Fisheries New Zealand
Tini a Tangaroa

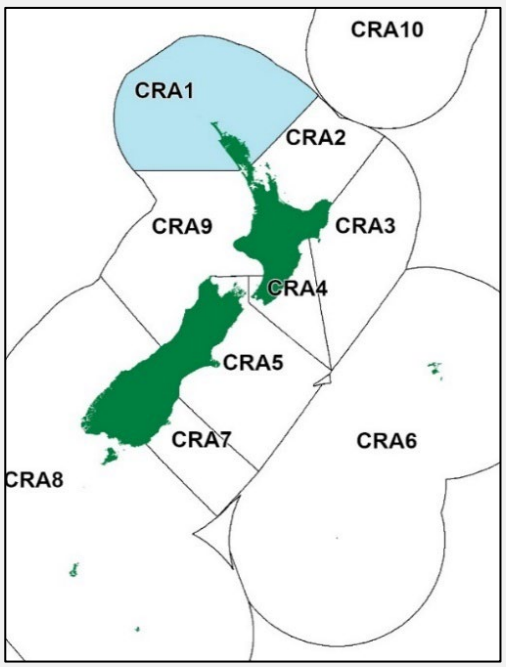
Discussion of proposed measures for the Northland spiny rock lobster fishery (CRA 1)

Fisheries New Zealand Discussion Paper No: 2024/30

ISBN: 978-1-991330-09-3 (online)
ISSN: 2624-0165 (online)

November 2024

Red or Spiny rock lobster
Kōura, crayfish – Jasus edwardsii



Quota Management Area for CRA 1 (Northland spiny rock lobster)

Te Kāwanatanga o Aotearoa
New Zealand Government

Contents

Executive summary

1. In 2023, the catch limits for the **CRA 1** spiny rock lobster (**rock lobster**) fishery were reduced in recognition of the need to increase the abundance of rock lobster to a level that enables them to contribute to the control of sea urchin populations. The Minister's 2023 decisions for CRA 1 responded to a High Court Judgment.[1] In making the decisions, the Minister at the time acknowledged that addressing the proliferation of urchin barrens will require a range of measures beyond catch limit reductions for rock lobster. [2] Fisheries New Zealand (**FNZ**) has an ongoing work programme to address urchin barrens and a number of measures have been implemented since April 2023 (see Part 4 under *'Summary of work programme to date'*).

2. During 2024, the CRA 1 industry implemented a range of non-regulated measures for the 2024/25 fishing year (April 2024-March 2025) to ensure sustainability, further assist the fishery rebuild, and mitigate the need for further catch limit reductions. FNZ's initial view is that the measures that have been put in place to date, as well as the current non-regulated industry measures, will not sufficiently address urchin barren issues (discussed in Parts 2 and 3).

3. This document discusses a range of management measures that are being considered by FNZ to better manage the impact of rock lobster fishing on urchin barren formation in CRA 1 (Table 1). The purpose of this document is to canvass the views of tangata whenua and stakeholders on these potential measures.

Table 1: Management measures being considered to help address urchin barrens in CRA 1 (discussed in Part 2).

Non-regulated measures implemented by the rock lobster industry
Non-regulated harvest limits and area/seasonal closures for 2024/25
Potential additional regulated measures
Subdivision of the CRA 1 Quota Management Area
Adjustments to legal size requirements
Area and/or seasonal closures
Accumulation and/or vessel limits for recreational rock lobster fishing
Measures to reduce recreational fishing pressure of packhorse rock lobster (*Sagmariasus verreauxi*).

4. This document discusses the potential uses of each measure and analyses their potential risks and benefits. It does not propose specific options within each measure. FNZ is taking this approach to allow greater involvement and input from tangata whenua and stakeholders in the management process and selection of measures to progress. Some measures if progressed, for example area closures, would require specific options to be developed alongside experts, local fishers, and hapū/iwi to ensure they meet tangata whenua and community aspirations and can be effectively enforced.

5. Following engagement, FNZ will seek Ministerial direction on which measure(s) to progress for the CRA 1 fishery. FNZ will then progress any chosen measure(s) by developing specific options for consultation alongside tangata whenua and stakeholders. The timing for implementation will depend on which measure(s) are progressed.

6. FNZ invites you to make a submission on the measures in this discussion document and welcomes feedback on other potential measures for the CRA 1 fishery which may help to address urchin barrens. Questions for submitters specific to each management measure are set out under Part 2 '*Management measures'*. The deadline for feedback is 5pm on Sunday 15 December 2024.

