercial fishers in a targeted potting fishery (>97% of spiny rock lobster caught commercially in CRA 7 and CRA 8 in the last five years were caught in rock lobster pots). The number of operating vessels in CRA 7 has varied between 9 and 12 vessels since 2011/12, with 9, 10 and 10 operating in 2020/21, 2021/22 and 2022/23, respectively. In CRA 8, the number of operating vessels in CRA 8 has varied between 61 and 69 since 2002–03, with 61, 64 and 67 operating in 2020/21, 2021/22 and 2022/23, respectively.

29. Recreational fishers predominantly catch spiny rock lobsters using targeted methods including hand-gathering by diving and potting. Most of the recreational catch in CRA 7 and CRA 8 is taken during the summer months, consistent with all other spiny rock lobster stocks. The region also sustains a dive charter industry catering to recreational fishing during summer.

30. Commercial harvesting is prohibited in some areas of CRA 8, including the inner fiords in Fiordland (see heading 8.5.6 *'Other plans and strategies'* and Figure A1 in Appendix 3 for further details).

31. Spiny rock lobster product is primarily exported with a free on board (**FOB**)[10] value of NZ $376 million for all spiny rock lobster stocks across New Zealand in the 2022 calendar year. It is unknown how much is sold on the domestic market.

[9] Sea urchin barrens are sea urchin dominated areas of rocky reef that would normally support healthy kelp forest but have little or no kelp due to overgrazing by sea urchins.

[10] Free on board is the value of export goods, including raw material, processing, packaging, storage and transportation up to the point where the goods are about to leave the country as exports. FOB does not include storage, export transport or insurance cost to get the goods to the export market.

3.3 Management background

32. Within New Zealand, spiny rock lobsters are managed within the Quota Management System (**QMS**)[11] using a range of both output (catch limits, minimum legal sizes) and input controls (regulations including area and gear restrictions, and recreational daily limits). The fishing year for spiny rock lobster runs from 1 April to 31 March.

33. The overall management approach for spiny rock lobster fisheries is to monitor and manage them to provide for use while ensuring sustainability, as per the purpose of the Fisheries Act 1996 (**the Act**). The use of regular scientific assessments to support reviews of spiny rock lobster catch limits is consistent with this approach. Being able to adapt and respond quickly to changes observed in spiny rock lobster abundance is important, because populations of spiny rock lobster can fluctuate rapidly in response to changes in the environment that can affect recruitment, abundance, and availability (Nursey-Bray et al., 2012, McLeay et al., 2019).

34. Since 1992, the National Rock Lobster Management Group (**NRLMG**) has assisted with advice on catch limits, regulatory and management actions that apply specifically to spiny rock lobster fisheries. The NRLMG is a national-level, multi-stakeholder group comprising representatives of tāngata whenua, recreational, and commercial fishing sectors, environmental organisations, and FNZ.

35. The NRLMG's management goal is for all spiny rock lobster fisheries "to be managed and maintained at or above the assessed and agreed reference levels, using a comprehensive approach that recognises a range of customary Māori, recreational, commercial, and environmental concerns and values."

36. Stock abundance for CRA 7 and CRA 8 combined was estimated to be below the soft limit from the early 1990s until 2000 but thereafter substantially increased and is now considered to be above the default management target and increasing (see heading 4 '*Status of the stocks'* below).

37. The TACs for CRA 7 and CRA 8 were last reviewed and modified in 2022.[12] At that time, the TAC in CRA 7 was increased from 126.2 tonnes to 134.5 tonnes (7% increase). Within this, the allowance for other sources of mortality caused by fishing was increased from 5 tonnes to 8 tonnes (60% increase), and the TACC was increased from 106.2 tonnes to 111.5 tonnes (5% increase). The TAC in CRA 8 was also increased from 1,282.7 tonnes to 1,453 tonnes (13% increase). Within this, the allowance for other sources of mortality caused by fishing was increased from 28 to 139 tonnes (396% increase), and the TACC was increased from 1,191.7 tonnes to 1,251 tonnes (5% increase).

3.3.1 Stock assessment and monitoring information

38. Full scientific stock assessments of spiny rock lobster stocks are usually carried out every four to five years, except for the data limited CRA 9 stock (Westland/Taranaki).[13] These assessments estimate the status of the stock relative to requirements of the Act and indicate how the stock has responded to previous management controls.

39. The most recent full stock assessment for CRA 7 and CRA 8 was conducted in 2021, and the next full stock assessment is scheduled for 2027.

40. Rapid update assessments are also conducted during the intervening years between full stock assessments, to provide updated estimates of stock status that are used to guide management settings on an annual basis. In 2023, rapid assessment updates were conducted for CRA 7 and CRA 8. These rapid assessment updates use new information (such as updated commercial

[11] For more information about the QMS go to https://www.mpi.govt.nz/law-and-policy/legal-overviews/fisheries/quota-management-system/.

[12] Review of Rock Lobster Sustainability Measures for 2022/23 Final Advice Paper (mpi.govt.nz).

[13] The small number of fishers in CRA 9 and low fishing pressure means that there is no currently accepted stock assessment for CRA 9. The stock is monitored using commercial catch and biological information from the fishery. The CRA 9 TAC and TACC are the smallest of the nine fished spiny rock lobster stocks.

catch information, recreational harvest estimates, length frequency, and growth information) to update the most recent full stock assessment model.

41. Two alternative measures of biomass for the CRA 7 and CRA 8 stocks were provided by the 2021 assessment model and subsequent rapid assessment updates. These are:

- Spawning Stock Biomass (**SSB**) – sexually mature females only. This includes females that are sexually mature but smaller than the minimum legal size that are not vulnerable to the fishery (i.e., cannot be landed legally).
- Vulnerable Biomass – vulnerable biomass refers to that portion of a stock's biomass that is available to fisheries, i.e., legally harvestable adult spiny rock lobsters, (that are also often referred to as the exploitable biomass). For spiny rock lobsters this is defined as male and female fish above the Minimum Legal Size (**MLS**) at the beginning of the autumn-winter season, excluding berried females.

42. Two alternative measures of stock biomass are required because:

- The Harvest Strategy Standard for New Zealand Fisheries **(HSS)** specifies that the 10% hard limit and 20% soft limit should be determined relative to the SSB of the unfished level; and
- A MSY-related target is most appropriately calculated from the vulnerable biomass component of the stock, that provides yield from the fishery.

43. Estimates of B_{MSY} compatible reference levels are produced by the most recent stock assessment for each spiny rock lobster stock, which inherently reflect the biological and fishery characteristics that are unique to each stock. These B_{MSY} compatible reference levels are calculated in a way that is consistent with the requirements of the Act, to maintain stocks at or above a level that can produce the MSY, while meeting the risk constraints in the HSS.

44. A B_{MSY} reference level (4,963 tonnes vulnerable biomass) for the combined CRA 7 and CRA 8 stocks was estimated from the 2021 for the full stock assessment model. This and more recent estimates of B_{MSY} for the combined CRA 7 and CRA 8 stocks are no longer considered to be reliable, following unsuccessful attempts to estimate B_{MSY} for each of these stocks independently of each other (see explanation in paragraph 62. As a result, the 2023 November Fisheries Assessment Plenary[14] rejected the 2021 B_{MSY} reference level as a management target for CRA 7 and CRA 8.

45. For this review of CRA 8, the 2023 November Plenary recommended that a default B_{MSY} management target of 40% SSB_0 (unfished spawning stock biomass) could be used to provide some guidance, as defined in the 2008 Harvest Strategy Standard.[15] Neither a 40% SSB_0 management target (see heading 4 *'Status of the stocks'*) nor a vulnerable biomass B_{MSY} management target could be reliably estimated for the CRA 7 stock.

46. It is important to note that single species' stock B_{MSY} management targets do not take into account wider ecosystem considerations, or the interdependence of stocks. Because management procedures are designed to maintain a stock around a management target, these procedures do not explicitly account for ecosystem considerations either. Further work and significant stakeholder engagement will be required before management targets can be developed to take into account multi-species interactions and wider ecosystem effects.

47. Management targets could be set at or above the B_{MSY} reference level, depending on social, cultural, ecological, and economic factors, as well as tāngata whenua and stakeholder aspirations for each spiny rock lobster fishery and the wider ecosystem in areas where fishing

[14] Fisheries Assessment Plenaries summarise fisheries, biological, environmental, and stock assessment information for NZ's commercial fish species and groups. The Plenaries, which are released annually in May and November (two different versions covering different stocks) provide our best available information on stock status for QMS fish stocks, including rock lobster. FNZ incorporates new research and information into the plenaries on an annual basis. This research and information is reviewed through a plenary working group process (led by FNZ's science team) that includes input from fisheries scientists, subject matter experts and fisheries stakeholders. The 2023 November Fisheries Assessment Plenary is accessible at: https://www.mpi.govt.nz/dmsdocument/60529-Fisheries-Assessment-Plenary-November-2023-Stock-Assessments-and-Stock-Status-Introductory-Section-to-Yellowfin-Tuna.

[15] Harvest Strategy Standard for NZ Fisheries (mpi.govt.nz).

occurs. In setting targets, the role of spiny rock lobster in maintaining biodiversity in a healthy marine environment will need to be considered. Management targets should take into account fishery implications such as predicted yields and catch rates. Additional approaches that could be used to move stocks toward these new targets or maintain the stock at or above any targets, would also need to be agreed by the Minister.

48. In 2022, the NRLMG formed a sub-group to explore management targets and identified areas where further work is needed, including:

    a) Sourcing science that might inform the levels of biomass that might better achieve the Act's environmental obligations;
    b) Improving the mechanisms that would allow estimation of recreational take with sufficient precision to inform management and obtaining information to calibrate recreational controls;
    c) Determining the way and rate of change to achieve the new selected target;
    d) How allocation decisions would be made in the process of building and maintaining stocks at new management targets.

49. In 2023, FNZ has contracted modelling to understand the consequences of managing to higher levels relative to B_{MSY} for a number of CRA stocks and further investigated ways to estimate recreational harvest. These results have been used to inform further discussions with the NRLMG to explore support for specific management targets for select CRA stocks. Progressing this work continues to be a priority for FNZ and the NRLMG.

3.3.2 Management procedures

50. As noted in the introduction of this paper, management procedures set out pre-agreed management actions that would be taken in response to changes in CPUE, an indicator of relative spiny rock lobster abundance. [16]

51. Management procedures were previously applied to management of the CRA 7 and CRA 8 stocks between 1996 and 2020 but were halted due to data issues arising following the implementation of the Electronic Reporting System (**ERS**) in 2019. In 2023, the November Plenary approved two different CPUE series for the CRA 7 and CRA 8 fisheries, which has allowed the development of new management procedures for both fisheries. Fisheries New Zealand is now consulting on the use of these updated management procedures from April 2024.

52. Heading 5 '*proposed management procedures'* provides further discussion of management procedures, including a general background explaining why management procedures are used, their history in CRA 7 and CRA 8, and a full outline of the management procedures proposed in CRA 7 and CRA 8 from 2024.

4 Status of the stocks[17]

53. The best available information for the status of CRA 7 and CRA 8 consists of the last full stock assessment conducted in 2021, the 2023 rapid assessment update, and the 2022/23 CPUE.

54. The combined CRA 7 and CRA 8 stock is estimated to be above the default management target of 40% SSB_0 (unfished spawning stock biomass), as is CRA 8 alone. The status of CRA 7 in relation to the management target cannot be estimated (for reasons discussed below under paragraphs 62 and 63). However, based on the status of the combined CRA 7 and CRA 8 stock and that the biomass trajectory for each stock is similar, CRA 7 is likely to be at or above a level consistent with the management target.

[16] Catch per unit effort (CPUE) is the quantity of fish caught with one standard unit of fishing effort e.g. the number of fish taken per 1000 hooks per day; or the weight of fish taken per hour of trawling. CPUE is often assumed to be an abundance index. A declining CPUE may mean that more effort (e.g., metres of net set and/or length of soak time, is required to catch a given volume of fish. This in turn may indicate that a fish stock has declined (although other factors can also influence rates of CPUE, particularly for species that have patchy or clumped distributions).

[17] For more on how New Zealand fish stocks are assessed, visit https://www.mpi.govt.nz/fishing-aquaculture/fisheries-management/fish-stock-status/.

4.1 Summary of 2021 stock assessment results

55. A full stock assessment was conducted for CRA 7 and CRA 8 in 2021. The stock assessment modelled CRA 7 and CRA 8 as one biological stock across two regions (Figure 2), because very few mature female lobsters are caught in CRA 7, with both sexes migrating from CRA 7 back into CRA 8 as they become sexually mature. The two regions are defined in the assessment model as:

    a) **Region 1 (Otago/Southland):** CRA 7 and statistical areas 922, 923, 924, and 925 of CRA 8; and
    b) **Region 2 (Fiordland):** Statistical areas 926, 927, and 928 of CRA 8 (see Figure 2).

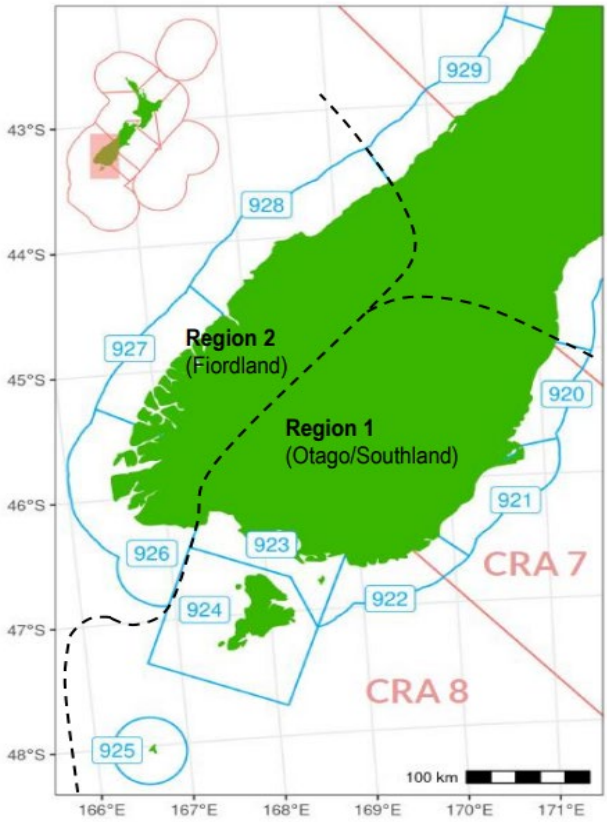

Figure 2: The CRA 7 (Otago) and CRA 8 (Southern) Quota Management Areas and statistical areas, showing approximate boundary of the two regions used in the 2021 CRA 7 & 8 stock assessment model (black dashed lines).

56. The 2021 stock assessment suggested that, for the combined CRA 7 and CRA 8 fishery, the vulnerable biomass in both regions had increased substantially from the low levels experienced near the end of the 1990s. In 2021, the combined vulnerable biomass of CRA 7 and CRA 8 was estimated to be 146% (7,114 tonnes) of the B_{MSY} reference level (4,863 tonnes vulnerable biomass) and was projected to increase to 169% (8,203 tonnes) of the B_{MSY} reference level by 2025.

57. Combined spawning stock biomass in 2021 was estimated to be 48% of the unfished level, well above the soft limit of 20% where it is FNZ policy to implement a formal, time-constrained rebuilding plan.

58. Projections of the 2021 stock assessment model out till 2025, based on 2021 catch levels and recent levels of recruitment, suggested that vulnerable biomass would increase in Region 1 and remain steady in Region 2, with an overall increase in vulnerable biomass across the two regions combined. The spawning stock biomass was projected to increase in both regions.

59. As noted above, the TACs and TACCs for CRA 7 and CRA 8 were increased in 2022 following the 2021 assessment results (~7% TAC increase for CRA 7 and ~13% TAC increase for CRA 8).[18]

4.2 Summary of the 2023 rapid assessment update

60. A 2023 rapid assessment update for CRA 7 and CRA 8 incorporated a further two years data into the 2021 stock assessment model.

61. The stock status estimates for 2023 provided by the most recent rapid assessment update model are consistent with the projected estimates provided by the 2021 full assessment model, indicating a slightly higher biomass which is largely attributable to higher-than-average recruitment in recent years. The consistency of these results therefore supports the trend in increasing biomass for the combined CRA 7 and CRA 8 stocks that was evident in the projections of the 2021 stock assessment model out to 2025.

62. The best available information for the status of CRA 7 and CRA 8 has changed since the 2021 stock assessment. The November 2023 Plenary rejected the B_{MSY} target reference level (vulnerable biomass) estimate provided by the combined stock 2021 assessment, because the estimated target levels for Region 1 and Region 2 were not considered acceptable, which undermined confidence in the combined stock estimate. The B_{MSY} estimate for Region 1 was also considered to be implausibly low relative to levels estimated for other regions, and implausibly high for Region 2.

63. The 2023 Plenary therefore recommended that the 40% SSB_0 default target (recommended by the HSS) should be used instead to provide some guidance on the status of the combined biological stock of CRA 7 and CRA 8, as well as CRA 8 individually. Therefore, the best available information for CRA 8 is the combined biomass and the SSB of Region 2 (Fiordland) (see Table 4). However, SSB cannot be reliably estimated for CRA 7, because an unknown amount of adult lobster from this area migrate to CRA 8 soon after maturation. In the absence of reliable SSB estimates for CRA 7, the best available information on the relative stock status for this stock is CPUE data (see Figure 6).

4.2.1 Combined status of CRA 7 (Otago) and CRA 8 (Stewart Island, Southland, Fiordland)

64. The results of the 2023 rapid update show that CRA 7 and CRA 8 combined vulnerable biomass is 25% (8,367 tonnes) of the unfished level (33,942 tonnes). See Figure 3 and Table 3 below.

[18] The relevant Minister's decision letter and advice paper can be found on FNZ's website at: https://www.mpi.govt.nz/consultations/review-of-sustainability-measures-2022-april-round/.

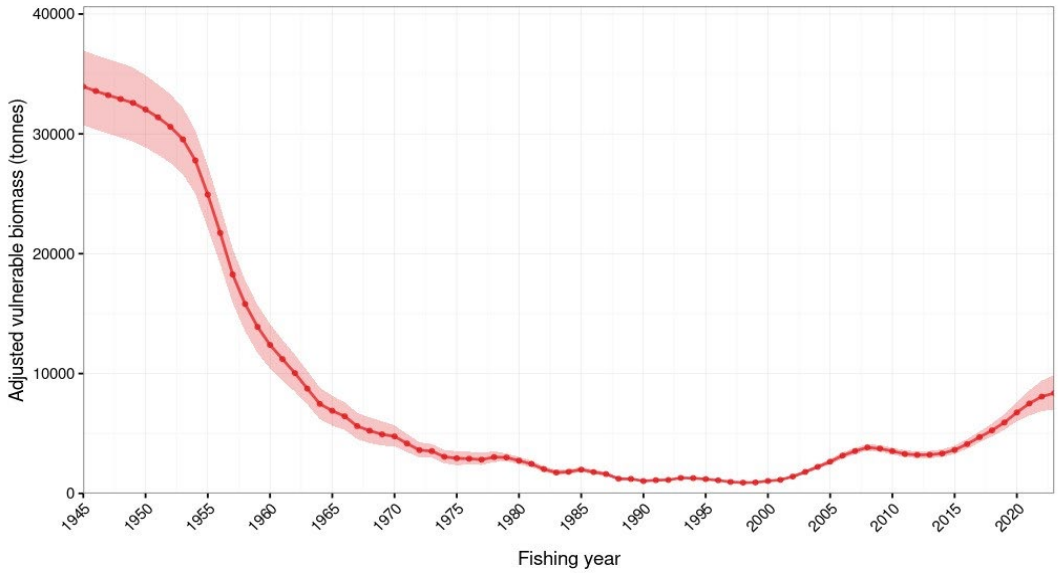

Figure 3: The 2023 rapid update estimates of the CRA 7&8 vulnerable biomass (tonnes) trend since 1945 (autumn winter adjusted). The solid line and points show the median estimates and the shaded region indicates 90% credible intervals. The two regions have been combined into a single CRA 7&8 series for this plot.

65. Combined spawning stock biomass for CRA 7 and CRA 8 is estimated to be 54% (10,232 tonnes) of unfished levels (19,026 tonnes) and very likely (>90% probability) to be above the 40% SSB_0 target (Figure 4). It is very unlikely (<10% probability) that 2023 spawning biomass is below the soft limit of 20% SSB_0 and the hard limit of 10% SSB_0 (Table 3).