Discussion document: canvass the views of tangata whenua and stakeholders (current step).	**November – December 2024**
Decision document: summarise input and submissions. Obtain Ministerial direction on the most appropriate measure(s) to progress.	**March 2025**
Co-develop options: with tangata whenua and stakeholders on measure(s) the Minister has chosen to progress.	**March – June 2025**

[1] The Environmental Law Initiative v Minister for Oceans and Fisheries [2022] NZHC 2969 [11 November 2022]. This case is discussed further under *'2022 High Court judgment'* in Part 4 of this paper. The 2023 Minister's decision is also subject to a legal challenge – see Part 4 under *'2024 High Court Hearing'* for more details.

[2] See the previous Minister's decision letter and FNZ's decision paper for the April 2023 sustainability round at: https://www.mpi.govt.nz/consultations/review-of-sustainability-measures-for-fisheries-2023-april-round/.

Part 1: Overview and background

1. Why are we considering additional management measures for the CRA 1 fishery?

7. The CRA 1 Quota Management Area (**QMA**) extends from Kaipara Harbour on the west coast to Te Arai Point, south of Whangārei, on the east coast. Urchin barrens are known to occur on the east coast of Northland but have not been identified on the west coast or at Manawatāwhi/Three Kings Islands[3], where they are considered less likely to occur due to high wave action.[4] A 2024 study estimated urchin barren coverage on shallow reefs at seven fished locations[5] on the east coast between Maitai Bay at the northwestern tip of the Northland Peninsula to Tāwharanui Peninsula in the Hauraki Gulf (in the CRA 2 QMA) (see Figure 1 for study locations).[6] Urchin barrens were found at all locations and ranged from 7% coverage on shallow reefs (at Maunganui Bay) to 49% coverage on shallow reefs (at Mimiwhangata). Other studies have provided estimates of urchin barren extent on shallow reefs in parts of the Bay of Islands which range between 9% and >90%.[7]

8. There is currently no broadly accepted formal definition in New Zealand of what constitutes an urchin barren. Consequently, FNZ has developed a working definition for the purpose of identifying areas of concern. Urchin barren areas typically exhibit low biodiversity and reduced primary and secondary production compared to healthy kelp forest ecosystems. With this in mind, FNZ consider urchin barrens to be:

> *"…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."* [8]

9. *Evechinus chloroticus* (**kina**) is the dominant barren-forming urchin species in New Zealand, although the subtropical urchin *Centrostephanus rodgersii* (**long-spined urchin**) has recently been reported as increasing in parts of northern New Zealand.[9] FNZ recognises that barrens caused by the long-spined urchin are an emerging threat and rock lobster, including packhorse rock lobster (*Sagmariasus verreauxi*), are potentially the only predators that can consume long-spined urchins in New Zealand. Although this paper primarily discusses management measures for urchin barrens caused by kina, measures that aim to increase rock lobster abundance and size should also enable them to function as an effective predator of long-spined urchins. Measures to reduce recreational fishing pressure on packhorse lobster are also considered (see *'Measures for recreational fishing of packhorse lobster'* under Part 2 and *'Summary of work programme to date'* under Part 4).

10. Urchin barrens are not ubiquitous across rocky reefs and tend to be restricted to different depth zones determined by environmental conditions. On moderately exposed coasts the shallow reef (0–3 m water depth) is characterized by brown algae,[10] intermediate depths (3–8 m water depth) are maintained as urchin barrens, and deeper reef (>8 m water depth) is dominated by kelp forests.[11] On more exposed reefs, barrens form on deeper sections of reef (12–20 m), while in more sheltered conditions barrens are restricted to shallower depths.[12] Urchin barrens tend to not form in very sheltered areas that experience high sediment loads.

11. Multiple factors can cause kelp decline (including sedimentation and marine heatwaves). In northeastern New Zealand, fishing of top reef predators is considered to be a key factor behind the proliferation of kina, resulting in extensive kelp loss and the expansion of urchin barrens.[13]

[3] Shears & Babcock (2004)
[4] At a local level, urchin abundance and feeding efficiency can be reduced due to excessive wave action (Doheny et al., 2023).
[5] At the time of data collection, these locations were all considered fished. Mimiwhangata Marine Park was closed to commercial fishing, but recreational fishing was permitted. It has subsequently been closed to recreational fishing (see *'Spatial characteristics of the CRA 1 fishery'*). Maitai Bay and Maunganui Bay are now under customary management (see *'Area closures'* and *'Kaitiakitanga'* for more detail).
[6] Kerr et al. (2024)
[7] Froude (2016) and Booth (2017)
[8] Doheny et al. (2023)
[9] Sweatman (2021)
[10] Fucalean algae which belongs to the order *Fucales* and are commonly found in marine environments.
[11] Choat & Schiel (1982) and Shears & Babcock (2004)
[12] Shears et al. (2004)
[13] 2024 Aquatic Environment Biodiversity Report, Chapter 13: Trophic and Ecosystem Level Effects – in review. And references within

This relationship is based on observations of the concurrent recovery of kelp and sea urchin predators (including snapper, *Pagrus auratus,* and rock lobster) inside long-term marine reserves near Leigh[14], and the positive effect of protection from fishing on the abundance of kelp and predators inside seven marine reserves from the Kermadecs to the Bay of Plenty.[15]

12. The loss of kelp forests is damaging for coastal ecosystems, fisheries productivity, biodiversity, and ocean carbon sequestration. Urchin barrens support a far lower level of biodiversity relative to kelp forests due to the loss of ecosystem services, including the complex three-dimensional habitat and organic matter provided by kelp forests.[16] The degraded state of these reefs may make them less resilient to the impacts of climate change and is likely already impacting ecosystem function.[17]

13. Once established, urchin barrens are stable and persistent. Studies have shown that urchin abundance must be reduced to very low levels (less than 1 urchin per square metre) for urchin barrens to revert to a kelp or macroalgae-dominated habitat.[18]

[14] Babcock et al. (1999), Shears & Babcock (2002), (2003), and Leleu et al. (2012)
[15] Edgar et al. (2017)
[16] Udy et al. (2019)
[17] 2024 Aquatic Environment Biodiversity Report, Chapter 13: Trophic and Ecosystem Level Effects – in review. And references within
[18] Filbee-Dexter & Scheibling (2014), Ling et al. (2015), and Shears & Babcock (2003)