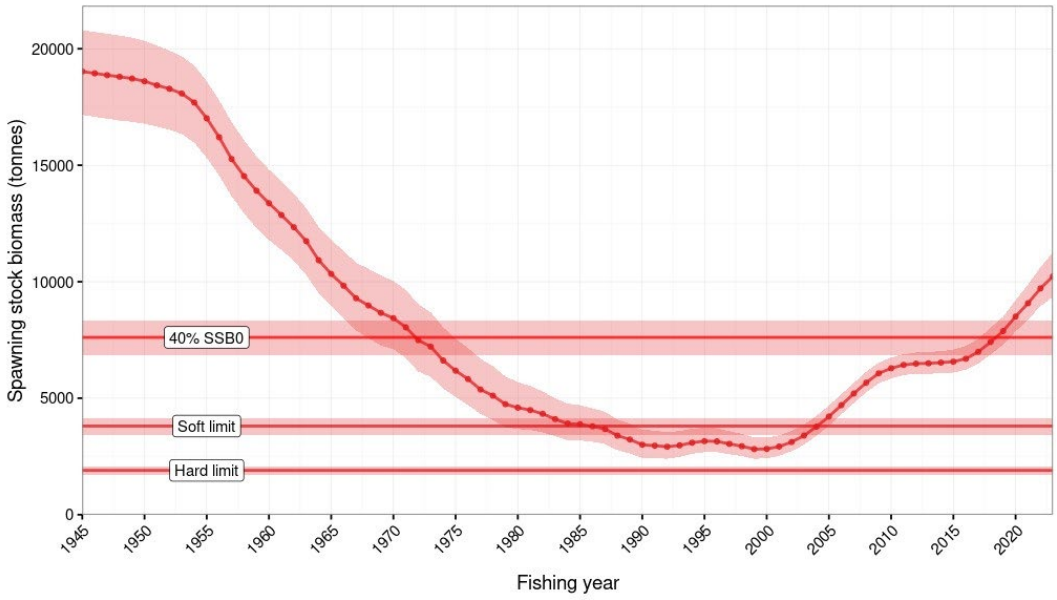

Figure 4: The 2023 rapid update estimates of trends in the spawning stock biomass in CRA 7&8 (tonnes) since 1945. The solid line and points show the median and the shaded region indicates 90% credible intervals. The distributions of the default target (40% SSB_0) and soft (20% SSB_0) and hard (10% SSB_0) limits are also shown. The two regions have been combined into a single CRA 7&8 series for this plot.

66. Table 3 provides further results for the combined biomass of CRA 7 and CRA 8 from the 2023 rapid assessment update in terms of vulnerable and spawning stock biomass, with associated uncertainty range estimates (quantiles).

Table 3. Estimates from the 2023 CRA 7 and CRA 8 rapid assessment update with 5th, 50th (median), and 95th quantiles (measures of uncertainty).[19] These values are reported for CRA 7 and CRA 8 combined.

Performance indicators	5% quantile	Median	95% quantile	Interpretation of the median results
Vulnerable biomass (B)				
B_{2023} / B_0	0.202	0.248	0.297	Vulnerable biomass in 2023 was 24.8% of unfished levels
Spawning stock biomass (SSB)				
SSB_{2023} / SSB_0	0.490	0.540	0.595	Spawning biomass in 2023 was 54% of unfished levels
Probabilities				
$P(SSB_{2023}>10\%SSB_0)$		1		Very unlikely (<10% probability) that 2023 spawning biomass is less than 10% of unfished levels (hard limit)
$P(SSB_{2023}>20\%SSB_0)$		1		Very unlikely (<10% probability) that 2023 spawning biomass is less than 20% of unfished levels (soft limit)

4.2.2 Status of CRA 8 (Stewart Island, Southland, Fiordland)

67. The best available information for CRA 8 is the combined biomass of CRA 7 and CRA 8 and the biomass of CRA 8 alone (estimated using Region 2 of the model).[20] In CRA 8, the vulnerable biomass is estimated to be 29% (5,266 tonnes) of unfished levels (18,461 tonnes). Spawning stock biomass is estimated to be 62% (6,377 tonnes) of unfished levels (10,391 tonnes). CRA 8 is very likely (>90% probability) to be above the default target of 40% SSB_0, and very unlikely (<10% probability) to be below the soft and hard limits (Table 4).[21]

Table 4. Estimates for CRA 8 from the 2023 rapid assessment update with 5th, 50th (median), and 95th quantiles (measures of uncertainty).[22]

Performance indicators	5% quantile	Median	95% quantile	Interpretation of the median results
Vulnerable biomass (B)				
B_{2023} / B_0	0.228	0.285	0.354	Vulnerable biomass in 2023 was 28.5% of unfished levels
Spawning stock biomass (SSB)				
SSB_{2023} / SSB_0	0.544	0.617	0.695	Spawning biomass in 2023 was 61.7% of unfished levels
Probabilities				
$P(SSB_{2023}>10\%SSB_0)$		1		Very unlikely (<10%) that 2023 spawning biomass is less than 10% of unfished levels (hard limit)
$P(SSB_{2023}>20\%SSB_0)$		1		Very unlikely (<10%) that 2023 spawning biomass is less than 20% of unfished levels (soft limit)

[19] The median is the midpoint of a distribution of possible values, such that there is an equal probability of falling above or below it. The 5% and 95% quantiles represent the lower 5% and upper 5% of a distribution of values.

[20] The status of CRA 8 is estimated using the results of the 2023 rapid assessment update for Region 2 of the assessment model. The status of the spiny rock lobster population in Region 2 is considered to be representative of CRA 8 because >80% of commercial harvest in CRA 8 is landed from Region 2, and the CPUE abundance index trend for CRA 8 is very similar to that calculated from Region 2 catch and effort data.

[21] The status of CRA 8 is estimated using the results of the 2023 rapid assessment update for Region 2 of the assessment model. The status of the spiny rock lobster population in Region 2 is considered to be representative of CRA 8 because >80% of commercial harvest in CRA 8 is landed from Region 2, and the CPUE abundance index trend for CRA 8 is very similar to that calculated from Region 2 catch and effort data.

[22] The median is the midpoint of a distribution of possible values, such that there is an equal probability of falling above or below it. The 5% and 95% quantiles represent the lower 5% and upper 5% of a distribution of values.

68. A statistically standardised CPUE index is considered to be a reliable indicator of relative changes in the abundance of spiny rock lobster in CRA 8 and has been used to inform the development of management procedures for the CRA 8 stock, which are being proposed here. (see heading 5 *'Proposed management procedures'* and Appendix 2 for further information on the CRA 8 management procedure).

69. The history of CRA 8 commercial CPUE is shown in Figure 5. This series uses offset year CPUE which is defined as the last six months of a fishing year combined with the first six months of the following year (1 October to 30 September). Since the 2011/12 fishing year, CPUE in CRA 8 has steadily increased, reaching over 5.0kg/potlift in 2017/18 and 2018/19. In 2022/23, CPUE is estimated to be 8.455 kg/potlift, suggesting further increases in abundance. These are the highest observed CPUEs in any of the spiny rock lobster stocks.

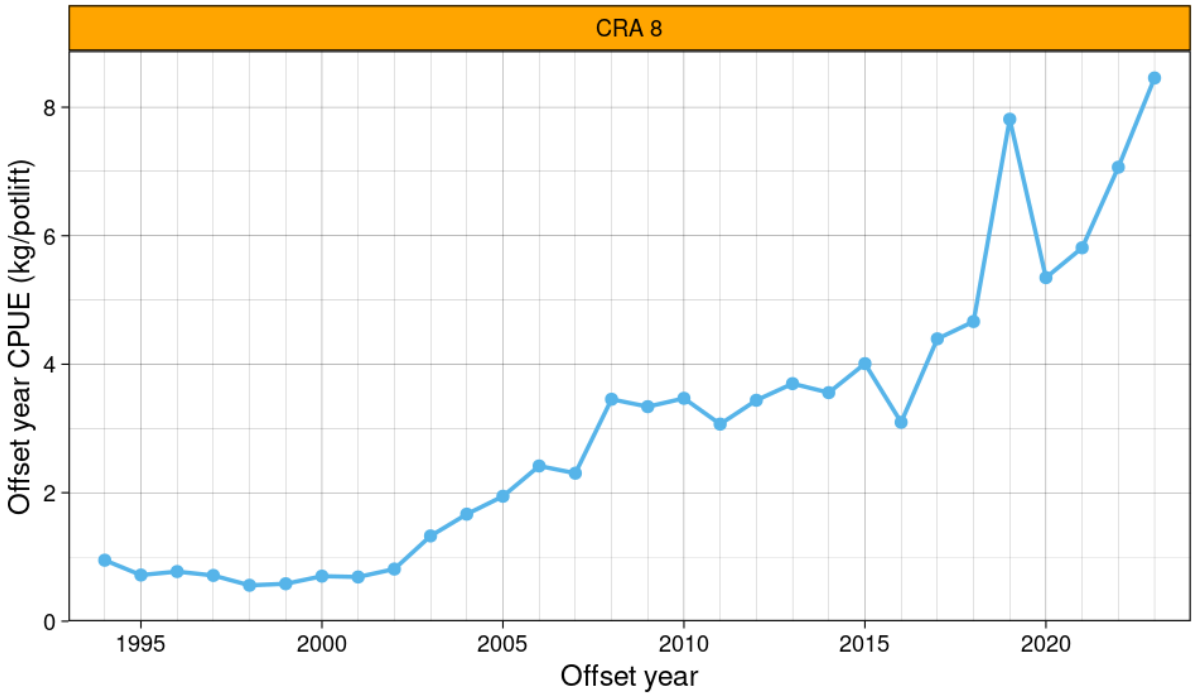

Figure 5. CRA 8 offset year CPUE in kg per potlift. The trend in CPUE since 1994/95 has been calculated from voluntary logbook data reported by CRA 8 commercial fishers. An offset year is defined as the last six months of a fishing year combined with the first six months of the following fishing year (1 October to 30 September). CPUE is calculated in terms of offset years, so that the estimate for the most recent year is based on data that are as up to date as possible given the timing of sustainability reviews for rock lobster stocks.

4.2.3 Status of CRA 7 (Otago)

70. Because biomass for CRA 7 cannot be reliably estimated separately, the best available information for stock status of CRA 7 is standardised CPUE based on past Catch Effort Landing Return (**CELR**) and ERS data. Standardised CPUE CELR data was also used as the abundance indicator for the previously accepted CRA 7 management procedure (see heading 5 *'Proposed management procedures'* and Appendix 1 for further information on the management procedure).

71. The history of CRA 7 commercial CPUE is shown in Figure 6. CPUE has been increasing since a low point in the late 1990s. Between 2008 and 2012 CPUE decreased but then increased over the following decade, reaching over 3.0 kg/potlift in 2022. In 2022/23 CPUE decreased to 2.5 kg/potlift. Overall, the trend in CPUE suggests that the abundance of spiny rock lobster in CRA 7 has increased in the last decade and remains high compared to historical levels.

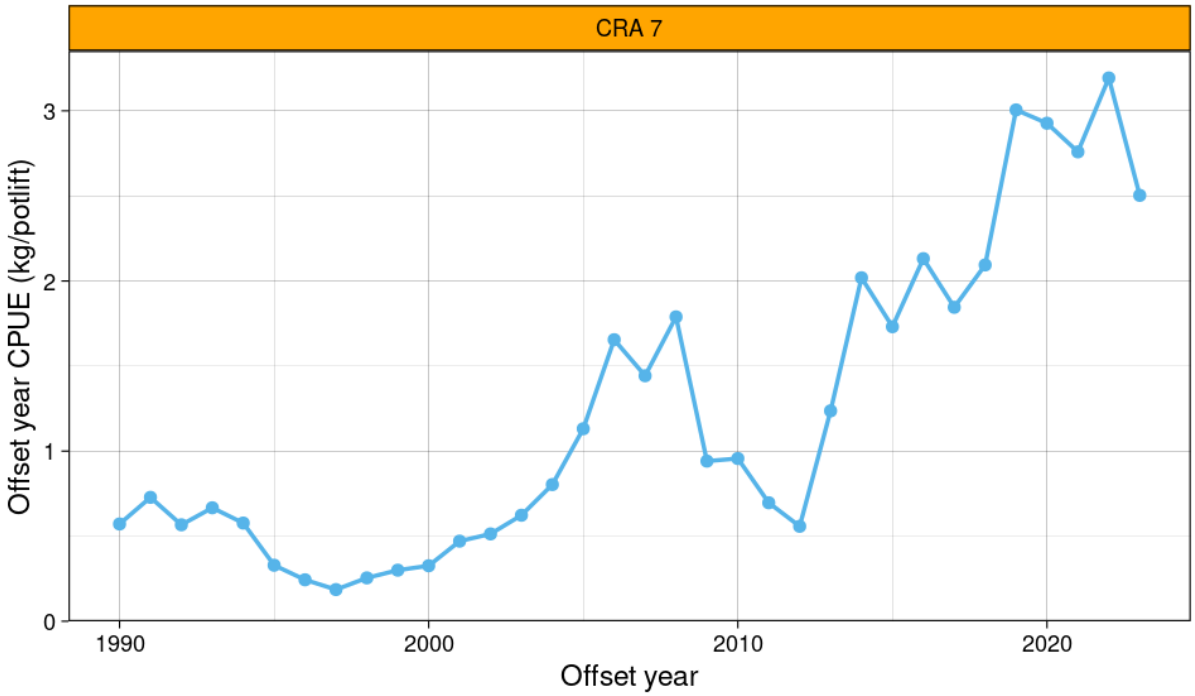

Figure 6. CRA 7 (Otago) offset year CPUE in kg per potlift from the 1990/91 to the 2022/23 fishing year, based on data from the Catch, Effort, and Landings Returns (CELR) until 2019 and from the Electronic Reporting System (ERS) from 2020.

4.2.4 Uncertainty in the stock assessment

72. The full stock assessment conducted in 2021 was independently reviewed and accepted by a Plenary panel, that included reviewers who had not been previously involved in the development of the assessment. While there are remaining uncertainties associated with the most recent stock assessment model (and annual rapid assessment updates of that model) it is still considered to be the best source of information available on the status of the CRA 7 and CRA 8 stocks.

73. A list of uncertainties that were noted at the time of the 2021 stock assessment are summarised in the November 2023 Plenary report (pages 450 - 477),[23] and are outlined as the following:

a) Magnitude of early catch history and the distribution of early catch within two regions.
b) The estimates of illegal catches and recreational catches for years without surveys are considered to be unreliable.
c) The tag-based growth estimates provided by the model may not represent growth of the underlying population.
d) A possible cryptic population of large males and mature females in Region 1.[24]
e) The extent of movement between regions in the model is unknown.
f) Selectivity in Region 1 is poorly known.

5 Proposed management procedures

5.1 Why are management procedures used?

74. The use of management procedures to inform appropriate catch limit settings has several advantages for management. These include:

a) enabling management to respond quickly to changes in stock abundance;

[23] The 2023 November Fisheries Assessment Plenary is accessible at: https://www.mpi.govt.nz/dmsdocument/60529-Fisheries-Assessment-Plenary-November-2023-Stock-Assessments-and-Stock-Status-Introductory-Section-to-Yellowfin-Tuna.

[24] However, there is currently no evidence to support the hypothesis that there is a substantive unexploited subpopulation of the stock elsewhere in CRA 7/Region 1.

b) allowing more explicitly defined management goals (e.g., maximising yield, maximising stability, managing at higher abundance, minimising risk) to be incorporated in the TAC review process, and providing greater certainty of achieving these goals;
c) providing for involvement of tāngata whenua and fishery stakeholders when choosing an appropriate set of management procedure rules; and
d) providing the ability to address uncertainty in all facets of the assessment and management process.

5.2 Previous management procedures in CRA 7 and CRA 8

75. Management procedures for rock lobster stocks were first developed and applied to manage the CRA 7 and CRA 8 stocks in 1996, to set TACs to rebuild the stocks so they could be maintained at or above target biomass levels.

76. Up until April 2020, management procedures were used to guide the setting of catch limits for most spiny rock lobster stocks (including CRA 7 and CRA 8) during the intervening years between full stock assessments.

77. Typically, management procedures are developed and approved by the Minister following a full stock assessment and then reviewed every five years unless an earlier review was required. The use of management procedures alongside full assessments was done to ensure that TAC settings remained compliant with the statutory requirements set out in the Act.

78. An initial peer-review of stock assessment models and management procedures is undertaken by the Rock Lobster Working Group (a Science Working Group convened by FNZ) and then ultimately and independently by the Plenary during the November of the same year as the full assessments were undertaken. Simulated data are used to assess and test any management procedures that are proposed, which included testing to assess the robustness of proposed procedures to any known uncertainties, model assumptions (e.g., variable levels of recruitment and non-commercial catches) and alternative base case model configurations.[25]

79. During 2020, management procedures were halted for all spiny rock lobster stocks following the implementation of electronic reporting of catch and effort information (hereafter referred to as the Electronic Reporting System or **ERS**) in 2019. In 2020, the Rock Lobster Working Group reviewed the data from the first year of electronic reporting (1 April 2019 to 31 March 2020), by comparing the data with that generated from the previous paper reporting system. The Rock Lobster Working Group concluded that CPUE estimated under the new electronic reporting system was likely to differ from CPUE estimated under the paper form system and is not comparable. The reasons for this include data being collected on a different spatial and temporal scale, a large number of new reporting codes, different reporting platforms and some issues with operators incorrectly interpreting the new reporting requirements.

80. The disruption to the time series of CPUE data meant that previously used management procedures could not be operated, as they rely on a consistent time series of CPUE.

5.3 2023 updated management procedures for CRA 7 and CRA 8

81. In 2023, the November Plenary approved alternative CPUE series for the CRA 7 and CRA 8 fisheries, allowing the adoption of management procedures to be considered again in both fisheries. The Plenary agreed that the ERS CPUE series in CRA 7 was reliable due to the high quality and consistent reporting by fishers in this area, allowing a further extension of the previously used CELR (Catch Effort Landing Return) CPUE time series index. For CRA 8, a new CPUE series was developed using data from a voluntary logbook programme.[26]

82. Subheadings 5.4 '*CRA 7*' and 5.5 '*CRA 8*' below outline details of the management procedures being proposed for each stock for 2024. Further details on the specifications of each

[25] See the 2023 November Fisheries Assessment Plenary for more information: https://www.mpi.govt.nz/dmsdocument/60529-Fisheries-Assessment-Plenary-November-2023-Stock-Assessments-and-Stock-Status-Introductory-Section-to-Yellowfin-Tuna.

[26] The voluntary logbook programme is a voluntary data collection programme. Fishers collect data from up to four prespecified logbook pots on every fishing trip. Fishers record and classify (sex, size, and maturity status) all of the lobster caught in each pot, but only counts of lobster larger than the minimum legal size are used when calculating CPUE.

management procedure are provided in Appendix 1 (CRA 7) and Appendix 2 (CRA 8). Fisheries New Zealand is consulting on separate management procedures for CRA 7 and for CRA 8. For CRA 7, the proposed management procedure is the same as the management procedure which applied to CRA 7 prior to 2021. The proposed management procedure for CRA 8 is new, as it has developed from previously unused logbook CPUE data.

83. If approved by the Minister, these management procedures would be used to guide management of the stocks through to the 2027/28 fishing year (which is when the next full stock assessment is scheduled), or until reviewed earlier.

5.4 CRA 7 management procedure proposed for 2024

84. It is proposed that the previously accepted management procedure should be used to guide TAC setting in the CRA 7 fishery from 2023/24 through to the 2027/28 fishing year, based on CPUE that has been calculated following new and improved standardisation methods.

85. The previously accepted management procedures were successfully used up until 2020/21, resulting in biomass increases over an eight-year period.

86. As discussed above in heading 5.2 '*Previous management procedures in CRA 7 and CRA 8*' management procedures were halted in all CRA fisheries in 2020 following the switch to electronic reporting, but the Rock Lobster Working Group has recently concluded that reporting under this regime is comparable with that reported previously, in this QMA.

87. Generally, management procedures are evaluated against the most recent full stock assessment to help ensure operation of the management procedure would not pose a sustainability concern. The previously accepted management procedure was not re-evaluated against the more recent 2021 full assessment model, however, because the spatial definition of that model differed from that used by the previous 2015 evaluation model.

88. It is likely that the population dynamics of CRA 7 will have changed since their evaluation in 2015, as indicated by increasing CPUE, recruitment, and biomass in the CRA 7 stock. This creates some uncertainty as to how the stock will respond to operation of the proposed management procedure. However, FNZ considers there is limited risk with operating the proposed management procedure if approved, given the degree of increase in the CRA 7 biomass since 2013, when these rules were first introduced. Rapid update assessments are now undertaken annually for this stock, to provide an independent measure of management performance.

89. In addition, the 2023 November Plenary noted that this would be a short-term management procedure, that may be replaced when CRA 7 and CRA 8 are next assessed (currently scheduled for 2027) by a combined stock model that makes a greater differentiation between the CRA 7 and CRA 8 fisheries. The Plenary also noted that CPUE in CRA 7 is increasing and is now well above the levels experienced since 1979/80.

90. The results of the 2015 evaluation of the CRA 7 management procedure suggested that CPUE would be above the plateau target catch rate (the horizontal part of the procedure where TACC remains stable; see Figure 7) for 50% of the time and below the plateau only 5% of the time. The probability of the biomass falling below all reference levels were low, and CPUE was projected to average 2 kg/potlift.[27] The TACC was changed in 44% of years because of the high proportion of years with CPUE on the upper slope (the right side of the procedure). For further information on the specifications of the new CRA 7 management procedure see Appendix 1.

91. Management procedures are applied to annual offset-year CPUE estimates, which are calculated from fishery data reported between 1 October to 30 September each year. This data is offset by six months from the statutory 1 April to 31 March fishing year, allowing the most recent six months of data of the active fishing year to be incorporated into the management procedure.

[27] The 2015 stock assessment of rock lobsters (*Jasus edwardsii*) in CRA 7 and CRA 8, and management procedure review. (fish.govt.nz).

92. A graphical representation of the proposed CRA 7 management procedure is provided in Figure 7. The graph shows the proposed TACC for the next fishing year as a function of CPUE in the current year. Under this set of management procedure rules, a CPUE of 2.5 kg/potlift in 2022/23 would indicate that the TACC for 2024/25 should be reset to 104.1 tonnes, which would be a 7.5 tonne (6.7%) decrease to the current 111.5 tonne TACC. However, the previously accepted minimum change threshold for the CRA 7 management procedure is 10%, and the indicated level of change to the current TACC is less than that required to trigger a TACC change in 2024/25.