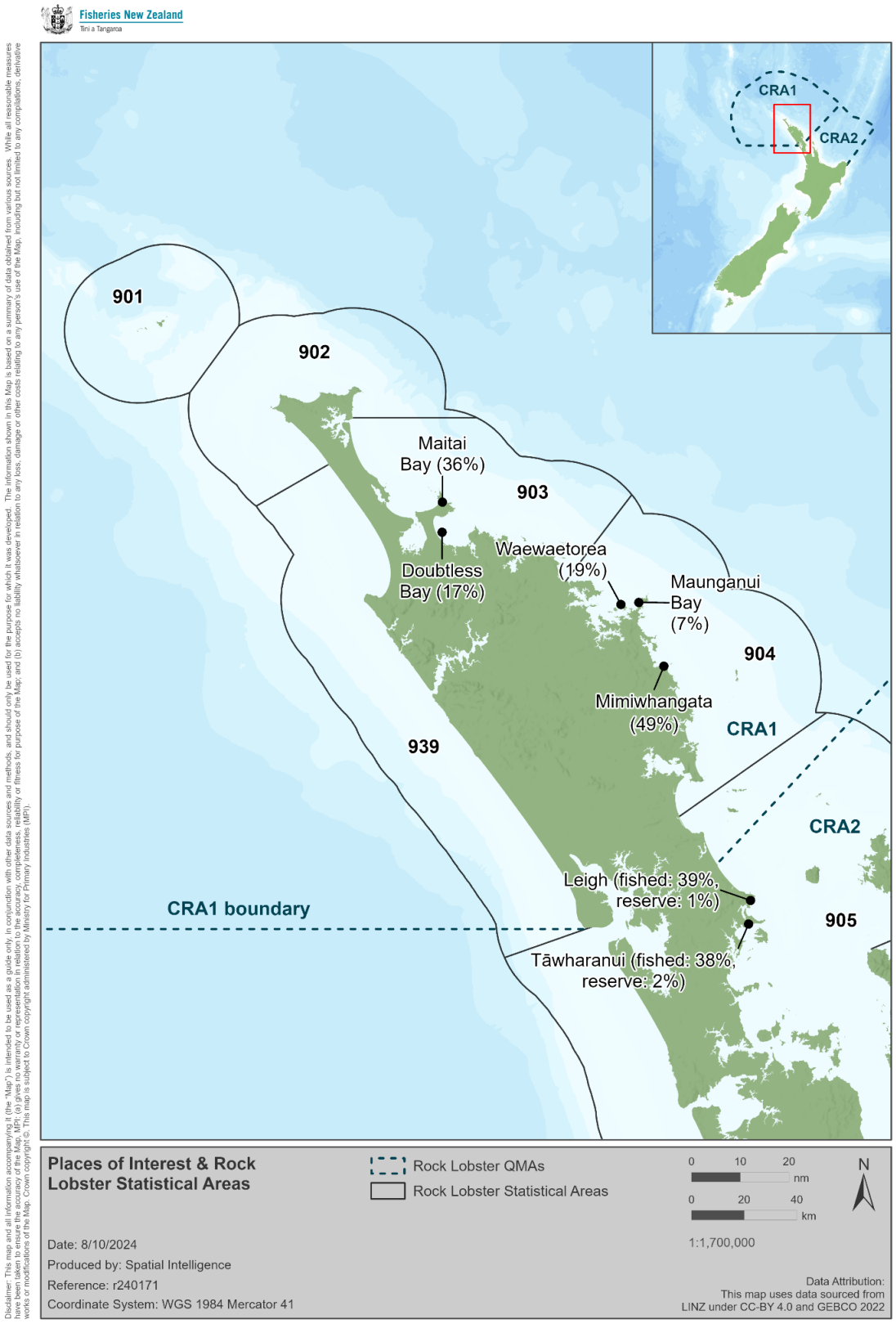


Figure 1: Seven locations where shallow subtidal habitats were mapped between 2003 and 2019 in Kerr et al. (2024). The study provided estimates of urchin barren coverage on shallow reefs that ranged between 7% (Maunganui Bay) and 49% (Mimiwhangata) at fished locations. Urchin barren coverage on shallow reefs (%) at each location coverage is indicated on the map. At Leigh and Tāwharanui both fished and unfished (outside and inside marine reserves) estimates were provided by the study. Matai Bay was treated as fished at the time of the study but is now under a rāhui established in 2017 by Te Whānau Moana/Te Rorohuri hapū of Ngāti Kahu iwi. Maunganui Bay (also treated as fished in the study) was temporarily closed to fishing under section 186A of the Act in 2022 and now forms part of the Rakaumangamanga MPA. Mimiwhangata Marine Park has been closed to commercial fishing since 1994 and recreational fishing was prohibited in 2022.

14. The Government has already implemented a range of management measures to facilitate urchin removals, including increasing the catch limits for kina in East Northland (SUR 1A) and Auckland, Hauraki Gulf, and Bay of Plenty (SUR 1B); increasing the recreational daily limit for kina;[19] and authorising a new special permit purpose and traditional non-commercial fishing use to provide for urchin culling, translocation, and removal (see '*Summary of work programme to date'* under Part 4).

15. Removing urchins is an important management action that can accelerate kelp forest restoration at local scales, but it does not address underlying ecosystem imbalances which contribute to the formation of urchin barrens. Evidence from marine reserves in northeastern New Zealand has shown that increased abundance of large urchin predators (including rock lobster and snapper) can assist in reversing urchin barrens and support the re-establishment of kelp forest habitat. Recovery of kelp forest habitat within no-take reserves can take decades[20] but may occur more quickly if combined with urchin removals. A recent study showed that a single large-scale urchin removal event promoted kelp recovery in urchin barrens within two years (this was labour intensive and required removing ~403,000 individual kina and 166 long-spined urchins from just 7.1 hectares of shallow reef), however these benefits are temporary and urchin abundance can increase as soon as 2 years post removal.[21]

16. In addition to consuming urchins, the presence of rock lobster and snapper can influence urchin behaviour. A study in northern New Zealand found that increased presence of predators such as rock lobster and snapper inside marine reserves increases cryptic behaviour (hiding in crevices) by urchins[22] which suggests that the presence of larger lobster alone may reduce the likelihood of urchin barrens forming.

17. The relative importance of rock lobster as a predator of kina compared to other species, such as snapper, has not been quantified. Urchin predation by fish such as snapper has been linked directly to the predator mouth size (i.e., how wide snapper can open their mouths), with larger fish capable of consuming larger urchins. Urchin predation by rock lobster is less size dependant because large rock lobster can use their claws to pry large urchins from rocks and open them via the urchins' unprotected mouthparts. However, laboratory-based feeding experiments have shown that only lobster with a carapace (body) length (**CL**) greater than 130 mm are capable of feeding on larger kina.[23] In CRA 1, 130 mm CL approximately equates to 83 mm tail width (**TW**) for female lobster and 68 mm TW for male lobster.[24]

18. Ensuring rock lobster fulfil their ecological role as a key predator of kina is likely to be best fulfilled by increasing the overall abundance of rock lobster and the abundance of large rock lobster. The abundance and size composition of rock lobster required to reduce or reverse the spread of urchin barrens is currently unknown, but is likely higher than current levels in urchin barren dominated habitats.