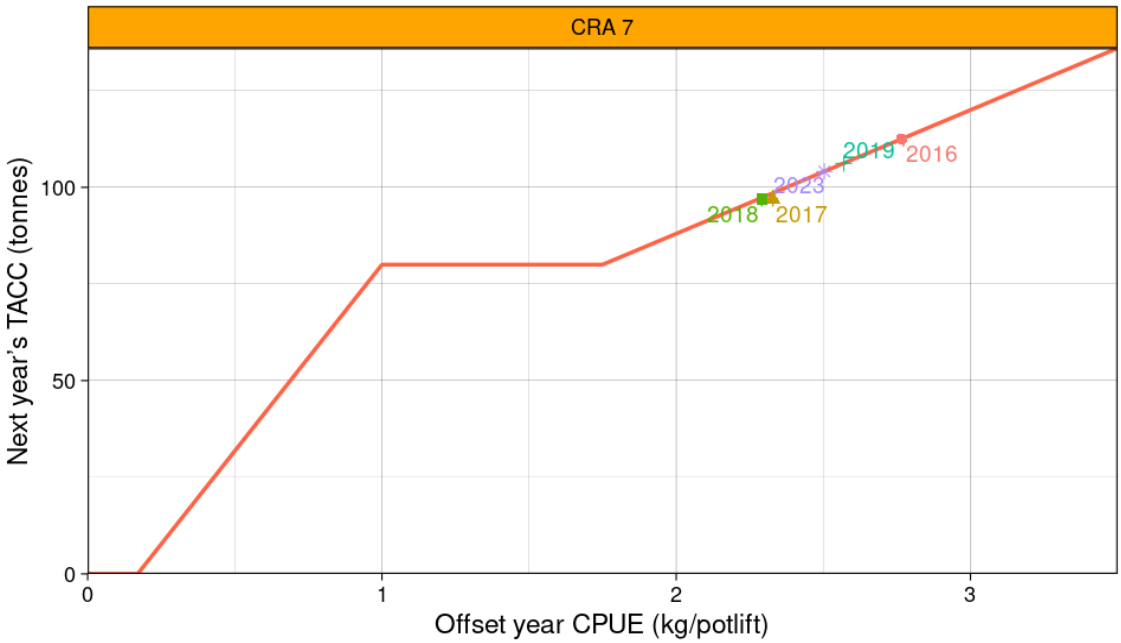

Figure 7. The proposed CRA 7 management procedure, showing the Total Allowable Commercial Catches (TACCs) resulting from evaluations performed from 2013 to 2023 (shown as coloured shapes) for the 2013/14 to 2023/24 fishing years.

93. An analysis of the benefits and risks of applying this management procedure in CRA 7 is provided below under the options and analysis sub-heading 11.1 '*CRA 7 management procedure*'.

94. Fisheries New Zealand welcomes any feedback on the proposal to re-instate this management procedure in CRA 7.

5.5 CRA 8 management procedure proposed for 2024

95. It is proposed that a new management procedure be used to guide TAC setting in the CRA 8 fishery from 2023/24 through to the 2027/28 fishing year.

96. As noted above, this new management procedure proposed for CRA 8 is based on a CPUE index calculated from previously unused voluntary logbook data. It is driven by offset year CPUE calculated from the voluntary logbook programme data that date back to the 1993/94 offset year, when the logbook programme was first initiated. This analysis was based on data reported by fishers for four monitoring pots, from which up to 25 lobsters were measured and sexed, with the rest counted.

97. In late 2023, the NRLMG considered 24 different possible 'rules' as candidates for this new CRA 8 management procedure. Following discussion, the sector representatives of the NRLMG agreed on a single rule for the CRA 8 management procedure, which is presented in more detail below.

98. The new management procedure was evaluated in 2023 and results suggest that its use would not pose a risk to stock sustainability. Use of the CRA 8 management procedure through to the 2027/28 fishing year is expected to outperform the requirements of the Harvest Strategy

Standard and is very likely (>90% probability) to maintain the stock above the default management target (40% unfished spawning stock biomass) and very unlikely (<10% probability) to result in biomass dropping below the soft and hard limits. For further information on the specifications of the proposed candidate CRA 8 management procedure refer to Appendix 2.

99. Simulation testing of the new CRA 8 management procedure also suggests it will continue to provide for utilisation benefits for all sectors in CRA 8.[28] Stock biomass is expected to be maintained well above the target level (Table 5).

Table 5. Summary of indicator results from base case model evaluations for the new CRA 8 management procedure.

Stock indicators	Results
Probability of stock biomass being above the default management target in 2027/28	>90%
Catch indicators	
Average commercial catch over four years (tonnes)	1,087
Median commercial catch in 2027/28 (tonnes)	1,087
CPUE indicators	
Average CPUE over four years (kg/potlift)	6.28
Commercial CPUE in 2027/28 (kg/potlift)	6.19

100. The rule proposed in this new management procedure is more conservative than the previous rules that operated between 2016/17 and 2020/21 and is the most conservative of the 24 rules considered. This current rule proposed is designed to manage CRA 8 at a higher CPUE (i.e., higher biomass).

101. The biomass of the CRA 8 stock has steadily increased since the 2016 management procedure was approved and initial input from the NRLMG suggests a preference from all sectors to maintain the CRA 8 stock well above the default management target. The commercial industry in CRA 8 has advocated for managing the stock at high biomass to capitalise on enhanced fishing efficiency and sustainability.

102. A graphical representation of the CRA 8 management procedure is provided in Figure 8. The graph shows the proposed TACC for the next fishing year as a function of CPUE in the current year. Under this set of management procedure rules, a 2022/23 CPUE of 8.455 kg/potlift corresponds to a TACC of 1,392.3 tonnes (1,392 tonnes rounded to the nearest tonne) for the 2024/25 fishing year, which would be a 141 tonne (11%) increase to the current 1,251-tonne TACC.

[28] The CRA 8 management procedure was evaluated using data from Region 2 (Fiordland) of the model. While this does not encompass the entire CRA 8 area, the majority (<80%) of commercial harvest which informs CPUE data is taken within Region 2. Therefore, it was assumed that the data in Region 2 was a reasonable representation of the CRA 8 component of the combined CRA 7 and 8 stock assessment. The management procedure, however, operates using CPUE data from the entire CRA 8 area.

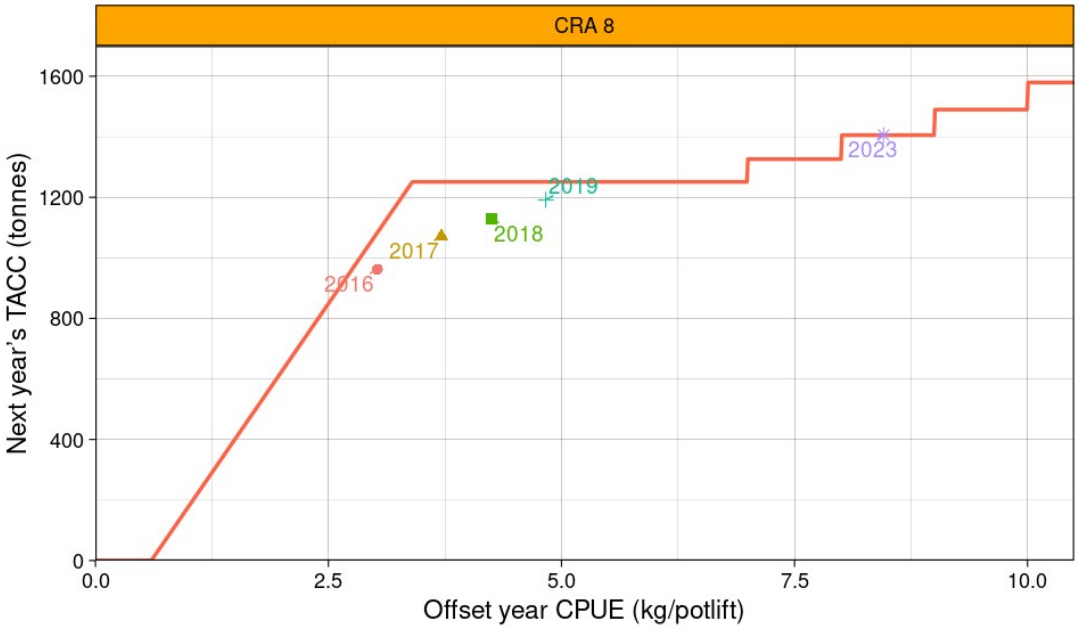

Figure 8. The proposed CRA 8 management procedure, showing the Total Allowable Commercial Catches (TACCs) resulting from evaluations performed from 2013 to 2023 (shown as coloured shapes) for the 2013/14 to 2023/24 fishing years.

103. Under this rule, a reduction to the TACC would be proposed if CPUE fell below 3.4 kg/potlift. It should be noted that CPUE in CRA 8 is currently above 8.0 kg/potlift and unlikely to decline to this threshold before the next full assessment in 2027, given the current stock status and trajectory.

104. An analysis of the benefits and risks of applying this management procedure in CRA 8 is provided below under the options and analysis sub- heading 11.3 '*CRA 8 management procedure and TAC options'*.

105. Fisheries New Zealand welcomes any feedback on the proposal to re-instate management procedures in CRA 8, and on the proposal to apply this management procedure in CRA 8 from 2024.

6 Catch information and TAC settings in CRA 8

106. The considerations in this section are summarised only for the CRA 8 fishery because they are relevant for the Minister when making decisions for a TAC review. CRA 7 is not summarised in this section because the TAC is not being reviewed within this paper (only the use of management procedures).

6.1 Commercial

107. CRA 8 is the largest commercial spiny rock lobster fishery in New Zealand. Annual landings and the TACC for CRA 8 since 1990 are shown in Figure 9.

108. CRA 8 commercial landings have remained at or near the TACC from the late 1990s to 2017/18 (Figure 9). The COVID-19 outbreak led to under-catch of the TACC in 2019/20. Carry-forward provided for landings greater than the TACC in 2020/21.[29]

[29] For most fisheries (apart from fish stocks listed in Schedule 5A of the Fisheries Act 1996), either all unused ACE or 10% of ACE owned by an individual—whichever is the lesser amount can be carried forward into the next fishing year, provided the stock is not subject to a Total Allowable Commercial Catch (TACC) decrease in the following fishing year. Carry forward applies to ACE holders who have unused ACE at the end of the fishing year. Spiny rock lobster and packhorse lobsters' stocks are listed in Schedule 5A—meaning that carry forward doesn't currently apply in any of these stocks. However, the under-catch in 2019/20 due to the COVID-19 outbreak led to additional approved ACE carry-forward in 2020/21.

109. From 1996 to 2020, the CRA 8 TACC has been set by the operation of management procedures, ending with setting the TACC for 2020/21. The TACC was raised through the operation of the management procedure in 2018/19 to 1,071 tonnes, in 2019/20 to 1,130 tonnes, and again in 2020/21 to 1,192 tonnes (Figure 9).

110. In April 2022, following the results of the 2021 stock assessment, the TACC was increased from 1,192 tonnes to 1,251 tonnes (5%).

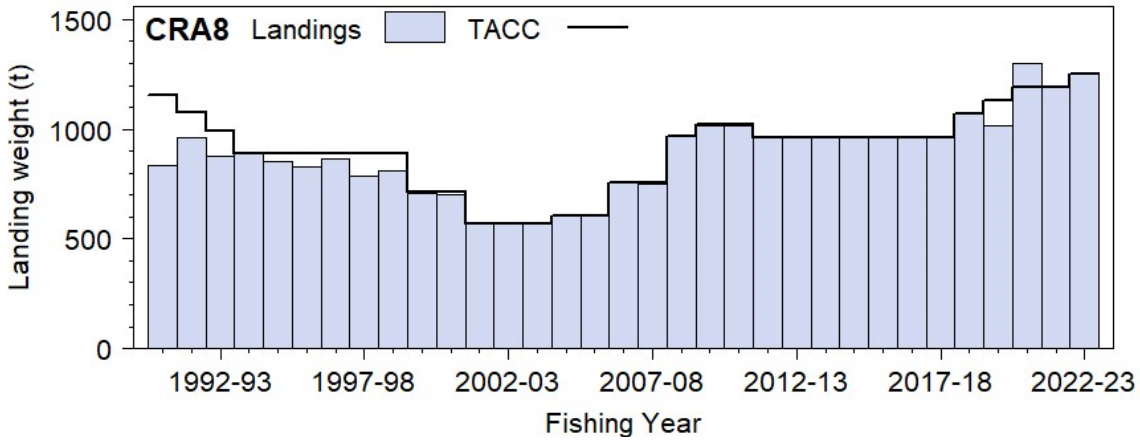

Figure 9. CRA 8 commercial landings and the Total Allowable Commercial Catch (TACCs) from 1990/91 to 2022/23.

6.2 Customary Māori

111. Spiny rock lobster (kōura) is a taonga species for tāngata whenua.

112. Customary catch in CRA 8 is authorised under the Fisheries (South Island Customary Fishing) Regulations 1999 as Tangata Tiaki/Kaitiaki have been appointed, with records of authorisations and catch maintained and made available to FNZ.

113. The current allowance for customary non-commercial harvesting of spiny rock lobsters in CRA 8 is 30 tonnes. This allowance has not changed since 1999.

114. Based on information received from customary reports from the last five years, customary catch in CRA 8 has fluctuated annually, with an average annual authorised amount of approximately 12,100 lobsters or 8.0 tonnes.[30] The maximum annual customary authorised amount reported in the last five years was approximately 25,900 lobsters or 16.9 tonnes in 2020.

115. The 2021 stock assessment assumed a customary harvest trajectory for CRA 8 starting with 6 tonnes per year from 1963 to 2012, increasing proportionally annually up to 15 tonnes in 2014, and then a constant annual harvest of 15 tonnes each year from 2014 until 2020.

116. Tangata Tiaki in CRA 8 have indicated that they have been conservative in their issuing of authorisations and have not approved approximately 15 to 20 tonnes of the customary allowance requests every year. This has been done in order to increase lobster numbers in water depths fished by customary fishers and provide future opportunities for customary catch success. Therefore, the reported customary authorisations may not reflect the long term needs of tangata whenua both for consumption and to provide for customary management objectives.

117. It appears that the customary allowance for CRA 8 is appropriate. However, FNZ welcomes further input from tangata whenua to inform advice on this allowance.

[30] Customary harvest in CRA 8 is primarily reported as the number of spiny rock lobster collected. The approximate volume (tonnes) of customary harvest was calculated using the mean weight of recreationally harvested spiny rock lobster in CRA 8 reported in the 2017/18 National Panel Survey (650 g per lobster).

6.3 Recreational

118. Relevant sources of information for estimating rock lobster recreational catch include the results of the National Panel Surveys of Marine Recreational Fishers (**NPS**), reported section 111 landings from commercial fishers, and reported catch from amateur charter vessels.

119. The current recreational allowance is 33 tonnes for CRA 8. The recreational allowance was last increased from 29 tonnes in 2009.

120. The CRA 8 fishery has a number of areas closed to commercial fishing, which provide non-commercial fishers with exclusive access to spiny rock lobsters. In Fiordland, the inner fiords are closed to commercial spiny rock lobster fishing. These closures were established in 2005 by the Fiordland Marine Guardians.

121. In some parts of Fiordland, recreational fishing is prohibited or restricted. A series of marine reserves in the inner fiords prohibit recreational fishing (see 8.5.4 '*Relevant statements, plans, strategies, provisions, and documents*') and in Milford Sound a reduced daily limit of three spiny rock lobsters applies to recreational fishers (see Figure A1 in Appendix 3).

122. The 2017/18 NPS[31] estimated 14.7 tonnes of recreational harvest in CRA 8.[32] However, the confidence intervals for these estimates are large (+/- 10.4 tonnes), which reflects a high degree of uncertainty. The same survey methods were also used to estimate the recreational catch taken from CRA 8 in 2011/12, but the result of 6.9 tonnes was considered highly uncertain (+/- 8.1 tonnes).[33]

123. The 2022/23 NPS, once analysed, will provide updated estimates of recreational harvest of spiny rock lobster in CRA 8.

124. In 2022/23, 15.1 tonnes of spiny rock lobster were taken in CRA 8 by commercial fishers for non-commercial purposes (as part of their daily recreational bag limit) under section 111 of the Act (see '*Section 111 commercial landings'* below).

125. Amateur charter vessels operating in CRA 8 reported 9.1 tonnes of spiny rock lobster harvest in 2022/23. The maximum annual amount of amateur charter vessel harvest in the last five years was 12.3 tonnes reported in 2018/19.

126. Taking the 2017/18 NPS results, 2022/23 section 111 landings, and the 2022/23 amateur charter vessel reports, the current estimate for recreational harvest in CRA 8 is 38.9 tonnes (39 tonnes when rounded to the nearest tonne). The 2022/23 estimate for recreational harvest exceeds the current allowance by six tonnes.

Section 111 commercial landings

127. Spiny rock lobsters taken for personal use by commercial fishers under section 111 of the Act must be declared on landing forms using the destination code 'F'. Section 111 landings must be accounted for within the recreational allowance.

128. Figure 10 below shows the reported section 111 landings between 2001 and 2022. The maximum in recent fishing years for section 111 landings is 2.24 tonnes for CRA 7 reported in 2022 and 16.62 tonnes for CRA 8 reported in 2020.

129. The accuracy of these statistics from 2019 onwards is uncertain because of concerns about the reliability of estimated catch reporting following the introduction of the ERS.

[31] National Panel Survey of Marine Recreational Fishers 2017–2018. (mpi.govt.nz)

[32] The total 2017/18 NPS estimate for CRA 8 (16.2 tonnes) includes harvest from amateur charter vessels. To avoid duplicating estimates in this review, the amount of spiny rock lobster reported from amateur charter vessels in the NPS was removed from the 2017/18 estimate.

[33] National Panel Survey of marine recreational fishers 2011-12: Harvest Estimates (mpi.govt.nz)

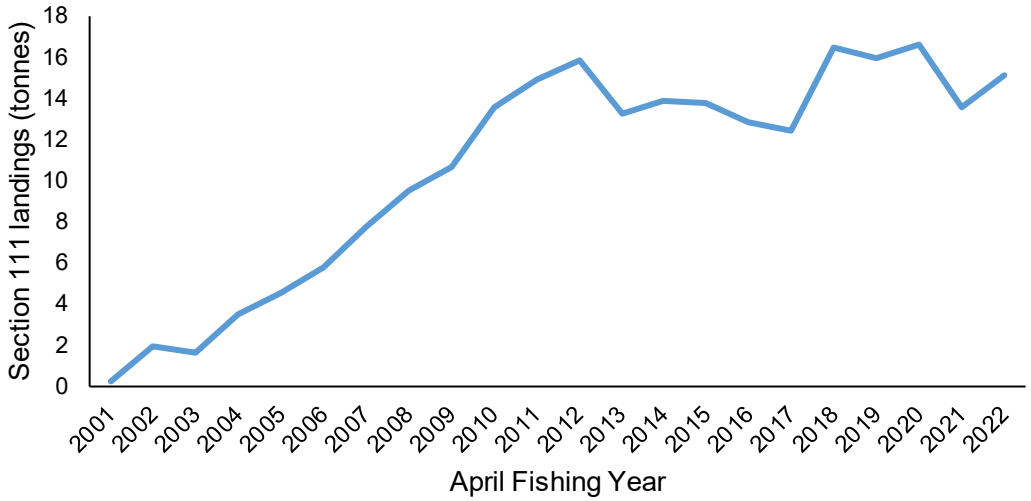

Figure 10. CRA 8 Section 111 commercial landings of spiny rock lobster (in tonnes, summed from landing destination code 'F') by fishing year and QMA. Note: the accuracy of these statistics from 2019 onwards is uncertain because of concerns about the reliability of estimated catch reporting following the introduction on electronic reporting.

6.4 Other sources of mortality caused by fishing

130. Other sources of mortality caused by fishing in CRA 8 includes illegal catch, handling mortality caused by the return of under-sized lobsters, berried female lobsters, and high-grading,[34] as well as predation on lobsters by octopus and other predators within pots.

131. Estimates from the 2023 rapid assessment update are the best available information for informing current levels of handling mortality and illegal catch. Data on the presence of octopus in pots are available from the voluntary logbook programme. The level of mortality caused by predation of spiny rock lobster within pots is considered negligible. However, there is uncertainty in this data because there is no observer coverage in CRA 8.

132. Stock assessments beginning in 2017 have assumed that handling mortality was 10% of returned lobsters until 1990 and then 5%, based on a literature review and the reasoning that greater care would be taken for the product with the development of the live export market.

133. In the 2021 full stock assessment, the Rock Lobster Working Group assumed illegal catch was 10% of the total commercial catch before 1990, the year that CRA 8 entered the QMS, and 2% of the summed commercial catch beginning in 1990 in recognition of the impact of the introduction to the QMS, including greater control over the sale and receipt of lobsters once they became a tradeable asset. Annual illegal catch was scaled proportionately to CPUE where possible. This acknowledges that illegal take is likely to be influenced by available abundance.

134. The 2023 rapid update estimated handling mortality and illegal catch for Region 1 (CRA 7 and the Southland region of CRA 8) and Region 2 (Fiordland region of CRA 8) for the model.