19. This paper outlines three regulated management measures the Minister at the time directed FNZ to provide advice on as part of the 2023 Total Allowable Catch (**TAC**) review of CRA 1 (Table 1). These measures intend to increase the abundance of rock lobster in areas of known urchin barrens in CRA 1. In May 2024, the Minister was made aware of a draft Industry Annual Operating Plan (**AOP**) detailing non-regulated measures being carried out by the rock lobster industry in CRA 1, including measures that restrict commercial catch in statistical areas 903 and 904 (Figure 1). These are included as part of this discussion because they are currently in operation and could support or provide an alternative to some regulated measures (e.g. QMA subdivision). Additional measures proposed by tangata whenua including vessel and

[19] The recreational daily limit is a combined limit for kina (*Evechinus chloroticus*) and the long-spined urchin (*Centrostephanus rodgersii*).
[20] Babcock et al. (2010), Shears & Babcock (2003), and Leleu et al. (2012)
[21] Miller et al. (2024)
[22] Spyksma et al. (2017)
[23] Andrew & MacDiarmid (1991)
[24] Webber et al. (2024). The carapace length to tail width conversion for the neighbouring QMA CRA 2 was used in the absence of a published conversion for CRA 1.

accumulation limits for rock lobster and additional measures for recreational fishing of packhorse rock lobster are also discussed.

2. Draft goal and objectives – rock lobster fisheries management responses to urchin barrens in northeast New Zealand

20. FNZ proposes setting a goal and objectives for management responses to urchin barrens in rock lobster fisheries for northeast New Zealand. This is intended to help stakeholders better assess the design and effectiveness of the measures being considered. The draft goal and objectives for rock lobster management are outlined below. These objectives are intended to apply at the scale of the whole QMA. Differing local objectives may be informed or developed by tangata whenua and community aspirations.

21. FNZ acknowledges that fisheries management measures to address urchin barrens should include measures to increase the abundance of additional urchin predators (including snapper and other as yet unidentified predators). The draft goal and objectives outlined here are specific to rock lobster because this document is specific to CRA 1.

22. This draft goal is guided by the purpose under section 8 of the Fisheries Act 1996 (**the Act**) which includes to avoid, remedy, or mitigate adverse effects of fishing on the aquatic environment, and the environmental and information principles of the Act (sections 9 and 10 of the Act, respectively).

23. FNZ considers the loss of ecosystem services and biodiversity associated with the replacement of kelp forest with urchin barrens as an adverse effect of rock lobster fishing on the aquatic environment (noting that rock lobster fishing is not the only cause of this).

24. Consistent with the purpose of the Act, urchin barrens as an adverse effect of fishing should therefore be avoided, remedied, or mitigated.[25]

25. There is no order of precedence on which action (i.e., remedying or mitigating or avoiding) should be taken over the other. While 'avoiding' is not a feasible management response to the existing urchin barrens as they have already formed, the Minister has discretion as to whether mitigating versus remedying existing urchin barrens is required. FNZ has identified mitigation of existing urchin barrens (defined as a continuum of management outcomes which range from the restoration of kelp forest on a large spatial scale to some reduction in the extent of urchin barrens in part of the region) and avoiding the formation of new urchin barrens as appropriate short-term objectives.

26. FNZ is seeking feedback on the value of setting a goal and objectives for rock lobster management in CRA 1 as well as the specific wording in the draft goal and objectives below.

Draft Goal: Rock lobster stocks are managed to levels that enable them to meaningfully contribute as rocky reef predators, including helping, at a minimum, to mitigate existing urchin barrens at both a QMA and local scale, while avoiding contributing to the formation of new barrens.

Draft Objective 1: Increase rock lobster abundance in areas with known urchin barrens to levels that contribute, at a minimum, to mitigating existing urchin barrens while avoiding contributing to the formation of new barrens; and

Draft Objective 2: Increase abundance of large rock lobsters in areas with known urchin barrens to levels that contribute, at a minimum, to mitigating existing urchin barrens while avoiding contributing to the formation of new barrens.

> Do you consider that setting a goal and objectives for rock lobster management in response to urchin barrens in CRA 1 is useful?
>
> Do you agree with the draft goal and objectives outlined above? If not, are there alternative objectives you think should be considered?

[25] 'Avoid' is not defined in the Act, however the Courts have considered a similar provision contained in section 5(2)(c) of the Resource Management Act 1991 and defined 'avoiding' as 'not allowing' or 'preventing the occurrence of'.

3. Spatial characteristics of the CRA 1 fishery

27. In recent years, the commercial CRA 1 fishery has operated mostly in statistical areas on the west coast, far north of Northland, and Manawatāwhi/Three Kings Islands (901, 902 and 939; Figure 2). In 2022/23, approximately 95% of annual commercial catch was taken from these three statistical areas (where urchin barrens have not been identified) with the remaining approximately 5% taken from the east coast statistical areas 903 and 904 (where urchin barrens are known to occur).