135. The current allowance for other sources of mortality caused by fishing in CRA 8 is 139 tonnes. This allowance was last changed increased from 28 tonnes in 2022.

136. To estimate the other mortality for CRA 8, the mortality estimates not attributed to CRA 7 for Region 1 were added to the Region 2 (Fiordland) estimates from the 2023 rapid assessment update. In the 2022/23 fishing year, CRA 8 accounted for 56% of commercial catch in Region 1. Taking 56% of the Region 1 estimates suggests an allowance of 4.9 tonnes for illegal catch and 8.9 tonnes for handling mortality. For Region 2 (which includes the Fiordland region of CRA 8) estimates of illegal catch (25.8 tonnes) and handling mortality (86.1 tonnes) were generated for

[34] High-grading is the practice of selectively harvesting fish so that only the best quality fish are landed to achieve the highest economic return. This means that some spiny rock lobster which would be legal to land are returned to the water to maximise the quality of spiny rock lobster that are landed.

the 2022/23 fishing year. The total estimate of other mortality for CRA 8 (taken by adding the handling and illegal catch mortalities from each region together) is 125.7 tonnes for the 2022/23 fishing year (126 tonnes when rounded to the nearest tonne).

7 Treaty of Waitangi obligations as set in legislation

137. Section 5(b) of the Act requires that the Act be interpreted, and that people making decisions under the Act will act, in a manner that is consistent with the Treaty of Waitangi (Fisheries Claims) Settlement Act 1992 (**the Settlement Act**). The Settlement Act provides that non-commercial customary fishing rights continue to be subject to the Principles of the Treaty of Waitangi and give rise to Treaty obligations on the Crown.

138. Section 10 of the Settlement Act requires the Minister to develop policies and programmes to recognise the use and management practices of tāngata whenua. The Minister must also recommend the making of customary fishing regulations under section 186 of the Fisheries Act to recognise and provide for customary food gathering by Māori and the special relationship between tāngata whenua and those places of customary food gathering importance. Consistent with this section, FNZ has worked with iwi to develop the Fisheries (South Island Customary fishing) Regulations 1999 and the Fisheries (Kaimoana Customary Fishing) Regulations 1998 to manage the activity of customary food gathering (which applies to CRA 8 fishing).

139. FNZ has also consulted with tāngata whenua to develop policies on the best way to establish engagement processes that enable iwi to work together to reach a consensus where possible and to inform the Ministry on how tāngata whenua wish to exercise kaitiakitanga[35] in respect of fish stocks in which they share rights and interests, and how those rights and interests may be affected by sustainability measures proposed by FNZ. These policies support the requirements under section 12 of the Fisheries Act to provide for the input and participation of tāngata whenua into sustainability process and to inform the Minister on how tāngata whenua exercise Kaitiakitanga.

7.1 Input and participation of tāngata whenua

140. Section 12(1)(b) of the Act requires that before undertaking any sustainability process the Minister shall provide for the input and participation of tāngata whenua who have a non-commercial interest in the stock or an interest in the effects of fishing on the aquatic environment in the area concerned. In considering the views of tāngata whenua, the Minister is required to have particular regard to kaitiakitanga.

141. Input and participation of tāngata whenua into the sustainability decision-making process is provided mainly through Iwi Fisheries Forums, which have been established to support that engagement. Each Iwi Fisheries Forum can develop an Iwi Fisheries Forum Plan that describes how the iwi in the Forum exercise kaitiakitanga over the fisheries of importance to them, and their objectives for the management of their interest in fisheries. Iwi Fisheries Forums may also be used as entities to consult iwi with an interest in fisheries. Engagement with individual iwi is also undertaken when appropriate.[36]

142. Although the CRA 7 and CRA 8 management areas are relevant to the area of the Te Waka a Māui me Ōna Toka Iwi Fisheries Forum, input and participation on the proposed review of these stocks was not sought from this forum as the CRA 7 and CRA 8 management areas are entirely within the rohe moana of Ngāi Tahu whānui. The views of Ngāi Tahu whānui in relation to this review of CRA 7 and CRA 8 are outlined below.

143. During the 2022 review of CRA 7 and CRA 8, Ngāi Tahu Tangata Tiaki from Otago and Southland expressed ongoing concern with the lack of information on recreational fishing levels and concern that recreational fishing is putting pressure on spiny rock lobster stocks and inhibiting the customary needs of tāngata whenua, particularly in nearshore waters. These

[35] The Fisheries Act defines kaitiakitanga to mean "the exercise of guardianship; and, in relation to any fisheries resources, includes the ethic of stewardship based on the nature of the resources, as exercised by the appropriate tangata whenua in accordance with tikanga Māori", where tikanga Māori refers to Māori customary values and practices.

[36] FNZ also engages directly with Iwi (outside of Forums) on matters that affect their fisheries interests in their area of interest and consults with any affected Mandated Iwi Organisations and Iwi Governance Entities where needed.

Tangata Tiaki also expressed concern with recreational charter fishing in the Fiordland Marine Area in particular.[37]

144. In 2023, Ngāi Tahu Tangata Tiaki, again expressed concerns that recreational fishing within CRA 7 and CRA 8 constrains tangata whenua's customary needs. Tāngata whenua have advocated that recreational harvest should be constrained within the current recreational allowance.

145. Tangata Tiaki in CRA 8 have indicated that they have been conservative in their issuing of authorisations and have not approved approximately 15 to 20 tonnes of the customary allowance requests every year. This has been done in order to increase lobster numbers in customary depths and provide future opportunities for customary catch success.

7.2 Kaitiakitanga

146. Information provided by forums, and iwi views on the management of fisheries resources and fish stocks, as set out in Iwi Fisheries Plans, are ways that tāngata whenua can describe how they exercise kaitiakitanga in respect of fish stocks.

147. Spiny rock lobster is listed as a taonga species in the fisheries plan of the Te Waka a Mauī me Ōna Toka Iwi Forum.

148. FNZ considers that the options proposed are generally consistent with the management objectives of the Te Waka a Māui me Ōna Toka Iwi Forum's Fisheries Plan. The options proposed align with the following objective:

- To develop environmentally responsible, productive, sustainable, and culturally appropriate commercial fisheries that create long-term commercial benefits and economic development opportunities for South Island iwi.

149. A few species that are bycaught in the CRA 7 and CRA 8 fisheries are also listed as a taonga species in the Forum's fisheries plan, these include octopus (wheke), conger eel (kōiro), and blue cod (rawaru).

150. FNZ is seeking input from tāngata whenua on how the proposed management procedures for CRA 7 or CRA 8, and proposed TAC options for CRA 8, may or may not provide for kaitiakitanga as exercised by tangata whenua, and how tangata whenua consider the proposals may affect their rights and interests in these stocks.

7.3 Mātaitai reserves and other customary management tools in CRA 8

151. When setting or varying any TACC under section 21(4) of the Act and allowing for Māori customary non-commercial interests, the Minister must take into account any gazetted mātaitai reserves and fishing method restrictions or prohibitions in the relevant quota management area.

152. There are 20 mātaitai reserves that fall within CRA 8. These are set out in Table 6 and in Figure A1 in Appendix 3. There are no taiāpure within CRA 8.

153. Several of the mātaitai reserves within CRA 8 have bylaws relevant to spiny rock lobster fishing. These include;

a) The Pikomamaku mātaitai prohibits fishing at all times for all people.
b) In the Te Whaka a Te Wera mātaitai, bylaws restrict the number of spiny rock lobster pots that may be used, set or possessed within the reserve. If an individual is fishing alone, they are restricted to two pots, and if two or more individuals are on a fishing vessel, they are restricted to four pots. In addition, the pot dimensions must not be larger than 1000 mm long by 1000 mm wide by 500 mm deep.
c) In the Kaihuka and Horomamae mātaitai fishing is prohibited for all people between 1 June in any year and 31 March in the following year.

[37] For further information on the 2022 review for CRA 7 and CRA 8, please see: Review of sustainability measures for rock lobster (CRA 1,7 and 8) for 2022 (mpi.govt.nz)

d) In four of the mātaitai (Paringa, Popotai Taumaka, Ōkahu, and Tauneke mātaitai) commercial fishing and the use of commercial spiny rock lobster holding pots is exempted from the general prohibition on commercial fishing. Makaawhio Rūnanga are developing additional bylaws for these mātaitai reserves, however currently there is no set timeframe for when these bylaws may be implemented.

Table 6: Customary fisheries management areas in CRA 8.

Customary area		Management type
Waikawa Harbour/Tumu Toka Mātaitai	Mahitahi/Bruce Bay Mātaitai	**Mātaitai reserve** Commercial fishing is not permitted within mātaitai reserves unless provided for in conditions.
Motupōhue Mātaitai	Manakaiaua/Hunts Beach Mātaitai	
Oreti Mātaitai	Okarito Lagoon Mātaitai	
Pikomamaku Mātaitai	Tautuku Mātaitai	
Te Whaka a Te Wera Mātaitai	Ōtara Mātaitai	
Kaihuka Mātaitai	Ōmāui Mātaitai	
Horomamae Mātaitai	Tauneke Mātaitai	
Waitutu Mātaitai	Ōkahu Mātaitai	
Okuru/Mussel Point Mātaitai	Popotai Taumaka Mātaitai	
Tauparikaka Mātaitai	Paringa Mātaitai	

154. The proposed TAC increase for Option 2 in CRA 8 is expected to increase commercial fishing effort. The effect of this on spiny rock lobster abundance and availability in these customary areas is not known. However, FNZ expects that if there is any effect it is likely to be small given that the abundance of lobsters in CRA 8 is estimated to be increasing and the proposed TAC increase is modest relative to the estimated abundance of the stock.

8 Environmental and sustainability considerations under the Act for CRA 8

8.1 Overview

155. The TAC change for CRA 8 would be made under section 13 of the Act. This is a sustainability measure. Before setting or varying a sustainability measure, the Minister must adhere to section 11 of the Act. When making a decision the Minister must also act consistently with the requirements in section 5, and sections 8-10 (Purpose and Principles of the Act).

156. The requirements and details of each of these sections are set out below, in the following order:

a) Section 5 (Application of international obligations and Treaty of Waitangi (Fisheries Claims) Settlement Act 1992);
b) Section 8 (Purpose);
c) Section 9 (Environmental principles);
d) Section 11 (Sustainability measures);
e) Section 13 (Setting a Total Allowable Catch); and
f) Section 10 (Information principles).

8.2 Application of international obligations and the Treaty of Waitangi (Fisheries Claims) Settlement Act 1992 – section 5 of the Act

157. The Minister must act in a manner consistent with both the Treaty of Waitangi (Fisheries Claims) Settlement Act 1992 and New Zealand's international obligations relating to fishing. Discussion of these relevant obligations is provided in the *Overview of legislative requirements and other considerations* document available on our website (https://www.mpi.govt.nz/dmsdocument/60415).

8.3 Purpose of the Act – section 8 of the Act

158. The Act's purpose is to "provide for the utilisation of fisheries resources while ensuring sustainability." Guidance on the meaning of section 8 and how it should be applied for decision making (for all the stocks being reviewed as part of this round) is provided in the *Overview of legislative requirements and other considerations* document available on our website (https://www.mpi.govt.nz/dmsdocument/60415).

8.4 Environmental principles – section 9 of the Act

159. The environmental principles that must be taken into account when considering sustainability measures for CRA 8 are as follows:

- Associated or dependent species should be maintained above a level that ensures their long-term viability.
- Biological diversity of the aquatic environment should be maintained; and
- Habitats of particular significance for fisheries management should be protected.

160. It is important to note that in some cases FNZ has made assumptions about environmental interactions (such as protected species interactions) based on fisher reported data that may not have been independently verified (for example, by an on-board FNZ observer).

161. Over the past five years there has been no observer coverage in CRA 8. Given this, there is increased uncertainty associated with estimates of environmental interactions in the fishery.

8.4.1 Associated or dependent species – section 9(a)

162. Associated or dependent species include marine mammals, seabirds, fish, and invertebrate species caught as bycatch in the spiny rock lobster fishery, as well as any non-harvested species taken or otherwise affected by the taking of any harvested species.

163. The removal of predators (particularly large predators) through fishing can contribute to kina barren formation with negative impacts on biodiversity and ecosystem health (Taylor & Schiel, 2010, MacDiarmid et al., 2013, Udy et al., 2019). The full extent of impact on biodiversity and ecosystem health is unknown (including impacts on associated and dependent species), but it is expected that a shift from productive kelp forests to kina barrens will result in reduced primary production and biodiversity.

164. Much of the evidence on the effects of fishing on kina barrens comes from observations from marine protected areas in north-eastern New Zealand. The extent of sea urchin barrens and contributing factors in other parts of New Zealand are not well understood (Doheny et al., 2023). In CRA 8, studies on kina barrens are limited but areas that are devoid of kelp are known to occur (Udy et al., 2019) (see heading 9.1 *'Interdependence of stocks'*).

Protected species interactions

165. In New Zealand waters, marine mammal entanglements with pot fishing gear have been documented since 1980. A recent New Zealand study on cetacean interactions with pot fisheries (Pierre et al., 2022) found that from 1980 to the present, 1–2 entanglement events of cetaceans per year were reported on average. However more recently, from 2010 to 2020, an average of 4–5 entanglement events per year have been recorded.

166. Nationally, the most recorded entanglements over time have involved humpback whales, followed by orca. There are no reported entanglements in CRA 8.

167. Methods to reduce impacts on cetaceans from interactions and entanglements with pot and trap fishing gear include modified fishing practices, spatial/temporal management, and active disentanglement of entrapped cetaceans. Actively disentangling is the main documented response to addressing entanglements in New Zealand to date.

168. Guidance for commercial pot fishers has been distributed by the New Zealand Rock Lobster Industry Council (**NZ RLIC**). This guidance includes proactive approaches to reduce the risk of cetacean entanglements with fishing gear, providing information on whale identification, best practice approaches to mitigation and reporting requirements.

169. The Hector's and Māui dolphin Threat Management Plan guides management approaches for addressing both non-fishing and fishing-related impacts on Hector's and Māui dolphins.[38] In October 2022, the previous Minister agreed on further measures to manage the effects of fishing-related mortality on South Island Hector's dolphins and support the delivery of the Threat Management Plan, those measures include new fishing-related mortality limits and a Bycatch Reduction Plan.[39] To date, with regard to the spiny rock lobster fishery, there have been no reported interactions with Hector's and Maui dolphins in CRA 8. Due to the lack of reported interactions to date, FNZ considers the residual risk to the Hector's and Māui dolphin from potting in CRA 8 to be low.

Seabirds

170. Management of seabird interactions with New Zealand's commercial fisheries is guided by the National Plan of Action – Seabirds 2020 (NPOA-Seabirds). The NPOA-Seabirds sets out the New Zealand government's commitment to reducing fishing-related captures and associated mortality of seabirds. The vision of the NPOA-Seabirds is that New Zealanders work towards zero fishing-related seabird mortalities.

171. Management actions and research under the NPOA-seabirds are guided and prioritised based on the seabird risk assessment that breaks down the risks to seabird populations by fishery groups. The most recent seabird risk assessment was published in 2023 and ranks the southern Buller's albatross as the most at-risk seabird, followed by the Salvin's albatross, New Zealand white-capped albatross, black petrel; and Westland petrel (Edwards et al., 2023).

172. There have been no reported interactions with seabirds in CRA 8 in the last 10 years. As such, FNZ expects that the proposed settings to the TAC, TACC, and allowances for CRA 7 or CRA 8 will have little, if any, effect on seabirds.

Fish and invertebrate bycatch

173. When spiny rock lobsters were targeted in CRA 8 from the 2019/20 to 2022/23 fishing years, the most frequently reported incidental species caught in the CRA 8 target fishery were: conger eel, octopus, wrasses, carpet shark, blue cod, scarlet wrasse, banded wrasse, and circular saw shell.

174. Blue cod (BCO 3, BCO 5, and BCO 7), ling (LIN 3, LIN5, LIN 6, and LIN 7), and moki (MOK 1, MOK 3, and MOK 5) are managed under the QMS, and bycatch of these stocks is managed through their respective catch limits. BCO 5 and BCO 7 are currently under a rebuild. The status of BCO 3 in relation to management targets is unknown but the stock is unlikely to be below the soft limit. However, the amount of blue cod bycaught in the CRA 8 fishery is relatively small with an average annual bycatch of 2.21 tonnes across BCO 3, BCO 5, and BCO 7 reported for CRA 8 between the 2022/23 and 2019/20 fishing years. The ling and moki stocks that overlap with CRA 8 are considered to be sustainable under current catch levels.

Black corals

175. All black corals (*Antipatharia spp.*) are protected under the New Zealand Department of Conservation Wildlife Act 2010. About 58 black coral species are known in New Zealand waters and some species may live for hundreds of years. Most species appear to live at a depth of 200-1000 m. Divers are most likely to encounter black corals below 40 m depth on offshore reefs in northern New Zealand. In Fiordland and parts of Port Pegasus, Stewart Island, *Antipathes fiordensis* may occur as shallow as 10 m depth.

[38] For more information on management actions taken to reduce Hector and Māui interactions in New Zealand Fisheries visit: Protecting Hector's and Māui dolphins | NZ Government (mpi.govt.nz).

[39] Available at: South Island Hector's Dolphin Bycatch Reduction Plan (mpi.govt.nz).

176. Shallow water corals possibly interact with commercial fishing methods such as potting for spiny rock lobster, and they are vulnerable to damage by anchors from vessels. There have been no reported interactions with black corals in the CRA 8 commercial fishery.

177. A number of mitigating measures are in place that help prevent interaction with fragile corals, some of these are designed specifically to mitigate coral interaction and some are designed for other purposes but provide protection. These include marine reserves that prohibit all forms of fishing, areas that prohibit commercial fishing including the inner fiords, and areas that prohibit recreational lobster potting within the Fiordland Marine Area (see heading 8.5.4 *'Relevant statements, plans, strategies, provisions, and documents'* and Figure A1 in Appendix 3). In addition, there are sites that prohibit anchoring within the Fiordland Marine Area to protect corals from anchor damage.

178. The Department of Conservation is currently conducting a three year project to ascertain whether there are fishing related effects on black coral colonies in Fiordland. The results from this study will help inform future reviews of CRA 8.

8.4.2 Biological diversity of the aquatic environment – section 9(b)

179. Any benthic impacts from fishing are an important consideration in relation to this principle, along with the impact fishing has on kelp distribution, given its critical role in coastal and marine environments.

Benthic impacts

180. Potting is the main method of targeting spiny rock lobster commercially and is assumed to have very little direct effect on non-target species. FNZ is not aware of any information that exists regarding the benthic effects of potting in New Zealand.

181. A study on the effects of lobster pots on the benthic environment was completed in a report on the South Australian rock lobster fisheries (Casement & Svane, 1999). This fishery is likely to be the most comparable with New Zealand because the lobster species is the same (*Jasus edwardsii*) and many of the same species are present, although pots and how they are fished may differ. This report concluded that the amount of algae removed by pots (due to entanglement) probably has no ecological significance.

182. Fishing for predators such as spiny rock lobsters has the potential to indirectly impact biological diversity of the aquatic environment because of the relationship between predator abundance and kina (which graze on kelp).

183. As outlined in the Aquatic Environment and Biodiversity Annual Review 2021 (**AEBAR**),[40] kelp provides a wide and diverse range of ecosystem services, including:

a) Providing important settlement, nursery, shelter, and refuge habitats for a wide range of coastal and inshore shellfish and finfish species, including for spiny rock lobster;
b) Providing food for invertebrates, shellfish, finfish, and seabird species, which in turn supports a variety of important commercial and non-commercial fisheries resources;
c) Modifying wave and tidal action and influencing coastal physical processes such as erosion, sedimentation, and turbidity;
d) Driving primary production and energy and nutrient recycling that contribute to other near-shore systems including sandy beaches and deepwater ecosystems.

184. It is important to note that kelp is indirectly affected by fishing for predators. The removal of predators, including spiny rock lobster, can reduce predatory control of the abundance of kina, which graze on kelp. The magnitude of this relationship depends on many factors that vary regionally. Biotic factors include (but are not limited to) fishing pressure, population dynamics of predators, prey and kelp and ecosystem resilience. Abiotic factors in include temperature, turbidity and chemistry (among others) (Doheny et al., 2023). An over-abundance of kina and the over grazing of kelp systems can result in kina barrens. Kelp forests are an important habitat and food source for many rocky reef dwelling species. Therefore, in making a decision, the

[40] Accessible at: Aquatic Environment and Biodiversity Annual Review (AEBAR) 2021: A summary of environmental interactions between the seafood sector and the aquatic environment (mpi.govt.nz).

Minister must give consideration to the indirect impacts of spiny rock lobster fishing on species that directly rely on kelp (this is also relevant to section 9(a) of the Act - associated or dependent species should be maintained above a level that ensures their long-term viability).

185. Kelp habitats are likely to be important for a range of harvested and non-harvested species, and any reduction in such habitats is therefore likely to be adverse to spiny rock lobster and other species that rely on kelp for shelter or food (Dayton, 1985).

186. Fishing-induced trophic cascades, kelp grazers (e.g., butterfish, Shears et al, 2008), and other impacts on the ecosystem due to fishing, sedimentation and climate change can have long term impacts on kelp abundance and distribution. In turn, this could potentially negatively impact the suitability of rocky reef habitat for juvenile and adult spiny rock lobsters as a refuge for settlement, as well as the availability of their prey species (Stanley et al., 2015).

187. Kina barrens have been observed in CRA 8, however there is limited information on the distribution and extent of the kina barrens as well as the role of fishing in the development of kina barrens in the region (see heading 9.1 *'Interdependence of stocks'*).

8.4.3 Habitats of particular significance for fisheries management – section 9(c)

188. Specific habitats of particular significance for CRA 8 have not been identified, however certain features of rocky and sandy habitats important for spiny rock lobster are discussed in Table 7.

189. In 2022 FNZ consulted on guidance for defining, identifying, and managing habitat of particular significance for fisheries management and for how FNZ considers that these habitats should be protected when preparing fisheries management advice.[41] This part of the Act was also noted in the Prime Minister's Chief Science Advisor's report titled *The Future of Commercial Fishing in Aotearoa New Zealand* (March 2021).[42]

Table 7: Summary of information on potential habitats of particular significance for fisheries management for CRA 8.

Fish stock	Spiny rock lobster –CRA 8
Potential habitat of particular significance	• No specific habitat of significance have been identified for CRA 8. <u>Juveniles:</u> • Spiny rock lobsters have high fecundity and an extensive pelagic larval stage of up to two years, which results in larval dispersal over wide areas by ocean currents. • During this pelagic phase, larvae are dispersed in the open ocean and carried by currents. The open ocean environment is important during this stage of spiny rock lobster development. • After the pelagic larval phase, larvae metamorphose into the post larval puerulus stage and settle on coastal shelf rocky reefs. Puerulus sometimes settle on complex seaweeds or bryozoans but less frequently. Puerulus and juvenile spiny rock lobsters preferentially inhabit holes and crevices in hard substrates where light levels are low. • Juveniles have more specificity in habitat use than adults, preferring small holes similar to their size. • Evidence from Australia that kelp habitat is important for spiny rock lobster settlement. However, the relationship for New Zealand spiny rock lobster has not yet been scientifically tested. <u>Adults:</u> • Adult spiny rock lobsters are found in reef habitats up to depths of 200 m, where they inhabit crevices, caves, and rocky overhangs. • Bivalves on sand flats surrounding reefs are a preferred prey for spiny rock lobsters, and they make foraging movements to prey on them nocturnally. • Macroalgae (kelp) increases structural complexity and provides habitat and food for prey species of spiny rock lobster.

[41] The habitat of particular significance for fisheries management consultation material is available here: https://www.mpi.govt.nz/consultations/guidance-for-identifying-a-habitat-of-particular-significance-for-fisheries-management/

[42] Accessible at: https://www.pmcsa.ac.nz/topics/fish/

Fish stock	Spiny rock lobster –CRA 8
	• Sand, horse mussel beds and low lying reef are important habitats during inshore-offshore movements. • Mussel bands in Fiordland have been found to support higher densities of spiny rock lobsters.
Attributes of habitat	• Coastal shelf, up to depths of 200m • Complex rocky habitats (crevices, caves, rocky overhangs). • Low light levels (juveniles). • Presence of macroalgae increases structural complexity. • Sand, horse mussel beds, and low lying reef are important for short distance migration and for nocturnal feeding.
Reasons for particular significance	• Successful reproduction, development of juvenile stages, and growth to mature adult sizes is critical to supporting the productivity of spiny rock lobster stocks. • Spiny rock lobsters are predators that forage on algae and benthic invertebrates including pāua, ophiuroids, and kina. • Complex rocky habitats provide critical habitats for spiny rock lobsters, including: - Settlement substrata for juveniles. - Shelter and refuge from predation. - Feeding opportunities.
Risks/threats	• Land-based practices can impact coastal reef habitats, including through sedimentation and eutrophication. • Climate change: - In the long-term oceanographic circulation patterns (currents, gyres, eddies) could be impacted by climate change, and changes in seawater temperature and predation may affect survival and settlement of spiny rock lobster larvae. - Seawater temperature change is known to affect complex coastal reef habitat (such as kelp) of spiny rock lobster, which has the potential to inhibit larval settlement, and the survival of juvenile and adult spiny rock lobster (through loss of habitat and food source).
Existing protection measures	• Several mātaitai reserves (discussed in '*Mātaitai reserves and other customary management tools*'). • Several marine reserves in the Fiordland Marine Area (discussed in '*Relevant statements, plans, strategies, provisions, and documents'* and '*Other plans and strategies')*.
Evidence	• Flood, A. S. (2021). *Gut Instincts: Feeding behaviour of the rock lobster, Jasus edwardsii* (Doctoral dissertation, ResearchSpace@Auckland). • García-Echauri, L., Liggins, G., Cetina-Heredia, P., Roughan, M., Coleman, M. A. & Jeffs, A. 2020. Future ocean temperature impacting the survival prospects of post-larval spiny lobsters. Marine Environment Research, 156, 104918. • Hinojosa, I. A., Gardner, C., Green, B. S., Jeffs, A., Leon, R. & Linnane, A. 2016. Differing environmental drivers of settlement across the range of southern rock lobster (Jesus edwardsii) suggest resilience of the fishery to climate change. Fisheries Oceanography, 26 (1): 49-64. • Shaffer, M.R. and Rovellini, A., 2020. A review of habitat use, home range and connectivity for selected New Zealand species. *Prepared for the Department of Conservation, Wellington, New Zealand*, p.43. • Fisheries New Zealand (2023). Fisheries Assessment Plenary, November 2023: stock assessments and stock status. Compiled by the Fisheries Science Team, Fisheries New Zealand, Wellington, New Zealand. 669.p.

190. The extent to which there are specific areas within CRA 8 that are habitats of particular significance for fisheries management in relation to life cycle stages of spiny rock lobsters has not yet been identified.

191. A study examining the influence of habitat and predation on spiny rock lobster in Tasmania has found improved spiny rock lobster survival in structurally complex kelp forests relative to low-complexity barren habitats, likely due to the shelter provided by kelp (Hinojosa et al., 2016). However, this trend was not observed in a 2015 study conducted in northeast New Zealand, the authors suggested that while kelp forests may provide shelter, they also have higher abundance of lobster predators (Hesse et al., 2015).

192. Because kelp (macroalgae) can be indirectly impacted by spiny rock lobster fishing, under a higher TAC setting there is a higher risk of reduced food availability and settlement habitat for spiny rock lobster in some areas of CRA 8. However, further research is required to better understand the relationship between kelp habitat and settlement and survival of spiny rock lobster in CRA 8.

193. FNZ notes that there is a relatively low risk of the proposed CRA 8 options having detrimental impacts on kelp habitats given that biomass in CRA 8 is estimated to be increasing under current fishing levels, and the TAC options proposed are moderate and aim to maintain the stock at a high biomass level.

8.5 Considerations for setting sustainability measures under section 11 of the Act

194. Section 11 of the Act sets out various matters that the Minister must take into account or have regard to when setting or varying sustainability measures (such as the TAC change proposed for CRA 8 as part of this paper). These include:

a) any effects of fishing on any stock and the aquatic environment; and
b) any existing controls under the Act that apply to the stock or area concerned; and
c) the natural variability of the stock concerned; and
d) any relevant planning instruments, strategies, or services.[43]

8.5.1 Effects of fishing on any stock and the aquatic environment – section 11(1)(a)

195. In setting or varying a sustainability measure the Minister must take into account any effects of fishing on any stock and the aquatic environment.

196. "Effect" is defined widely in the Act.[44] The broader effects of removing spiny rock lobster from CRA 8 on the ecosystem as well as the more direct effects of potting need to be considered.

197. Information relevant to the effects of spiny rock lobster potting on any stock and the aquatic environment is discussed above in heading 8.4. *'Environmental principles'* and below under heading 9 *'Setting a Total Allowable Catch – section 13 of the Act'.*

8.5.2 Existing controls that apply to CRA 8 – section 11(1)(b)

198. In setting or varying a sustainability measure the Minister must take into account any existing controls under the Act (including rules and regulations made under the Act (section 2(1A)) that apply to the stock when setting or varying the TAC.

199. A range of existing management controls apply to CRA 8, including:

a) **Gear restrictions:** nationally, there is a prohibition on the use of spears for taking spiny rock lobsters by both recreational and commercial fishers. Recreational fishers are also prohibited from using spring loaded loop or lassos as well as set or baited nets for taking spiny rock lobster.

b) **Number of pots (recreational only):** there is a maximum number of pots that may be used, set, or possessed in New Zealand fisheries waters on any day for recreational purposes. All pots and surface floats must be legibly and permanently marked with the

[43] Sections 11(2) and (2A).

[44] Section 2(1) of the Act defines "effect" to mean the direct or indirect effect of fishing, and includes any positive, adverse, temporary, permanent, past, present, or future effect. It also includes any cumulative effect, regardless of the scale, intensity, duration, or frequency of the effect, and includes potential effects.

fisher's surname and initials. Individual recreational fishers are generally restricted to no more than three pots, while two or more recreational fishers on a vessel are restricted to a combined maximum of six pots.

There are two exceptions to this. Te Waka ā Te Wera/ Paterson Inlet Mātaitai Reserve fishing bylaws restrict an individual fisher to no more than two rock lobster pots. Two or more persons fishing from a vessel are restricted to a maximum of four pots. Within Te Waka ā Tera Mātaitai Reserve there is a maximum rock lobster pot size bylaw, restricting pot dimensions to no more than 1,000 mm long, by 1,000 mm wide, by 500 mm deep. Within the Fiordland (Te Moana o Atawhenua) Marine Area, an individual recreational fisher is restricted to no more than three rock lobster catching pots. In the case of two or more persons on a vessel, the maximum vessel rock lobster pot limit is three rock lobster pots. Fiordland Marine Area specific provisions also allow the use of rock lobster holding pots in addition to rock lobster catching pots. Holding pots are excluded from other rock lobster pot limits and escape gap requirements. There is a limit of one holding pot per person or a maximum of two holding pots per vessel if there are two or more persons on board. Holding pot surface floats must be clearly and permanently marked with the vessel name, and the characters 'HP1' and 'HP2' to denote a holding pot.

c) **Escape apertures**: a fisher must not set, use, or possess on a vessel a rock lobster pot, unless the pot has at least two rectangular apertures (other than the mouth of the pot) through which undersize spiny rock lobsters are able to escape. This applies to both recreational and commercial fishers. There are different escape gap aperture requirements depending on the recreational pot design and construction.

d) **Size restrictions:** A Minimum Legal Size (MLS) applies to take of rock lobster in CRA 8. The MLS is different between commercial and recreational fishers. Commercial fishers can take female spiny rock lobsters at or above 57 mm tail width at any time of year. Recreational fishers in CRA 8 can only take male lobsters with tails wider than 54 mm and females with tails wider than 60 mm. In 2012, the previous Minister agreed to retain the commercial differential MLS, because the differentials were not considered to impact on stock sustainability (the sizes are taken into account in stock assessments), and because of the significant economic impact that any increase in size would have.

   In 2014, the government then decided against allowing recreational fishers to take spiny rock lobsters at the lower commercial minimum legal size, because of compliance and enforcement challenges associated with a differential size regime for recreational fishers. However, at the time, the commercial sector (and NRLMG sector members) supported recreational fishers having access to the same minimum legal size limited population as commercial fishers. Fisheries New Zealand is reviewing the differential MLS at this time but welcomes feedback on the differential MLS that applies CRA 8.

e) **Prohibited states:** nationally, it is illegal to take or possess spiny rock lobsters carrying external eggs (in berry), or spiny rock lobsters in the soft-shell stage (post-moulting). This applies to both recreationally and commercially caught fish.

f) **Daily limits (recreational only):** No person may take or possess more than six rock lobsters on any one day in CRA 8, apart from the internal waters of Milford Sound (Piopiotahi) where no person may take or possess more than three rock lobsters on any one day.

g) **Area closures:** area restrictions set under the Act can apply to both recreational and commercial fishers. Area closures may be put in place to ensure sustainable utilisation or to protect habitats of particular significance for fisheries management. There are several mātaitai reserves that fall within CRA 8 (refer to heading 7.3 *'Mātaitai reserves and other customary management tools')* as well as several marine reserves in the Fiordland marine area of CRA 8 (see heading 8.5.4 *'Relevant statements, plans, strategies, provisions, and documents - section 11(2)'*). Within the internal waters of Fiordland, commercial fishing is prohibited. This applies to 15 named fiords. See Figure A1 in Appendix 3 for maps of the area closures. Additional areas that prohibit lobster potting and vessel anchoring are established in Fiordland. Marine reserves are not fisheries management tools but are included here as examples of area restrictions utilised within CRA 8.

h) **Accumulation limits (recreational only):** Within CRA 8 there are no amateur fishing accumulation limits, which prevent fishers from possession of more than the daily limit of fish, including rock lobsters. The Fisheries (Amateur Fishing) Regulations 2013, regulation

157 defence provision allows a defence of possessing more than the specified daily limit of any fish species, if the fisher can prove the fish were not taken in excess of the daily limit. The current defence exceptions are blue cod and pāua, constraining accumulation to two times the daily limit, if legally taken on two days or more.

However, within the Fiordland (Te Moana o Atawhenua) Marine Area in CRA 8, there is a Regulation 160(2) defence provision to allow individual fishers to possess and accumulate up to a maximum of 15 rock lobsters taken over three or more days without exceeding the daily limit of six rock lobsters on any one day. This is conditional on the rock lobster being held in labelled containers or bags that contain only rock lobsters taken on a single day; and are clearly labelled to record the individual fishers full name, the date the lobster were caught and the number of lobsters in the container. In the case of accumulated rock lobsters stored in a holding pot, fishers must maintain a written record detailing the various individual fisher's names, date the fish were caught, the number held in the holding pot and the GPS coordinates.

8.5.3 The natural variability of the stock – section 11(1)(c)

200. In setting or varying a sustainability measure the Minister must take into account the natural variability of the stock.

201. A variety of environmental factors are thought to influence the productivity of spiny rock lobster populations, including water temperature, ocean currents, shelter availability, and food availability (Linnane et al., 2010). Lobsters grow at different rates around New Zealand and female lobsters mature at different sizes (Annala, 1983).

202. Spiny rock lobster larvae spend a long time in a planktonic stage, swimming and drifting in the ocean for up to 24 months. This means that 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. In New Zealand, genetic evidence suggests that larvae may originate a considerable distance from the settlement site. The number of 'puerulus', the final planktonic developmental phase of spiny rock lobster, that settle to the sea floor varies among areas and from year to year.

203. Puerulus settlement may be affected by environmental factors such as the amount of suitable habitat available, the persistence of storms, prevailing ocean currents, sea temperature, food availability, and predation. Large numbers of puerulus larvae also die before reaching suitable habitat, which is due in part to predation, but may also be a result of unfavourable environmental conditions.

204. Information on variability in growth, maturity, available abundance, mortality, and recruitment is incorporated into the stock assessments that inform spiny rock lobster management. This information informed the development of options discussed in this paper.

205. CRA 8 appears to be in a period of high recruitment (based on data from puerulus settlement surveys and estimates in the rapid assessment update), and therefore abundance is expected to remain high for at least the next few years. However, if recruitment were to decrease then the biomass of CRA 8 may in turn decrease. Annual biomass assessments (through full stock assessments and rapid assessment updates) and the operation of a management procedure will provide regular monitoring of the fishery and allow for responsive change to management measures if trends in recruitment or biomass change.

Climate change

206. The ocean around New Zealand is, in some regions, warming at a rate well in excess of the global average (Sutton & Bowen, 2019). While the extent to how this will impact the wider ecosystem is largely unknown, it can be expected that there will be an impact on spiny rock lobster, including their spatial variability. Current studies (refer to heading 8.4.3 '*Habitats of particular significance for fisheries management – section 9(c)'*) suggest potentially negative relationship between sea surface temperature and spiny rock lobster recruitment in northern New Zealand.

207. Spiny rock lobsters are likely to be affected by climate change and ocean acidification (Cornwall & Eddy, 2015). Organisms such as spiny rock lobsters are particularly susceptible to ocean

acidification because it lessens their ability to lay down calcified body structures during each moult (Bell et al., 2013, Hepburn et al., 2011).

208. Changes to kina and spiny rock lobster productivity may have wider consequences in coastal ecosystems, because these species often have important ecosystem roles (Pinkerton et al., 2008; Cornwall & Eddy, 2015) (refer to heading 8.4.1 '*Associated or dependent species – section 9(a)'* and heading 9.1. *'Interdependence of stocks'*). Changes to ocean circulation patterns also have the potential to affect the recruitment of the spiny rock lobster, given the extended phyllosoma (larval) stage.

209. Recent work undertaken by the rock lobster stock assessment team (a FNZ contracted research group) indicates a potentially negative relationship between sea surface temperature and spiny rock lobster recruitment in Northern New Zealand. This work is preliminary and requires further scrutiny, however this could be a significant development.

210. Extended periods of extremely warm ocean temperatures known as marine heatwaves[45] are increasing in intensity and frequency across the globe with trends predicted to accelerate under future climate change. New Zealand experienced several marine heatwaves in recent years (Salinger et al. 2019, Bell et al. 2023), causing a range of impacts including temporary southern migrations of warm-water fish and loss of ecologically important seaweeds (Thomsen et al. 2019, Salinger et al. 2020, Thomsen et al. 2021).

211. Marine heatwaves may have direct effects on spiny rock lobster through temperature stress affecting their physiological condition (Oellermann et al., 2020) or indirect effects through impacts on associated habitats e.g., kelp forests.

212. FNZ will continue to monitor for potential impacts on spiny rock lobster abundance in CRA 8 through annual rapid assessment updates and full stock assessments.

8.5.4 Relevant statements, plans, strategies, provisions, and documents - section 11(2)

213. In setting or varying the TAC of CRA 8, the Minister must have regard to relevant statements, plans, strategies, provisions, and planning documents under section 11(2) of the Act, that apply to the coastal marine area. The following plans and strategies apply to CRA 8.

Regional plans- section 11(2)(a)

214. Two regional councils have coastlines within the boundaries of CRA 8: West Coast and Southland. Each of these authorities have policy statements and plans to manage the coastal and freshwater environments, including terrestrial and coastal linkages, ecosystems, and habitats.

215. The provisions of these various documents are, for the most part, of a general nature and focus mostly on land-based stressors on the marine environment. There are no provisions specific to spiny rock lobster.

216. FNZ has reviewed these documents and the provisions that might be considered relevant can be found in a separate document titled *Regional plan provisions and policy statements*, which is accessible at https://www.mpi.govt.nz/dmsdocument/54625. FNZ considers that the proposed options in this paper are consistent with the objectives of these relevant regional plans.

217. The FNZ Coastal Planning Team engages with the RMA coastal planning processes (including regional authorities) to support marine management decisions to manage not only the fishing effects on the coastal environment but also land-based impacts on fisheries.

[45] The scientific definition of marine heatwaves is when seawater temperatures are warmer than the 90th percentile of the local long-term (25-year) average for at least five consecutive days (Hobday et al., 2016).

Fiordland (Te Moana o Atawhenua) Marine Management Act 2005

218. The Fiordland (Te Moana o Atawhenua) Marine Management Act 2005 (**The Fiordland Marine Act**) applies to the Fiordland area, which lies within CRA 8.

219. Section 26 of the Fiordland Marine Act requires that all persons (including management agencies) exercising powers or carrying out functions in the Fiordland (Te Moana o Atawhenua) Marine Area must take into account any advice or recommendations provided by the Fiordland Marine Guardians. This includes actions under the Fisheries Act 1996, such as the TAC settings of CRA 8 within this review.

220. Input from the Fiordland Marine Guardians for this review was sought during November 2023, however they did not provide specific feedback. During the 2022 review of CRA 8, the Fiordland Marine Guardians expressed concerns about increased recreational fishing effort in Fiordland, particularly from amateur charter-fishing vessels (**ACV**s). However, during a 2023 review of daily limits for recreational fishing in Fiordland, the Fiordland Marine Guardians considered the current limit for rock lobster recreational fishing to be appropriate.

8.5.5 Relevant services or fisheries plans – section 11(2A)

221. Before setting or varying any sustainability measure (such as the TAC), the Minister must take into account any conservation or fisheries services, and any relevant fisheries plans approved under section 11(2A) of the Act.

222. There are no fisheries plans approved under section 11(2A) specific to CRA 8, or of specific relevance to this review of measures for the fisheries.

223. Fisheries services of relevance to the options in this paper include the research used to monitor stock abundance, such as contracted projects for stock monitoring and stock assessment, tag deployment and recapture, and puerulus settlement monitoring. In addition, fisheries services include the tools used to enforce compliance with management controls in the fishery.

224. Fisheries New Zealand notes that the CRA 8 fishery has not had observer or on-board camera coverage. In the 2023/24 fishing year, FNZ intends to have observer coverage in CRA 8. In addition, Fisheries Compliance regularly monitors the CRA 8 area to ensure that management controls are being adhered to.

8.5.6 Other plans and strategies

225. The following plans and strategies are not mandatory considerations under section 11 of the Act, but they may be considered relevant to this review.

Te Mana o te Taiao (Aotearoa New Zealand Biodiversity Strategy)

226. Te Mana o te Taiao – the Aotearoa New Zealand Biodiversity Strategy sets a strategic direction for the protection, restoration and sustainable use of biodiversity, particularly indigenous biodiversity, in Aotearoa New Zealand.[46] The Strategy sets a number of objectives across three timeframes. The most relevant to setting sustainability measures for CRA 8 are objectives 10 and 12:

    Objective 10: Ecosystems and species are protected, restored, resilient and connected from mountain tops to ocean depths.