28. This represents a relatively recent shift in the distribution of commercial fishing effort. Historically, the east coast statistical areas (903 and 904) have accounted for approximately 20% of total landings until 2020/21, when the percentage of catch dropped to below 10%.[26] The shift in commercial effort away from the east coast likely relates to a number of factors including (but not limited to): a reduction in the size of the fishing fleet that coincided with commercial catch limit reductions, higher catch rates typically occurring in other statistical areas attracting a greater share of the reduced TACC, and the avoidance of conflict with the recreational fishery.

29. Whilst the contribution of historical commercial catch on the east coast to the formation of urchin barrens needs to be considered, management measures focused on the commercial fishery alone may have little effect on the future abundance of rock lobster in areas of known urchin barrens due to low commercial effort in these areas.

30. Fine-scale recreational data are not available to characterise recreational fishing effort across the CRA 1 QMA. Recreational catch is estimated through the results of the National Panel Surveys of Marine Recreational Fishers (**NPS**), reported section 111 landings from commercial fishers,[27] and reported catch from amateur charter vessels. The NPS has shown a decrease in recreational harvest from 23.98 tonnes (±7.2 tonnes) in 2011/12[28] to 15.91 tonnes (±14.7 tonnes) in 2017/18[29], and more recently, 8.00 tonnes (± 3.9 tonnes) in 2022/23 (not including 2.02 tonnes of section 111 landings and 160 kg of amateur charter vessel catch reported in 2022/23).[30]

31. The majority of recreational harvest (78% on average across the 2011/12, 2017/18, and 2022/23 NPS) takes place on the east coast of CRA 1 (roughly aligned with statistical areas 903 and 904). In 2013/14, the highest recreational fishing effort on the east coast of CRA 1 was noted to likely be around the main population centres in the Whangārei district and Bay of Islands.[31] A less intensive survey in 2022/23 suggested the relative importance of the Bay of Islands for recreational rock lobster harvest may have declined.[32] Most recreational fishing is done through hand gathering by diving, with a small portion using pots.

32. Trends in rock lobster abundance from a marine park in CRA 1 which allowed recreational fishing add supporting evidence that measures focused solely on commercial fishing are unlikely to be effective at addressing urchin barrens. Mimiwhangata Marine Park (with urchin barrens covering 49% of shallow reefs, when surveyed in 2003)[33] has been closed to commercial fishing since 1994 and was only recently closed to recreational fishing in 2022. A survey of rock lobster abundance in the Marine Park conducted 10 years after commercial fishing was prohibited did not find the same recovery in rock lobster abundance or size that occurred in no-take marine reserves in CRA 2.[34] This suggests recreational fishing pressure can keep rock lobster abundance low if it has already been depressed.

---

[26] Starr, P.J. (2024). Fisheries Assessment Report 2024/10

[27] Commercial fishers can take home lobsters for personal use under section 111 of the Act. These lobsters must be declared on landing, and should be accounted for within the recreational allowance.

[28] 2011/12 National Panel Survey of Marine Recreational Fishers

[29] 2017/18 National Panel Survey of Marine Recreational Fishers

[30] See the 2022/23 National Panel Survey of Marine Recreational Fishers. Noting, the recreational daily limit was decreased from 6 to 3 spiny rock lobster on 1 April 2023, part way through the survey. In addition. the season that was monitored in 2022/23 was somewhat atypical due to weather impacts which could affect estimates of recreational fishing activity (see page 95 of the 2022/23 National Panel Survey).

[31] Holdsworth (2014)

[32] Johnson et al. (2024)

[33] Kerr et al. (2024)

[34] Denny & Babcock (2004) and Shears et al. (2006). Whilst these marine reserves are located in CRA 2, they are relevant due to the ecological similarity between CRA 1 (statistical areas 903 and 904) and CRA 2 (statistical areas 905 and 906).

33. The spatial characteristics of customary harvest in CRA 1 are not well understood. Non-commercial customary fishing can occur through customary authorisations under the Fisheries (Kaimoana Customary Fishing) Regulations 1998 or the Fisheries (Amateur Fishing) Regulations 2013 (**the Amateur Fishing Regulations**), the location of harvest is not required to be reported to FNZ under either regulation. Further information on CRA 1 customary harvest is summarised under Part 4 in *'Fishery characteristics and settings'*.