    Objective 12: Natural resources are managed sustainably.

227. FNZ is working with the Department of Conservation and other agencies on implementation of the strategy. As part of that work, we are progressing to a more integrated ecosystem-based approach to managing oceans and fisheries. In that context, this review contains information on biodiversity impacts, ecosystem function, and habitat protection associated with adjustments to sustainability measures (refer to heading 8.4 *'Environmental Principles'*).

[46] Accessible at: https://www.doc.govt.nz/nature/biodiversity/aotearoa-new-zealand-biodiversity-strategy/.

9 Considerations for setting the CRA 8 Total Allowable Catch – section 13 of the Act

228. As outlined above in '*Status of the stocks'*, the best available information on the status of CRA 8 includes:

- The last full CRA 7 and CRA 8 stock assessment conducted in 2021.
- The 2023 CRA 7 and CRA 8 rapid assessment update.
- Trends in CPUE and the 2022/23 CPUE estimate from the voluntary logbook programme.
- Outputs from the proposed management procedure.

229. CRA 8 is estimated to be at or above the default management target of 40% SSB_0 and decisions to set the TAC would be made under section 13(2)(a) of the Act. Under section 13(2)(a) the Minister must set a TAC that maintains the stock at or above a level that can produce MSY while having regard to the interdependence of stocks. The Minister has discretion to manage the stock at or above MSY, but their discretion is not unfettered. It is important to recognise that the Minister must exercise their discretion to promote the purpose of the Act and its principles. As CRA 8 is estimated to be above MSY, this section would apply to maintaining the status quo or increasing the TAC.

230. As outlined in *'Status of the stocks'*, the 2023 rapid assessment estimated CRA 8 biomass to be 62% SSB_0 (unfished spawning stock biomass), and very likely (>90% probability) to be above the target biomass level of 40% SSB_0. These results suggest that there is an opportunity to provide for greater utilisation from 2023/24, and that a modest increase to the TAC of CRA 8 would maintain the stock at or above MSY.

231. Under both options proposed for CRA 8, FNZ considers that the TAC would be set consistent with the objective of maintaining the stock at or above a level that can produce the maximum sustainable yield, while also having regard to the interdependence of stocks. While there are no forward projections available to determine precisely what level the stock would be at following the specified TAC changes, the management procedure used to inform Option 2 aims to maintain the stock well above the 40% SSB_0 management target.

9.1 Interdependence of stocks

232. When setting the CRA 8 TAC under section 13, the Minister must have regard to the interdependence of stocks. The interdependence of stocks also involves the consideration of the effects of fishing on associated stocks affected by fishing for the target stock (see heading 8.4 '*Environmental principles*' above*)*.

233. Examples include non-target fish species (bycatch) or benthic species that are incidentally taken or impacted by fishing gear. The role of the target stock in the food chain should also be considered. In particular, interdependence involves direct trophic relationships between stocks (i.e., one stock is likely to be directly affected through a predator-prey relationship by the abundance of another stock).

234. Evidence suggests predation upon spiny rock lobsters by octopus, rig, blue cod, grouper, southern dogfish, seals, and other spiny rock lobsters. Reducing the abundance of spiny rock lobster in CRA 8 could reduce food availability for spiny rock lobster predators. However, these species have relatively broad diets and it is unlikely that any of these species are entirely dependent on spiny rock lobster as a food source.

235. Spiny rock lobsters are ecologically important predators in New Zealand's rocky reef ecosystems, feeding on a wide range of prey such as molluscs, crustaceans, annelid worms, macroalgae, echinoderms, sponges, bryozoans, fish, foraminifera, and brachiopods. There is evidence to suggest that top predators on inshore reefs can have a significant role in mitigating sea urchin (kina) barrens, which are less biologically diverse environments than the kelp forest

habitats they replace. Large rock lobster are considered an important predator of kina given that they are one of the only reef predators with the ability to consume larger kina.

Kina or urchin barrens and fisheries-induced trophic cascades

236. Much of the available information relating to the relationship between fishing and kina barrens comes from CRA 2 (Hauraki Gulf/Bay of Plenty). However, the information from CRA 2 is not directly comparable to CRA 7 or CRA 8 because of differences in the environment and ecology of coastal reefs between the regions (Wing et al., 2022). Wing et al., (2022) note that southern areas such as Fiordland show substantially different patterns to Northland, as it has "intact native forested catchments, comparatively low fishing pressure, and a large regional network of marine reserves."

237. The majority of literature on the causes of kina barrens focuses on reefs in north-eastern New Zealand where removal of top predators of kina are considered a primary factor. The occurrence of kina barrens may also be influenced by a range of other environmental factors, such as environmental and climatic influences, species' demographics, and catchment-derived sedimentation. The extent of kina barrens and relative importance of contributing factors varies regionally across New Zealand (Schiel., 2013, Wing et al., 2022). It should be noted that multiple causality does not mean that the role of fishing can be disregarded.

238. Kina barrens are reported to occur in parts of southern New Zealand. Within CRA 8 kina are more common on the southern coasts. Around Stewart Island, kina are abundant in the sheltered Paterson Inlet but are less abundant and have patchy distribution in more exposed sites (Shears and Babcock, 2007).[47]

239. A 2019 scientific study assessed fish diversity, kina abundance, and the occurrence of kina barrens between fished areas and marine reserves in Fiordland and the Marlborough Sounds (Udy et al., 2019). In Fiordland, where there were relatively high densities of potential sea urchin predators (rock lobster and banded wrasse), there were lower densities of sea urchins and a smaller proportion of urchin barrens habitat.

240. While kina barrens occur in southern New Zealand, they do not appear to be extensive, and bottom-up forces like marine heatwaves and land-based inputs may play a stronger role in controlling kelp distribution than fishing effects on the food web (Udy et al., 2019, Wing et al., 2022). However, if environmental stressors (such as marine heatwaves) reduce kelp density, then a trophic cascade may be more likely to be occur (Foster and Schiel, 2010).

241. While there is uncertainty in the threshold of abundance and size structure of spiny rock lobster required to reverse or prevent further spread of kina barrens (along with other predators and other factors affecting kelp), the best available information on the status of CRA 8 suggests that the stock is in a period of high abundance relative to stock status since about the 1960s.

242. Option 2 proposes an increase to the TAC. This would result in a lower abundance of spiny rock lobster than Option 1. However, given the increasing abundance suggested by recent trends in CPUE and biomass, under Option 2 the overall biomass of rock lobster in CRA 8 may not reduce compared to the current level. In addition, marine reserves and area restrictions in the Fiordland Marine Area offer a range of fishing restrictions within the inner fiords that already support enhanced abundance of spiny rock lobster (Clark, 2023) (see Figure A1 in Appendix 3).

Interdependence of CRA 7 and CRA 8

243. The CRA 7 and CRA 8 stocks are considered to comprise one biological stock (see heading 3.1 *'Biology'* and heading 4 *'Status of the stocks'*). Tagging data suggests that as juvenile lobsters in CRA 7 mature, some migrate back into the southern areas of CRA 8, and only a small proportion of the catch taken from CRA 7 is consequently comprised of mature females. Fisheries New Zealand therefore assesses both CRA 7 and CRA 8 concurrently to account for their interdependence and recognises that a TAC decision for one of these two stocks can have an influence of the future stock status of its neighbouring stock.

[47] Quantitative description of mainland New Zealand's shallow subtidal reef communities (Part 1 of 8) (doc.govt.nz).

9.2 Harvest Strategy Standard (HSS)

244. Section 13 of the Act provides for the setting of a TAC for CRA 8, and guidance is provided by the Harvest Strategy Standard for New Zealand Fisheries (**HSS**). The High Court has held that the HSS is a mandatory relevant consideration that the Minister must have regard to when setting a TAC under section 13 of the Act, and the Court of Appeal has confirmed the decision of the High Court.[48]

245. The HSS is a policy statement of best practice in relation to the setting of fishery and stock targets and limits for fish stocks in New Zealand's QMS. It is intended to provide guidance on how fisheries law will be applied in practice, by establishing a consistent and transparent framework for decision-making to achieve the objective of providing for utilisation of New Zealand's QMS species while ensuring sustainability.

246. The HSS outlines the Ministry's approach to relevant sections of the Act and forms a core input to the Ministry's advice to the Minister on the management of fisheries. The HSS defines a hard limit as a biomass limit below which fisheries should be considered for closure and a soft limit as a biomass limit below which the requirement for a formal time-constrained rebuilding plan is triggered.

247. Under the HSS, the default management target is 40% SSB_0 (unfished spawning stock biomass), the soft limit is 20% SSB_0, and the hard limit is 10% SSB_0. The default management target applies to CRA 8.

248. In addition, the HSS specifies requirements for management procedures such as those proposed for CRA 7 and CRA 8 in this review. The HSS specifies that management procedures should be designed to ensure that the probability of:

    a) Achieving the MSY-compatible target or better is at least 50%.
    b) Breaching the soft limit does not exceed 10%.
    c) Breaching the hard limit does not exceed 2%.

249. For CRA 8, the default management target of 40% SBB_0, soft limit, and hard limit have been applied. CRA 8 was assessed to be at 62% of SSB_0 in 2022, and CRA 7 and CRA 8 combined were assessed to be at 54% of SSB_0. CRA 8 is very likely (>90% probability) to be above the 40% SSB_0 management target, and very unlikely (<10% probability) to be below the soft and hard limits.

250. In respect to the review of CRA 8, the HSS assists in meeting the requirements of sections 13(2)(a) by providing that stocks should be managed to fluctuate around a specified target based on MSY-compatible reference points or better. Application of the proposed CRA 8 management procedure through to 2027/28 is expected to meet the requirements of the HSS and is very likely (>90% probability) to maintain the stock above 40% SSB_0 and very unlikely (<10% probability) to result in biomass dropping below the soft limit and hard limit.

251. For further information on the specifications of the proposed CRA 8 management procedure, refer to heading 5 *'Proposed management procedures'* and Appendix 2.

10 Information principles: Uncertainties and unknowns - section 10 of Act

252. Under section 10 of the Act, decision-makers are required to take into account four information principles:

    a) decisions should be based on the best available information.[49]
    b) decision makers should consider any uncertainty in the information available in any case;

[48] Fisheries Inshore New Zealand Ltd v Royal Forest and Bird Protection Society of New Zealand Incorporated [2023] NZCA 359.

[49] Section 2(1) of the Act defines "best available information" to mean "the best information that, in the particular circumstances, is available without unreasonable costs, effort, or time"

c) decision makers should be cautious when information is uncertain, unreliable, or inadequate;
d) the absence of, or any uncertainty in, any information should not be used as a reason for postponing or failing to take any measure to achieve the purpose of this Act.

253. FNZ considers that the information presented on the status of CRA 7 and CRA 8 in this paper represents the best available information.

254. In various sections of this paper, FNZ has pointed out where information is uncertain and warrants caution for the Minister's decision making, in line with the principles above.

255. As discussed under heading 4 *'Status of the stocks'* there is uncertainty in the stock status of CRA 8 with respect to *MSY* and estimates of recreational and illegal catch.

256. In addition, over the past five years there has been no observer coverage in CRA 8. Given this, there is increased uncertainty associated with estimates of environmental interactions in the fishery.

257. Some risks in the use of management procedures have been highlighted above in section 5 '*Proposed management* procedures' and below under section 11 '*Options and analysis'*. One of the key risks to consider in the proposed application of the CRA 8 management procedure in informing appropriate catch limit settings is that its success depends on the reliability of CPUE as a measure of stock abundance, and it is difficult to determine how accurately CPUE reflects abundance because it can also be influenced by other factors (such as reporting changes). However, Fisheries New Zealand perceives this risk to be low given that the CPUE series used to inform the CRA 8 management procedure has been review and accepted by Plenary as being a reliable indicator of CRA 8 abundance.

258. In addition, there are several areas where more research and analysis is required to understand the role that spiny rock lobster do and can have in their ecosystem (this includes controlling kina populations), which the Minister should take into consideration when making a decision. For example:

- The biomass threshold and size frequency distribution of spiny rock lobster required to ensure their ecosystem role (such as preventing kina barrens from occurring or to reverse existing barrens that may exist in CRA 8).
- Due to environmental variability, and the range of other biotic and abiotic factors, the extent to which the relationship between kina barrens and fishing pressure is applicable to CRA 8.
- The specific contribution that spiny rock lobsters make to healthy reef ecosystems in CRA 8 relative to other predatory species.
- The extent of the impact that climate change and marine heat waves will have on spiny rock lobsters.
- The size composition of the CRA 8 stock required to support a healthy ecosystem.

259. However, it is important to note that (as emphasised by section 10(d)) uncertainty should not be used as a reason for the Minister to postpone or fail to take any measure to achieve the purpose of the Act.

11 Options and analysis

11.1 CRA 7 management procedure

260. Fisheries New Zealand welcomes feedback on the proposed use of a management procedure in the CRA 7 fishery. The CRA 7 fishery has not utilised a management procedure since 2020/21. After 2020/21 the previously approved procedure was discontinued due to a disruption to the underlying CPUE series that informed the procedure (detailed above under heading 5 '*Proposed management procedures'*).

261. The 2023 November Plenary approved an updated CPUE series for CRA 7, and FNZ are now considering re-instating the previously approved management procedure in the CRA 7 fishery. The specifications used in this CRA 7 management procedure are summarised above in sub-heading 5.4 of '*Proposed management procedures'* and detailed further in Appendix 1.

262. Fisheries New Zealand is proposing two simple options: one would reject the use of this previously approved management procedure (Option 1), and the other would confirm its continued use in the management of CRA 7 fishery through to 2027/2028, unless reviewed earlier (Option 2) (refer to heading 5.4 *'CRA 7 management procedure proposed for 2024'* and Figure 7 for details of the proposed management procedure).

11.1.1 Option 1 – Reject the use of the previously approved CRA 7 management procedure

263. This option would retain the status quo for the fishery. Under this option the management procedure would not be used to inform whether the TACC of CRA 7 should be reviewed for change each year. If not used, FNZ would rely on other information (primarily on rapid assessment updates) to determine when and how the TAC should be reviewed.

11.1.2 Option 2 - Confirm the continued use of the previously approved CRA 7 management procedure

264. Under this option, the management procedure would be re-instated and used to inform management of CRA 7 until 2027/28, unless reviewed earlier. Fisheries New Zealand would use the procedure to inform when and how the TACC of CRA 7 should be reviewed, noting that the management procedure will 'trigger' the need for an annual review when CPUE reaches certain levels (as shown in Figure 7 above).

265. It is important to note that this does not mean the TACC of the stock will be decided based solely on the management procedure. The management procedure will help to guide in when and how the TACC should be reviewed, but when a review is initiated FNZ will continue to consider all available information in determining appropriate options for public consultation (which may include options to set the TACC at a different level than is recommended by the management procedure). As with other sustainability reviews, following consultation, the Minister will have discretion in deciding on TAC and TACC settings that are considered to meet the statutory requirements of the Act.

11.1.3 Analysis

266. Re-instating the CRA 7 management procedure would provide several benefits for management of the stock. This includes providing greater certainty for stakeholders in the assessment and management process. Operation of the procedure would also help to maximise stability in fishing yields and respond appropriately to changes in stock status given that it recommends stronger changes when CPUE deviates more significantly.

267. The risks of reinstating the management procedure are limited. One risk to consider is that the population dynamics of CRA 7 would have changed since the last evaluation of this management procedure against a full stock assessment in 2015 (CPUE, recruitment, and biomass in CRA 7 have increased since 2015). This creates some uncertainty as to how the CRA 7 stock will respond to operation of this management procedure. However, FNZ considers that this risk is limited given that this management procedure has previously operated successfully (between 2012/13 and 2020/21) and CRA 7 biomass increased during the previous operation of the management procedure. The management procedure is also proposed to operate on a relatively short-term, expected to be replaced when CRA 7 and CRA 8 are next assessed (currently scheduled for 2027).

268. Another risk to consider in operation of the management procedure is that its success depends on the reliability of CPUE as a measure of stock abundance. It is difficult to determine how closely CPUE changes reflect abundance because changes can sometimes be related to other factors (for example, changes in reporting). However, FNZ notes that this risk is also low because the 2023 CPUE series for CRA 7 has been accepted by the Plenary as being a reliable indicator of abundance. It should be noted that this CPUE series is also used to inform the stock assessments for CRA 7. This means that even if the management procedure is not adopted, CPUE will still be a factor used in informing sustainable TAC and TACC settings in CRA 7 (just without specific guiding rules).

269. Ngāi Tahu and commercial representatives on the NRLMG support reinstating this management procedure in CRA 7. However, recreational sector representatives on the NRLMG (the New Zealand Sports Fishing Council) have expressed that they do not support reinstating a management procedure in CRA 7 prior to setting an agreed management target for the fishery. Environmental sector representatives have not yet finalised their position on whether they support reinstating the management procedure.

270. Based on tāngata whenua and stakeholder's aspirations for the fishery and the environment, an agreed management target could be set higher than a MSY management target. A different management target would have to be considered in the operation of the management procedure if set. The recreational sector representatives of the NRLMG also do not support the use of a management procedure based on CPUE without an alternative measure of abundance.

11.2 CRA 7 TAC settings

271. The current TAC, allowances and TACC of CRA 7 are outlined below.

TAC: 134.5 t	**TACC:** 111.5 t	**Customary:** 10 t	**Recreational:** 5 t	**Other mortality**: 8 t

272. Regardless of whether the management procedure is adopted for the CRA 7 fishery, FNZ is not proposing any changes to the TAC settings of CRA 7 for the upcoming 1 April 2024 fishing year. The current settings appear to be appropriate based on the 2023 rapid assessment update and CRA 7 management procedure (refer to heading 4 - *status of the stocks* and heading 5 – '*Proposed management procedures'* above).

11.3 CRA 8 management procedure and TAC options

11.3.1 Current settings

A management procedure is not currently being used in management of the CRA 8 fishery				
TAC: 1,453 t	**TACC:** 1,251 t	**Customary:** 30 t	**Recreational:** 33 t	**Other mortality:** 139 t

273. The *status quo* is not proposed as an option in this review for CRA 8. FNZ considers that maintaining the current recreational allowance would not be appropriate because it does not align with the best available information on recreational fishing (see heading 6.3 *'Recreational'* above).

274. The current recreational allowance of 33 tonnes was set in 2009. Since then, the estimates for recreational harvest have increased and the 2022/23 estimate for all recreational harvest (including information from the 2017/18 NPS, amateur charter vessel reporting, and section 111 landings) is 39 tonnes. FNZ considers that the allowance should be set at a minimum of 39 tonnes to reflect this but welcomes further input on this allowance setting. An increase to the allowance is considered appropriate in light of the high abundance within CRA 8.

275. As detailed earlier (in *'Input and participation of tāngata whenua'*) Ngāi Tahu Tangata Tiaki in CRA 8 have expressed concern that recreational fishing within the region constrains tāngata whenua's customary needs. Tangata Tiaki have advocated that the recreational allowance should not be increased, and alternatively measures should be taken to constrain recreational harvest within the current allowance of 33 tonnes. FNZ consider current recreational harvest in the CRA 8 region as a whole is sustainable, however there may be localised issues and FNZ will engage further with Ngāi Tahu to understand potential issues and impacts for tāngata whenua.

11.3.2 Option 1 – Reject new management procedure and apply small increase to TAC and recreational allowance.

Reject the use of the new CRA 8 management procedure and set the TAC, allowances, and TACC as follows:				
TAC: 1,459 t (↑ 6)	**TACC:** 1,251 t	**Customary:** 30 t	**Recreational:** 39 t (↑ 6)	**Other mortality:** 139 t

Rejection of management procedure

276. Under this option the new management procedure for CRA 8 would not be used as a trigger to determine when and how the TACC should be reviewed for changes (refer to heading 5.5 *'CRA 8 management procedure proposed for 2024'* and Figure 8 for details of the proposed management procedure). FNZ would rely on other information (primarily on rapid assessment updates) to determine when and how the TACC of CRA 8 should be reviewed in future. The consequences of this are considered below under the '*new management procedure*' subheading under heading 11.3.3 '*Option 2'* below.

TAC

277. Under Option 1 the TAC would increase from 1,453 to 1,459 tonnes, a six tonne (0.4%) increase pursuant to section 13(2)(a) of the Act.

278. As detailed earlier (in '*Status of the stocks')* CRA 8 appears to have been increasing in biomass in recent years and is very likely (>90% probability) to be above the interim management target. Based on this, FNZ considers that there is a utilisation opportunity for CRA 8.

279. This option reflects a cautious approach to management and carries the least sustainability risk to CRA 8. It also acknowledges and places weight on uncertainty in the extent of kina barren distribution in CRA 8 and the potential influence of spiny rock lobster fishing on the creation of kina barrens (see heading 9.1 *'Interdependence of stocks'* above).

280. This TAC change would not provide for increased catch by any sector. Thus, it is extremely unlikely that adopting this option will lead to any change in fishing behaviour or increase in fishing effort for spiny rock lobster. It is therefore also unlikely that this option would lead to any increased impacts on the environment (see heading 8 '*Environmental and sustainability considerations'* above), or on any interdependent stocks.

281. It is important to note that there is uncertainty in the extent of kina barrens and the potential influence of removal of spiny rock lobster through fishing on kina barren proliferation in CRA 8 (see heading 9.1 *'Interdependence of stocks'*). Fishing of spiny rock lobsters in other regions of New Zealand (notably north eastern New Zealand) has been implicated in the prevalence of kina barrens. However, Wing et al., (2022) note that southern areas such as Fiordland show substantially different patterns to Northland, as it has "intact native forested catchments, comparatively low fishing pressure, and a large regional network of marine reserves."

282. Kina barrens have been observed in regions of CRA 8 (including Stewart Island and Fiordland). Kina barrens may also be present in other regions of CRA 8 that have not yet been detected, as there has been less research on the distribution of kina barrens in the region compared to northern New Zealand.

283. The available scientific research suggests that marine heatwaves and land-based inputs may play a stronger role than trophic cascades in affecting kelp abundance and distribution in southern New Zealand (see heading 9.1 *'Interdependence of stocks'*). However, removal of key predators (such as spiny rock lobster) from the environment may further reduce ecosystem resilience to these stressors.

284. It is also important to note that there may be additional prey or predator species of spiny rock lobster that could be influenced by removal of spiny rock lobster in CRA 8 (see heading 9.1 *'Interdependence of stocks'* and heading 8.4 '*Environmental principles'*). There is limited information on these trophic interactions and the potential effects of fishing, however it is reasonable to expect that removal of spiny rock lobster through fishing may influence the abundance and ecological role of their prey or predator species.

285. When considering the potential ecosystem impacts under this review of CRA 8, it is important to note that the stock is estimated to be in a period of high abundance and the TAC increases proposed under Options 1 and 2 are moderate relative to the total estimated biomass of spiny rock lobster in CRA 8, and unlikely to have a large impact on that abundance. Therefore, while there are important ecosystem interactions to consider, it is unlikely that the options proposed in this paper will pose significant risks to the environment or any interdependent stocks.

286. This option would forgo the utilisation opportunity that the best available information indicates is likely to exist for this stock and does not adopt the recommended TACC increase resulting from the proposed management procedure. See heading 12 *'Economic context'* below for further information on the potential economic impacts of the options for CRA 8.

287. Under this option, assuming the TACC is fully caught, the annual port price[50] revenue would be $1.60 million lower than the 2022/23 fishing year, and $21.65 million higher than the 5-year average, based on annual port prices and landings. The 2023/24 port price is $93.47/kg.

Allowances

288. As discussed in "*Customary Māori'* above, customary reporting reveals that authorised customary harvest of CRA 8 has been 8 tonnes on average over the last five years, with a maximum annual authorised harvest of 16.9 tonnes in 2020. The customary Māori allowance is considered to be appropriate and is proposed to remain at 30 tonnes for all options.

289. The current recreational allowance does not align with the best available information for estimates of recreational harvest (39 tonnes). Option 1 proposes to increase this allowance from 33 tonnes to 39 tonnes, an increase of 6 tonnes (18%), to ensure that it accurately accounts for recreational fishing. An allowance of 39 tonnes is proposed for all options.

290. The allowance for 'all other sources of mortality caused by fishing' is proposed to remain at 139 tonnes. The current estimate of illegal catch and handling mortality (126 tonnes in the 2022/23 fishing year) is within the allowance.

TACC

291. Under Option 1 the TACC would remain at 1,251 tonnes.

292. It carries the lowest sustainability risk of the options presented and would maintain current commercial utilisation. However, it carries a higher risk of constraining commercial utilisation opportunities and places less weight on the most recent rapid assessment update that suggests CRA 8 is well above the management target.

11.3.3 Option 2 - Confirm the use of the new CRA 8 management procedure

Confirm the use of the new CRA 8 management procedure and set the TAC, allowances, and TACC as follows:				
TAC: 1,601 t (↑148)	**TACC:** 1,392 t (↑141)	**Customary:** 30 t	**Recreational:** 39 t (↑6)	**Other mortality:** 140 t (↑1)

New management procedure

293. Under this option, the new management procedure for CRA 8 would be used until 2027/28, unless reviewed earlier. Fisheries New Zealand would use the procedure to guide when and how the catch limits should be reviewed. As has been proposed under this option, FNZ would use the management procedure to help inform initial TAC and TACC settings for consultation (though as noted above for CRA 7, this does not imply that the TACC would be set based solely on the management procedure). FNZ would continue to consider additional information in determining appropriate TAC options for public consultation when CRA 8 is reviewed.

294. This management procedure was evaluated in 2023 and the evaluation results suggest that its use would not pose a risk to stock sustainability. Use of the CRA 8 management procedure through to the 2027/28 fishing year is expected to outperform the requirements of the Harvest Strategy Standard and is very likely (>90% probability) to maintain the stock above the default management target (40% unfished spawning stock biomass) and very unlikely (<10% probability) to result in biomass dropping below the soft and hard limits.

[50] Each year, MPI sends a voluntary survey to all licensed fish receivers (LFRs) to calculate the port price index for the year ahead. Port price represents the greenweight price per kg paid on a particular day and not an average for the whole year. The fishing method is not included in the survey even though a particular method may receive a higher landed price. Port prices represent what commercial fishers receive at port, not what the fish is worth at market (which is higher). Nor does it reflect the income for Licensed Fish Receivers (including, wholesalers and/or processors) and retailers.

295. Simulation testing of the management procedure suggests it will continue to provide for utilisation benefits for all sectors of the CRA 8 fishery, as stock biomass is expected to be maintained well above the target level. The management procedure would also help to maintain stability in fishing yields, including through the minimum change threshold, and be responsive to changes in stock status noting that it recommends stronger management actions when CPUE varies more significantly. Adopting the management procedure would also provide greater certainty for stakeholders in the assessment and management process for CRA 8.

296. One of the key risks of this management procedure is that its success depends on the reliability of CPUE as a measure of CRA 8 stock abundance. As noted above in the discussion on the CRA 7 management procedure, it is difficult to determine how accurately CPUE reflects abundance because CPUE can also be influenced by other factors (such as reporting changes). Notwithstanding this, FNZ considers that the risk of using CPUE in this way is low because the new CPUE series (based on voluntary logbook reporting) has been accepted by the Plenary as a reliable indicator of abundance.

297. Ngāi Tahu and commercial representatives on the NRLMG support reinstating this management procedure in CRA 8. However, recreational sector representatives on the NRLMG (the New Zealand Sports Fishing Council) have expressed that they do not support reinstating a management procedure in CRA 8 prior to setting an agreed management target for the fishery. Environmental sector representatives have not yet finalised their position on whether they support reinstating the management procedure.

TAC

298. Under Option 2 the TAC would increase from 1,453 to 1,601 tonnes, a 148 tonne (10%) increase pursuant to section 13(2)(a) of the Act.

299. This option acknowledges the utilisation opportunity indicated by the high probability that CRA 8 is above the management target, as detailed above and in heading 4 *'Status of the stocks'*.

300. This TAC setting has been guided by the proposed management procedure (see above) which has been formally and independently evaluated by the Rock Lobster Working Group (a Science Working Group convened by FNZ).

301. Under this option an increase in fishing effort is expected. This would result in a lower abundance of spiny rock lobster than Option 1. However, given the increasing abundance suggested by recent trends in CPUE and biomass, under this TAC increase the overall biomass of rock lobster in CRA 8 is likely to only be marginally reduced compared to the current level (or may not even reduce given indications that the stock is increasing in abundance). Thus, there is uncertainty as to whether this option may lead to increased impacts on the environment (see heading 8 *'Environmental and sustainability considerations'*) or on any interdependent species.

302. As discussed above, kina barrens are known to occur in CRA 8 and there is uncertainty regarding the potential influence of removal of spiny rock lobster through fishing on kina barren creation in the region. It is likely that reduced spiny rock lobster abundance may act to reduce predation pressure on its prey (such as kina). However, as discussed in *'Interdependence of stocks'* the relative effect of fishing on kina abundance in CRA 8 is uncertain and the overall biomass may not reduce with this TAC increase.

303. Similarly, reduced abundance of spiny rock lobster may reduce food availability for its predators (see heading 9.1 *'Interdependence of stocks'* and heading 8.4 *'Environmental principles'*). However, the relative importance of spiny rock lobster as a prey species for its predators is uncertain and therefore their dependence on spiny rock lobster as a food source is also uncertain.

304. As highlighted above, the level of spiny rock lobster biomass required to maintain its role in the ecosystem (i.e., in relation to predator prey interactions and prevention of trophic cascades) is unknown, however it is likely that a higher abundance would increase this certainty. Thus, Option 2 provides less certainty than Option 1 that spiny rock lobster biomass will remain at an as yet unknown level that will allow them to play their part in delivering ecosystem functions and reduce the potential for the creation of further kina barrens within CRA 8. However, it is important to note that the stock is estimated to be in a period of high abundance and the TAC

increase under this option is moderate and the overall biomass may not reduce with this TAC increase.

305. In addition, the spatial restrictions on commercial fishing within Fiordland reduce the spatial overlap between commercial fishing and the presence of kina barrens within Fiordland. This is considered to reduce the likelihood that an increase to the TAC would lead to any increase in kina barrens in this region. However, there is likely more overlap in fishing effort and kina barren distribution in other regions of CRA 8. Thus, there is more uncertainty as to the potential impact of a TAC increase on kina barren prevalence within these wider regions of CRA 8 (including Stewart Island).

306. Under this option, assuming the TACC is fully caught, the annual port price[51] revenue would be $11.58 million higher than the 2022/23 fishing year, and $34.82 million higher than the 5 year average, based on annual port prices and landings. The 2023/24 port price is $93.47/kg. (see heading 12 *'Economic context'* below). Downstream benefits to associated business and communities are anticipated, though these benefits are more difficult to measure.

307. The social and cultural benefits of this option are more uncertain. There is a potential economic benefit for Ngāi Tahu whānui through providing for increased commercial utilisation because at least 14.4% of CRA 8 quota is owned by their settlement entity.[52] The income from this quota, either through sales of Annual Catch Entitlement (**ACE**) holdings or direct fishing can be used to fund a range of social and cultural services.

Allowances

308. The customary Māori allowance is proposed to remain at 30 tonnes and the recreational allowance is proposed to increase to 39 tonnes, consistent with the reasoning provided above under Option 1.

309. The allowance for all other mortality caused by fishing under Option 2 is proposed to be increased to 140 tonnes - a one tonne or 0.7% increase from the current allowance. This is based on the current estimates of 'all other sources of mortality caused by fishing' (126 tonnes in 2022/23), and then increasing it by 11% to reflect likely increases in other mortality (handling mortality) as a result of increased fishing.

TACC

310. Under Option 2 the TACC is proposed to increase from 1,251 to 1,392 tonnes. This is a modest approach to provide for increased commercial utilisation. This TACC setting is informed by the management procedure (see heading 5 *'Proposed management procedures'* and Appendix 2 for more information).

311. This option would allow for increased commercial harvest, increasing the maximum landed catch by 141 tonnes (11% increase) which has the potential to result in an increase of annual revenue to the catching sector alone of approximately $13.2 million (based on the 2022/23 port price information of $93.47 per kg) (see *'Economic context'* below).

12 Economic context

312. The CRA 8 fishery supports many people, including quota holders, commercial fishers, licensed fish receivers (**LFR**s), and seafood processing facilities. To give a sense of scale and distribution, based on data from the last three April Fishing Years, in CRA 8 there have been on average 148 quota owners, supplying ACE to 66 permit holders, landing rock lobster to 12 LFRs. CRA 8 has slightly more participants for all parts of the supply chain than the 10 year

[51] Each year, MPI sends a voluntary survey to all licensed fish receivers (**LFR**s) to calculate the port price index for the year ahead. Port price represents the greenweight price per kg paid on a particular day and not an average for the whole year. The fishing method is not included in the survey even though a particular method may receive a higher landed price. Port prices represent what commercial fishers receive at port, not what the fish is worth at market (which is higher). Nor does it reflect the income for Licensed Fish Receivers (including, wholesalers and/or processors) and retailers.

[52] This value is likely an underestimation because it only accounts for quota from settlements and quota owned by known Māori entities (i.e., iwi associations). Quota owners and fishers are not required to report if they are Māori and therefore the value does not contain quota owned by individuals, some of which may be Māori.

average. There is some cross over of participants between CRA 7 and CRA 8, but they are primarily different.

313. Over the last 3 years in CRA 8, 28% of quota was owned by 4 entities, and 72% was owned by the remaining 144 entities (Table 8). Settlement quota makes up 10% of CRA 8 quota. At the end of the April 2022/23 fishing year, in CRA 8, 21% of ACE was held by 4 entities, and the remaining 79% of ACE was held by 67 entities. On average over the last 3 fishing years in CRA 8, 22% of greenweight was landed by 4 permit holders, while the remaining 78% was landed by 62 permit holders. Also, in CRA 8, 94% of greenweight was landed to 4 LFRs, and the remaining 6% was landed to 8 LFRs.

Table 8: Number of entities and the distribution of ownership between the entities for CRA 8. Statistics on Annual Catch Entitlement (ACE) is based on data at the end of the April 2022/23 fishing year, and the remaining data is an average based on the last three fishing years.

	Number of entities	Percentage held/landed by top 4 entities
Quota	148 quota owners	28%
Annual Catch Entitlement (ACE)	71 ACE holders	21%
Greenweight (kg) landed by permit holders	66 permit holders	22%
Greenweight (kg) landed to licensed fish receivers	12 licensed fish receivers	94%

314. Spiny rock lobster is primarily exported. In the 2022 calendar year, 2,738 tonnes of spiny rock lobster were exported with a Free On Board (**FOB**)[53] value of NZ $376 million.

315. Potential changes in revenue have been calculated from the proposed TACC changes and the respective port prices[54] within CRA 8 for the 2023/2024 fishing year. Over the last five years the average annual port price revenue has been $95.29 million in CRA 8, while over the same period the average FOB[55] export revenue was $141.38 million in CRA 8.

316. The average price of CRA 8 ACE (the earnings quota owners receive when selling their ACE) for the 2022/23 fishing year was $51,218.55 per tonne. More detail on CRA 8 ACE and quota prices over the last five years can be found in Table 9.

Table 9: Number of transfers and average prices of ACE and quota for CRA 8.[56]

April fishing year	Annual Catch Entitlement (ACE)		Quota	
	Number of transfers	Average price (per tonne)	Number of transfers	Average price (per tonne)
2022/23	492	$51,218.55	22	$1,627,751.27
2021/22	453	$47,420.6	25	1,322,388.29
2020/21	529	$44,439.21	15	1,487,509.51
2019/20	500	$56,647.37	14	1,441,140.60
2018/19	429	$51,037.82	30	1,525,324.52

317. Under Option 1, the current TACC settings would be retained at 1,251 tonnes. This would not result in any increase in commercial harvest of spiny rock lobster thus not resulting in any increase in annual revenue.

[53] Free on board is the value of export goods, including raw material, processing, packaging, storage and transportation up to the point where the goods are about to leave the country as exports. FOB does not include storage, export transport or insurance cost to get the goods to the export market.

[54] It is important to note that port price is an index calculation of what commercial fishers receive across a QMA, based on a voluntary survey sent each year to LFRs to calculate the port price for the year ahead. Port prices represent what commercial fishers receive at port, not what the fish is worth at market (which is higher). Nor does it reflect the income for Licensed Fish Receivers (including, wholesalers and/or processors) and retailers.

[55] Exports (including re-exports) are valued as free on board (FOB), which is the value of goods at New Zealand ports before export, and are shown in New Zealand dollars.

[56] Quota and ACE trading prices registered with FishServe may include transactions between related commercial entities and the averages may understate true market/transfer price.

318. Under Option 2, the TACC would increase from 1,251 tonnes to 1,392 tonnes. This would allow for increased commercial harvest, increasing the maximum landed catch by 141 tonnes – a 11% increase. Under this option, assuming the TACC is fully caught, the annual port price[57] revenue would be $11.58 million higher than the 2022/23 fishing year, and $34.82 million higher than the 5 year average, based on annual port prices and landings. The 2023/24 port price is $93.47/kg.

13 Deemed value rates

319. Deemed values are the price paid by fishers for each kilogram of unprocessed fish landed in excess of a fisher's ACE holdings. The purpose of the deemed values regime is to provide incentives for individual fishers to acquire or maintain sufficient ACE to cover catch taken over the course of the year, while allowing flexibility in the timing of balancing, promoting efficiency, and encouraging accurate catch reporting.

320. The Deemed Value Guidelines set out the operational policy FNZ uses to inform the development of advice to the Minister on the setting of deemed values.

321. The deemed value rates for CRA 8 are shown below in Table 10.

Table 10: Deemed value rates ($/kg) for all spiny rock lobster stocks.

Interim rate ($/kg)	Annual differential rates ($/kg) for excess catch (% of ACE)					
	100-120%	120-140%	140-160%	160-180%	180-200%	>200%
99.00	110.00	132.00	154.00	176.00	198.00	220.00

322. The average price paid by fishers during the 2022/23 fishing year for one kilogram of ACE was $51.22 for CRA 8. The most recent (2023/24) port price for spiny rock lobster is $93.47 per kilogram. This port price is below the basic annual deemed value rate, which is set at $110/kg (Table 10). Note the average export price ($/kg) for all spiny rock lobster exported in the 2022 calendar year was $136.26.

323. CRA 8 is a high value single target fishery. Having the annual deemed value rate set above port price recognises the need of strong incentives for spiny rock lobster fishers to avoid catching in excess of ACE.

324. FNZ is satisfied that the current deemed values for CRA 8 are consistent with section 75(2)(a) of the Fisheries Act in that they provide sufficient incentives for fishers to balance their catch with ACE. FNZ is therefore not recommending any changes to deemed value rates at this time. FNZ acknowledges, however, that if the TACC of CRA 8 is increased, subsequent changes in fishing behaviour and the ACE market may result in the need for the deemed value to be re-evaluated in the future.

325. FNZ welcomes feedback on these deemed value settings.

14 Questions for submitters

- Do you support the use of the proposed management procedure in CRA 7 or CRA 8? Why?
- Which option do you support for revising the TAC and allowances for CRA 8? Why?
- If you do not support any of the options listed, what alternative(s) should be considered? Why?

[57] Each year, MPI sends a voluntary survey to all licensed fish receivers (LFRs) to calculate the port price index for the year ahead. Port price represents the greenweight price per kg paid on a particular day and not an average for the whole year. The fishing method is not included in the survey even though a particular method may receive a higher landed price. Port prices represent what commercial fishers receive at port, not what the fish is worth at market (which is higher). Nor does it reflect the income for Licensed Fish Receivers (including, wholesalers and/or processors) and retailers.

- Are the allowances for customary Māori, recreational and other sources of mortality appropriate? Why?
- Do you think these options adequately provide for social, economic, and cultural wellbeing?
- Do you have any concerns about potential impacts of the proposed options on the aquatic environment?
- Is there any literature or research that is relevant and has been omitted in this paper?
- What are your thoughts on the ecological importance of spiny rock lobster in CRA 7 and CRA 8?
- Do you have any feedback on the current deemed values settings?

326. We welcome your views on these proposals. Please provide detailed information and sources to support your views where possible.

15 How to get more information and have your say

327. Fisheries New Zealand invites you to make a submission on the proposals set out in this discussion document. Consultation closes at 5pm on 2 February 2023.

328. Please see the Fisheries New Zealand sustainability consultation webpage (https://www.mpi.govt.nz/consultations/review-of-sustainability-measures-2024-april-round) for related information, a helpful submissions template, and information on how to submit your feedback. If you cannot access to the webpage or require hard copies of documents or any other information, please email FMSubmissions@mpi.govt.nz.

16 Legal basis for managing fisheries in New Zealand

329. The Fisheries Act 1996 provides the legal basis for managing fisheries in New Zealand, including the Minister's responsibilities for setting and varying sustainability measures. See the separate document *Overview of legislative requirements and other considerations* at https://www.mpi.govt.nz/dmsdocument/60415 for more information.

17 Referenced reports

Andrew, N. L., & MacDiarmid, A. B. (1991). Interrelations between sea urchins and spiny lobsters in northeastern New Zealand. *Marine Ecology Progress Series*, 211-222.

Annala, J. H., McKoy, J. L., Booth, J. D., & Pike, R. B. (1980). Size at the onset of sexual maturity in female Jasus edwardsii (Decapoda: Palinuridae) in New Zealand. New Zealand journal of marine and freshwater research, 14(3), 217-227.

Annala, J. (1983) New Zealand rock lobsters: biology and fishery. Fisheries Research Division Occasional Publication No. 42. New Zealand Ministry of Agriculture and Fisheries, Wellington. 36 p.

Bell, J. J., Davy, S. K., Jones, T., Taylor, M. W., & Webster, N. S. (2013). Could some coral reefs become sponge reefs as our climate changes?. Global change biology, 19(9), 2613-2624.

Bell, J. J., Smith, R. O., Micaroni, V., Strano, F., Balemi, C. A., Caiger, P. E., ... & Shears, N. T. (2023). Marine heat waves drive bleaching and necrosis of temperate sponges. *Current Biology*, *33*(1), 158-163.

Bradford RW, Griffin D, Bruce BD (2014) Estimating the duration of the pelagic phyllosoma phase of the southern rock lobster, Jasus edwardsii (Hutton). Marine and Freshwater Research 66(3):213-219.

Casement, D; Svane, I (1999) Direct Effects of Rock Lobster Pots on Temperate Shallow Rocky Reefs in South Australia: a study report to the South Australian Rock Lobster Industry. South Australian Research & Development Institute. 24 p.

Chiswell, S. M., & Booth, J. D. (2008). Sources and sinks of larval settlement in Jasus edwardsii around New Zealand: where do larvae come from and where do they go?. Marine Ecology Progress Series, 354, 201-217.