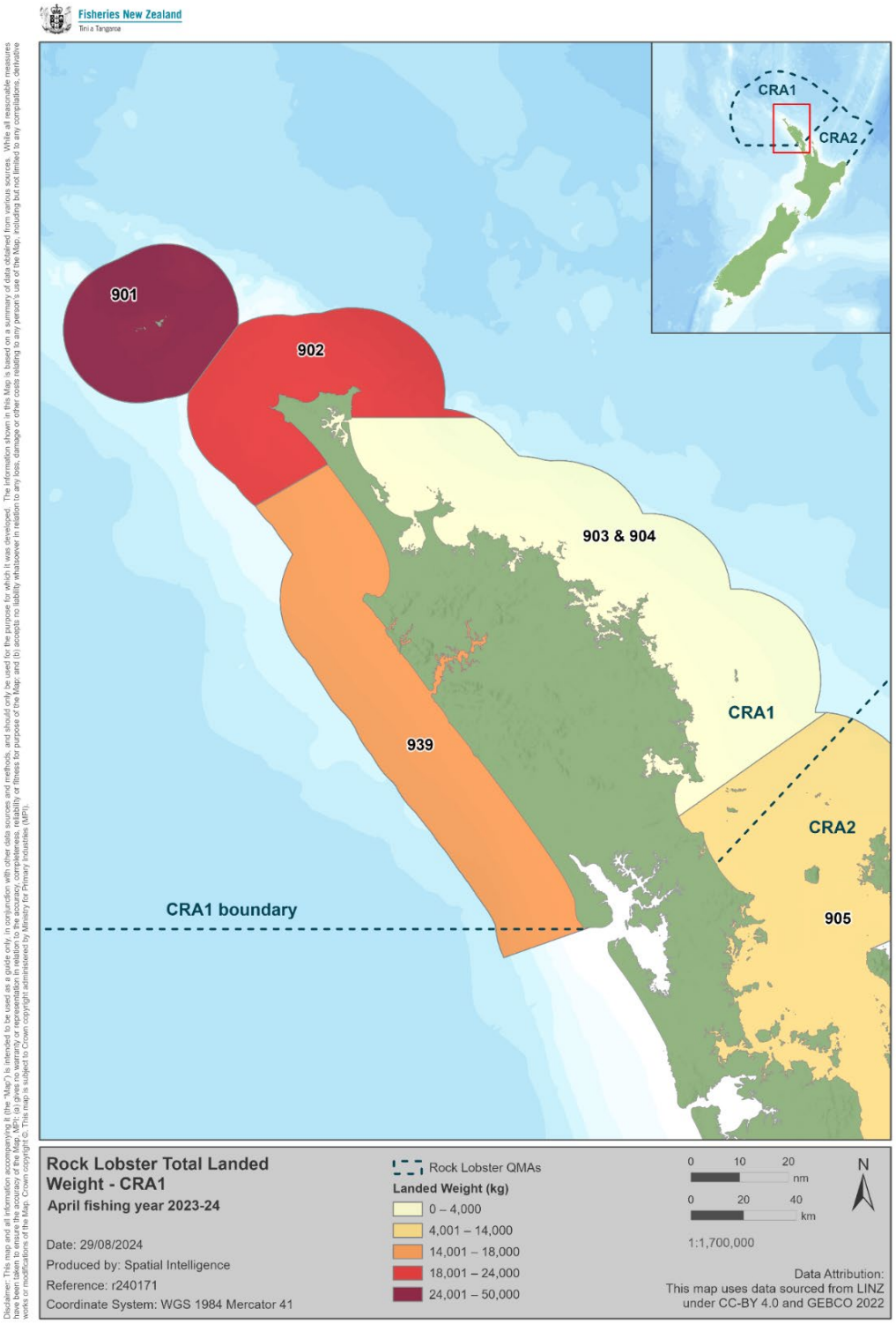


Figure 2: Total landed weight (kg) of rock lobster in the CRA 1 commercial fishery in the 2023/24 April fishing year across reporting statistical areas. The northern portion of statistical area 905 (above the dashed line) is within the CRA 1 fishery, however, catch data are reported across the entire statistical area and the CRA 1 portion cannot be separated from the CRA 2 portion. Statistical areas 903 and 904 were combined to meet commercial sensitivity requirements.

4. CRA 1 stock status

34. Our best available information on the abundance of rock lobster in CRA 1 comes from fishery-dependent standardised catch per unit effort (**CPUE**). The last full stock assessment was conducted in 2019, before the reduction in commercial effort in the east coast statistical areas was recorded. In the 2019 stock assessment, explicit consideration was given to whether the CRA 1 stock could or should be modelled as separate sub-stocks for the east and west coasts. Based on comparisons between length frequency data and standardised CPUE abundance indices between the two regions, the stock assessment experts did not find evidence that these two regions should be assessed separately and CRA 1 was evaluated as one region.

35. Rapid assessment updates are usually carried out in years between full stock assessments for rock lobster stocks to monitor if the stock is following the expected trajectory predicted by the full stock assessment. Rapid assessment updates include new data in the base case model (i.e., the 2019 stock assessment) and refit the model without reassessing the model structure, hence the rapid assessment updates did not reconsider if the two coasts should be modelled separately.