Clark, Z. W. D. (2023). *Analysis of Fiordland commercial rock lobster (Jasus edwardsii) fishery subject to a network of marine protected areas* (Doctoral dissertation, University of Otago).

Cornwall, C. E., & Eddy, T. D. (2015). Effects of near-future ocean acidification, fishing, and marine protection on a temperate coastal ecosystem. Conservation Biology, 29(1), 207-215.

Dayton, P. K. (1985). Ecology of kelp communities. Annual review of ecology and systematics, 215-245.

Department of Conservation and Fisheries New Zealand (2019). Hector's and Māui Dolphin Threat Management Plan. Latest review accessible at: https://www.mpi.govt.nz/consultations/hectors-and-maui-dolphins-threat-management-plan-review/

Department of Conservation and Fisheries New Zealand (2020). National Plan of Action — Seabirds 2020. Accessible at: https://www.mpi.govt.nz/dmsdocument/40652-National-Plan-Of-Action-Seabirds-2020-Report

Doheny, B., Davis J.P., Miller, B. (2023). Fishery-Induced Trophic Cascades and Sea Urchin Barrens in New Zealand: A Review and Discussion for Management. New Zealand Aquatic Environment and Biodiversity Report No. 4425. 126 p.

Edwards, C.T.T.; Peatman, T.; Goad D.; Webber, D.N. (2023). Update to the risk assessment for New Zealand seabirds. New Zealand Aquatic Environment and Biodiversity Report No. 314. 66 p.

The Fiordland (Te Moana o Atawhenua) Marine Management Act 2005. Fiordland (Te Moana o Atawhenua) Marine Management Act 2005 No 36 (as at 24 August 2023), Public Act Contents – New Zealand Legislation

Fisheries New Zealand (2011). Operational Guidelines for New Zealand's Harvest Strategy Standard. Accessible at: https://www.mpi.govt.nz/dmsdocument/19706-OPERATIONAL-GUIDELINES-FOR-NEW-ZEALANDS-HARVEST-STRATEGY-STANDARD

Fisheries New Zealand (2020). Guidelines for the review of deemed value rates for stocks managed under the Quota Management System. Accessible at: https://www.mpi.govt.nz/dmsdocument/40250/direct

Fisheries New Zealand (2022). Aquatic Environment and Biodiversity Annual Review 2021. Compiled by the Aquatic Environment Team, Fisheries Science and Information, Fisheries New Zealand, Wellington New Zealand. 779 p.

Fisheries New Zealand (2022). South Island Hector's Dolphin Bycatch Reduction Plan. Accessible at: South Island Hector's Dolphin Bycatch Reduction Plan (mpi.govt.nz)

Fisheries New Zealand (2023). Fisheries Assessment Plenary, November 2023: stock assessments and stock status. Compiled by the Fisheries Science Team, Fisheries New Zealand, Wellington, New Zealand. 669.p Accessible at: https://www.mpi.govt.nz/dmsdocument/60529-Fisheries-Assessment-Plenary-November-2023-Stock-Assessments-and-Stock-Status-Introductory-Section-to-Yellowfin-Tuna.

Foster, M. S., & Schiel, D. R. (2010). Loss of predators and the collapse of southern California kelp forests (?): Alternatives, explanations and generalizations. *Journal of Experimental Marine Biology and Ecology*, *393*(1-2), 59-70.

Flood, A. S. 2021. PhD: Gut Instincts: Feeding behaviour of the rock lobster, Jasus edwardsii. The University of Auckland, Auckland, New Zealand.

García-Echauri, L., Liggins, G., Cetina-Heredia, P., Roughan, M., Coleman, M. A. & Jeffs, A. 2020. Future ocean temperature impacting the survival prospects of post-larval spiny lobsters. Marine Environment Research, 156, 104918.

Gerrard, J. (2021). The Future of Commercial Fishing in Aotearoa New Zealand-Full Report-Part 2: References & Appendices.

Green, B. S., Gardner, C., & Kennedy, R. B. (2009). Generalised linear modelling of fecundity at length in southern rock lobsters, Jasus edwardsii. *Marine Biology*, *156*, 1941-1947.

Hepburn, C. D., Pritchard, D. W., Cornwall, C. E., McLeod, R. J., Beardall, J., Raven, J. A., & Hurd, C.L. (2011). Diversity of carbon use strategies in a kelp forest community: implications for a high CO2 ocean. Global Change Biology, 17(7), 2488-2497.

Hesse J, Stanley JA, Jeffs G (2015) Do changes in reef habitats influence relative predation risk on the juvenile Australasian spiny lobster Jasus edwardsii (Hutton, 1875). Brill 88:7-8.

Hinojosa, I. A., Gardner, C., Green, B. S., Jeffs, A., Leon, R. & Linnane, A. 2016. Differing environmental drivers of settlement across the range of southern rock lobster (Jesus edwardsii) suggest resilience of the fishery to climate change. Fisheries Oceanography, 26 (1): 49-64.

Kelly, S., MacDiarmid, A. B., & Babcock, R. C. (1999). Characteristics of spiny lobster, Jasus edwardsii, aggregations in exposed reef and sandy areas. *Marine and Freshwater Research*, *50*(5), 409-416.

Kendrick, T., & Bentley, N. (2003). Movements of rock lobsters (Jasus edwardsii) tagged by commercial fishers around the coast of New Zealand from.

Linnane, A., Gardner, C., Hobday, D., Punt, A., McGarvey, R., Feenstra, J., ... & Green, B. (2010). Evidence of large-scale spatial declines in recruitment patterns of southern rock lobster Jasus edwardsii, across south-eastern Australia. Fisheries Research, 105(3), 163-171.

Linnane, A; McGarvey, R; Gardner, C; Hartmann, K; De Lestang, S (2021) Southern rock lobster (2021). Fisheries Research and Development Corporation, Canberra. 6 p. URL: https://fish.gov.au/2020-Reports/southern_rock_lobster.

MacDiarmid, A., D. Freeman, and S. Kelly. 2013. Rock lobster biology and ecology: contributions to understanding through the Leigh Marine Laboratory 1962–2012. New Zealand Journal of Marine and Freshwater Research 47:313-333.

McKoy, J. L. (1983). Movements of rock lobsters, Jasus edwardsii (Decapoda: Palinuridae), tagged near Stewart Island, New Zealand. New Zealand Journal of Marine and Freshwater Research, 17(4), 357-366.

McLeay, L. J., Doubell, M. J., & Linnane, A. J. (2019). Spatial and temporal variations in female size at maturity of a Southern Rock Lobster (Jasus edwardsii) population: A likely response to climate change. PLoS One, 14(11), e0225144.

National Panel Survey of Marine Recreational Fishers 2017/18:

National Panel Survey of Marine Recreational Fishers 2017–2018. (mpi.govt.nz)

National Panel Survey of Marine Recreational Fishers 2011/12: https://fs.fish.govt.nz/Doc/23718/FAR_2014_67_2847_MAF2010-01.pdf.ashx.

New Zealand Government (2020). Te Mana o te Taiao - Aotearoa New Zealand Biodiversity Strategy 2020. Accessible at: https://www.doc.govt.nz/nature/biodiversity/aotearoa-new-zealand-biodiversity-strategy/

Nursey-Bray, M., Pecl, G., Frusher, S., Gardner, C., Haward, M., Hobday, A. J., ... & van Putten, I. (2012). Communicating climate change: climate change risk perceptions and rock lobster fishers, Tasmania. Marine Policy, 36(3), 753-759.

Oellermann, M., Hickey, A. J., Fitzgibbon, Q. P., & Smith, G. (2020). Thermal sensitivity links to cellular cardiac decline in three spiny lobsters. Scientific reports, 10(1), 202.

Pierre, J. P., How, J. R., & Dunn, A. (2022). Whale entanglements with New Zealand pot fisheries: characterisation and opportunities for management.

Pinkerton, M., C. Lundquist, C. Duffy, and D. Freeman. 2008. Trophic modelling of a New Zealand rocky reef ecosystem using simultaneous adjustment of diet, biomass and energetic parameters. Journal of Experimental Marine Biology and Ecology 367:189-203.

Pinkerton, M., A. MacDiarmid, J. Beaumont, J. Bradford-Grieve, M. Francis, E. Jones, C. Lalas, C.Lundquist, A. McKenzie, S. Nodder, L. Paul, J. Stenton-Dozey, D. Thompson, and J. Zeldish. (2015). Changes to the food-web of the Hauraki Gulf during the period of human occupation: a mass-balance model approach. New Zealand Aquatic Environment and Biodiversity Report 160.

Salinger, M. J., Renwick, J., Behrens, E., Mullan, A. B., Diamond, H. J., Sirguey, P., ... & Sutton, P. J. (2019). The unprecedented coupled ocean-atmosphere summer heatwave in the New Zealand region 2017/18: drivers, mechanisms and impacts. *Environmental Research Letters*, *14*(4), 044023.

Salinger, M. J., Diamond, H. J., Behrens, E., Fernandez, D., Fitzharris, B. B., Herold, N., ... & Trought, M. C. (2020). Unparalleled coupled ocean-atmosphere summer heatwaves in the New Zealand region: drivers, mechanisms and impacts. *Climatic Change*, *162*, 485-506.

Schiel, D.R. (2013). The other 93%: trophic cascades, stressors and managing coastlines in non-marine protected areas. *New Zealand Journal of Marine and Freshwater Research 47 (3)*: 374–391.

Shaffer, M.R. and Rovellini, A., 2020. A review of habitat use, home range and connectivity for selected New Zealand species. *Prepared for the Department of Conservation, Wellington, New Zealand*, p.43.

Shears, N.T.; Babcock, R.C. (2003). Continuing trophic cascade effects after 25 years of no-take marine reserve protection. Marine Ecology Progress Series 246: 1–16.

Shears, N. T., & Babcock, R. C. (2007). *Quantitative description of mainland New Zealand's shallow subtidal reef communities*. Wellington, NZ: Science & Technical Pub., Department of Conservation. Quantitative description of mainland New Zealand's shallow subtidal reef communities (Part 1 of 8) (doc.govt.nz)

Shears, N.T.; Babcock, R.C.; Salomon, A.K. (2008). Context-dependent effects of fishing: variation in trophic cascades across environmental gradients. Ecological Applications 18 (8): 1860–1873.

Stanley, J.A., Hesse, J., Hinojosa, I.A. et al., (2015) Inducers of settlement and moulting in post-larval spiny lobster. Oecologia 178, 685–697

Sutton, P. J., & Bowen, M. (2019). Ocean temperature change around New Zealand over the last 36 years. New Zealand Journal of Marine and Freshwater Research, 53(3), 305-326.

Taylor, D.I., Schiel, D.R. (2010). Algal populations controlled by fish herbivory across a wave exposure gradient on southern temperate shores. Ecology, 91, 201-211. https://doi.org/10.1890/08-1512.1

The 2015 stock assessment for CRA 7 and CRA 8:

The 2015 stock assessment of rock lobsters (Jasus edwardsii) in CRA 7 and CRA 8, and management procedure review. (fish.govt.nz)

The 2022 sustainability for CRA 7 and CRA 8:

Review of Rock Lobster Sustainability Measures for 2022/23 Final Advice Paper (mpi.govt.nz)

The 2021 stock assessment for CRA 7 and CRA 8:

FAR 2022/17 The 2021 stock assessment of red rock lobsters (Jasus edwardsii) in CRA 7 and CRA 8 (fish.govt.nz)

The data for the 2021 stock assessment for CRA 7 and CRA 8:

fs.fish.govt.nz/Doc/25145/FAR-2022-16-Data-For-2021-Stock-Assessment-CRA7-And-CRA8-4266.pdf.ashx

Thomsen, M. S., Mondardini, L., Alestra, T., Gerrity, S., Tait, L., South, P. M., ... & Schiel, D. R. (2019). Local extinction of bull kelp (Durvillaea spp.) due to a marine heatwave. *Frontiers in Marine Science*, *6*, 84.

Thomsen, M. S., Mondardini, L., Thoral, F., Gerber, D., Montie, S., South, P. M., ... & Schiel, D. R. (2021). Cascading impacts of earthquakes and extreme heatwaves have destroyed populations of an iconic marine foundation species. *Diversity and Distributions*, *27*(12), 2369-2383.

Udy, J. A., Wing, S. R., Jowett, T., O'Connell-Milne, S. A., Durante, L. M., McMullin, R. M., & Kolodzey, S. (2019). Regional differences in kelp forest interaction chains are influenced by both diffuse and localized stressors. *Ecosphere*, *10*(10), e02894.

Wynne-Jones, J.; Gray, A.; Heinemann, A.; Hill, L.; Walton, L. (2019). National Panel Survey of Marine Recreational Fishers 2017-2018. New Zealand Fisheries Assessment Report 2019/24. 104p. Accessible at: https://www.mpi.govt.nz/dmsdocument/36792-far-201924-national-panel-survey-of-marine-recreational-fishers-201718

Wing, S. R., Shears, N. T., Tait, L. W., & Schiel, D. R. (2022). The legacies of land clearance and trophic downgrading accumulate to affect structure and function of kelp forests. *Ecosphere*, *13*(12).

Appendix 1: CRA 7 (Otago) management procedure specifications

Management procedures have operated in the CRA 7 fishery from 1996/97 until the 2020/21 fishing year.

In 2013, the Minister approved a new CRA 7 management procedure to operate from the 2013/14 fishing year until the 2018/19 fishing year. In 2015, a new stock assessment was carried out for CRA 7 in conjunction with CRA 8. The 2015 stock assessment model was used to re-evaluate the performance of the CRA 7 management procedure, and the procedure was extended to the 2020/21 fishing year.

Some important elements of the CRA 7 management procedure are:

a) The output variable is Total Allowable Commercial Catch (**TACC**) in tonnes;
b) Offset-year standardised CPUE is used as an input to the rule to determine the TACC for the fishing year that begins in the following April;
c) CPUE is calculated using the *F0_LFX* procedure which uses landings to a licensed fish receiver and the amount of rock lobsters returned to the water (high graded rock lobsters);
d) The management procedure is to be evaluated every year (no "latent year"), based on off-set year CPUE;
e) The minimum change threshold for the TACC is 10% and the maximum change threshold is 50%.

The CRA 7 management procedure is based on a generalised plateau rule, illustrated in Figure 7 above. Between CPUEs of zero and 0.17 kg/potlift the TACC is zero, the TACC then increases linearly with CPUE to 80 tonnes at a CPUE of 1 kg/potlift. The TACC remains at 80 tonnes until CPUE reaches 1.75 kg/potlift and then increases linearly.

Table A1. History of the CRA 7 management procedure. 'Rule result' is the result of the management procedure after operation of all its components.

Year of analysis	Applied to April fishing year	Offset year CPUE at time of analysis (kg/potlift)	Rule result TACC (tonnes)	TAC (tonnes) set by the Minister	TACC (tonnes) set by the Minister
2012	2013/14	0.625	43.96	64	44
2013	2014/15	1.356	66.00	86	66
2014	2015/16	2.304	97.7	117.7	97.7
2015	2016/17	2.212	97.7	117.7	97.7
2016	2017/18	2.766	112.5	132.5	112.5
2017	2018/19	2.328	98.5	117	97.0
2018	2019/20	2.292	97.3	117	97.0
2019	2020/21	2.567	106.2	126.2	106.2
2020	2021/22	-	-	126.2	106.2
2021	2022/23	-	-	134.5	111.5
2022	2023/24	-	-	134.5	111.5
2023	2024/25	2.503	111.5	-	-

Appendix 2: New CRA 8 (Stewart Island, Southland, Fiordland) management procedure specifications

Management procedures have operated in the CRA 8 fishery from 1996/97 until the 2020/21 fishing year.

The last management procedure was operated from 2016/17 until the 2020/21 fishing year.

Twenty-four different CRA 8 management procedure options were considered by the NRLMG in late 2023. The NRLMG have put forward one of these rules for consideration (Rule 23).

Some important elements of the CRA 8 management procedures are:

a) The output variable is Total Allowable Commercial Catch (**TACC**) in tonnes;
b) Offset-year standardised CPUE is used as an input to the rule to determine the TACC for the fishing year that begins in the following April;
c) CPUE is calculated from data provided through the voluntary logbook programme, which indexes numbers of legal-sized lobsters caught in dedicated logbook pots (all lobster greater than the MLS including egg-bearing females).
d) The management procedure is to be evaluated every year (no "latent year"), based on off-set year CPUE;
e) The minimum change threshold for the TACC is 5%. There is no maximum change threshold for the TACC.

The proposed new CRA 8 management procedure is based on a generalised plateau step rule, illustrated in Figure 8 above. Between CPUEs of 0 and 0.6 kg/potlift the TACC is zero, the TACC then increases linearly with CPUE to 3.4 kg/potlift, and between CPUES of 3.4 to 7 kg/potlift the TACC is 1,251 tonnes. As CPUE increases above 7 kg/potlift, the TACC increases in steps with a width of 1 kg/potlift and a height of 5.5% of the preceding TACC.

Table A2. Results of the proposed new CRA 8 management procedure for the 2023/24 fishing year, after operation of all its components including thresholds.

Proposed CRA 8 rule	Offset year CPUE at time of analysis (kg/potlift)	Rule result TACC (tonnes)
Rule 23	8.455	1,392

Appendix 3: CRA 8 (Stewart Island, Southland, Fiordland) spatial regulations map

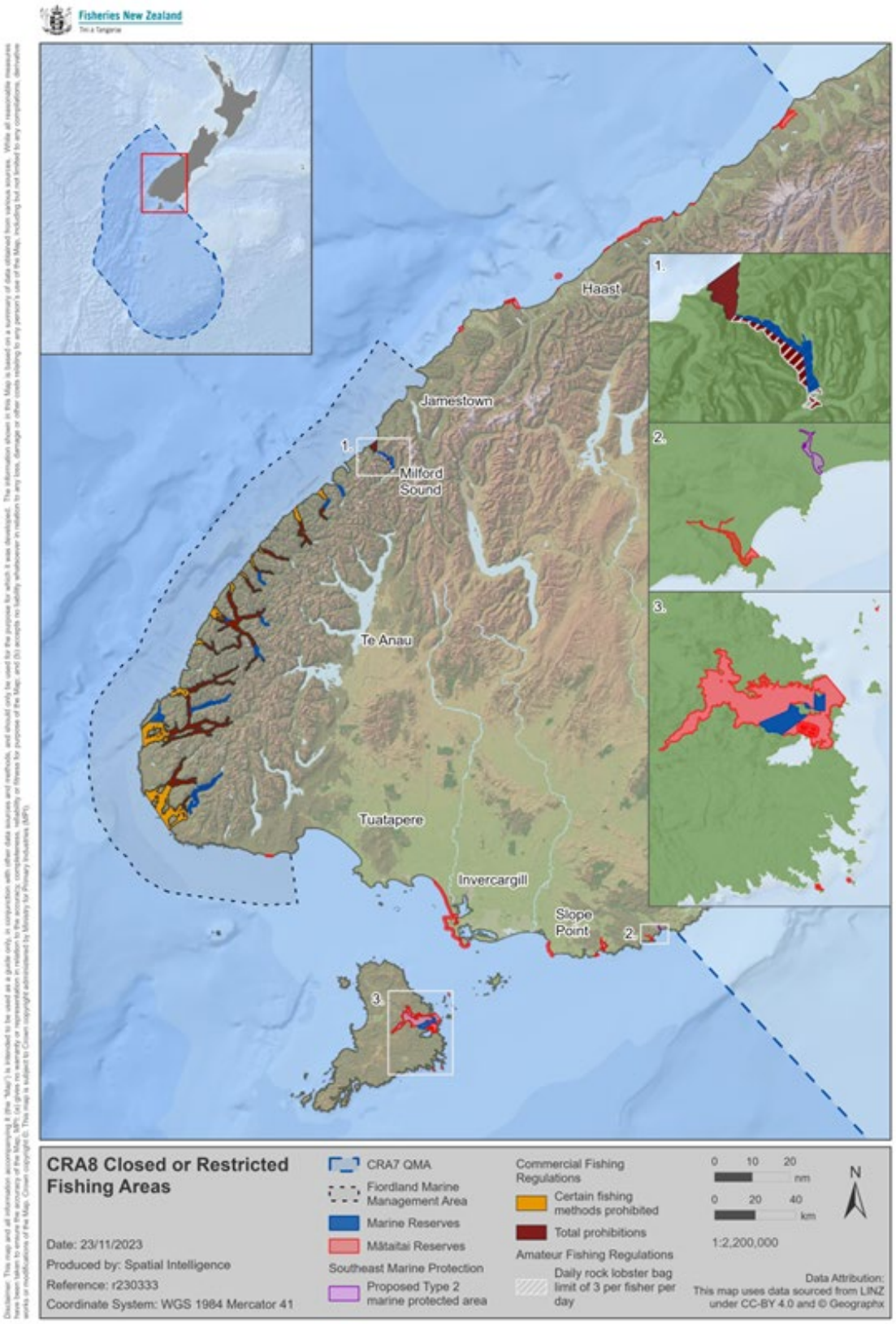

Figure A1. Closed or restricted fishing areas within the rock lobster CRA 8 Quota Management Area. Mātaitai reserves prohibit commercial fishing provided for in the conditions of the mātaitai. All types of fishing are prohibited within marine reserves. The Fiordland Marine Management Area indicates the area that operates under the Fiordland (Te Moana o Atawhenua) Marine Management Act 2005.