36. The latest assessment of CRA 1 stock status is based on a rapid assessment update conducted in 2023 (rapid updates were also conducted in 2020, 2021, and 2022). In 2023, the CRA 1 fishery was estimated to be About as Likely as Not (40-60% probability) to be at or above the biomass associated with *maximum sustainable yield* (***B_{MSY}***),[35] and Very Unlikely (<10% probability) to be below the soft and hard limits (Fisheries Assessment Plenary, November 2023 (**the Plenary**).

37. Since 2019, rapid assessment updates have not included new data for CPUE, the index of abundance used in rock lobster stock assessments. In addition, no projections of future CRA 1 biomass will be available until the next full stock assessment (which is expected to be in 2025).

38. It is important to note that single stock B_{MSY} management targets do not take into account wider ecosystem considerations or environmental interactions which are considerations when setting sustainability measures. One way of building consideration for environmental interactions is to manage to higher levels relative to B_{MSY} . To progress this approach for CRA 1, modelling of alternative management targets that are higher relative to B_{MSY} should be done following a new stock assessment when the latest B_{MSY} reference level is estimated (currently scheduled for 2025), and once it is known which management measures discussed in this document will be implemented.

39. The full stock assessment for CRA 1 planned for 2025 is expected to provide updated biomass estimates for the west coast of CRA 1 (including Manawatāwhi/Three Kings Islands). Given the recent withdrawal and ongoing limited commercial fishing along most of the east coast of CRA 1 since the previous full assessment, it is unlikely that the 2025 assessment model will be able to estimate current biomass for the east coast region.

40. Additional surveys will likely be required to monitor rock lobster abundance in east coast statistical areas and to assess the effectiveness of any implemented management measures. FNZ are exploring approaches that could be used to monitor trends in rock lobster abundance on the east coast alongside urchin and kelp distribution.

[35] Maximum Sustainable Yield 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.

Part 2: Management measures

5. Non-regulated measures

41. The CRA 1 Rock Lobster Industry Association (**CRAMAC 1**)[36] has developed an AOP for the 2024/25 fishing year to ensure sustainability, further assist the fishery rebuild, and mitigate the need for further Total Allowable Commercial Catch (**TACC**) reductions.[37] FNZ recognises the proactive steps taken by the rock lobster industry in developing this AOP. The AOP documents non-regulated commercial fishing practices agreed to by the members of CRAMAC 1, including:

    a) a non-regulated harvest cap of five tonnes across both statistical areas 903 and 904 combined for the 2024/25 fishing year implemented to further assist in halting the decline in rock lobster abundance in the east coast statistical areas;

    b) non-regulated commercial closed seasons between 20 December and 20 February for statistical areas 902, 903, and 904 and between 1 December and 28 February for statistical areas 901 and 939 implemented to avoid fishing over the summer period when increasing water temperatures are thought to be responsible for increased mortality in lobsters either landed or returned to the sea.[38] Not commercially fishing over the summer months also helps to avoid conflict with recreational fishers, and;

    c) non-regulated closed areas, including Tutukaka Harbour (north side) to Bay of Islands, Hokianga to Herekino Harbours, and parts of the Three Kings implemented to mitigate conflict between recreational and commercial fishers and to leave areas available for recreational and customary fishing only.[39]

42. The CRAMAC 1 2024/25 AOP is already being followed by almost all CRA 1 commercial fishers, and FNZ can monitor adherence to the non-regulated measures. Monitoring and reporting adherence to the measures within the plan may mitigate possible perceptions of low confidence in the application of these measures from other sectors.

43. FNZ acknowledges the collective action and positive contribution of the industry, but notes that constraining commercial catch to five tonnes in statistical areas 903 and 904 may not substantially increase the abundance of rock lobster and large rock lobster (see *'Draft goals and objectives')* due to the remaining commercial and non-commercial harvest in these areas. It is FNZ's initial view that the measures FNZ and the Minister have put in place to date, as well as the current non-regulated industry measures, will not sufficiently address urchin barren issues.

44. Combining industry non-regulated measures with section 11 measures discussed below (including legal size limit changes and area closures) will help increase the overall abundance of rock lobster and large rock lobster in areas of known urchin barrens. However, the industry AOP is reviewed annually, so measures in the plan may be adjusted, and any changes require agreement of the rock lobster industry. The industry AOP does not guarantee that commercial catch in statistical areas 903 and 904 will remain at five tonnes (or lower) for the length of time it takes to recover rock lobster abundance to levels that mitigate existing urchin barrens (i.e., likely decades at a minimum based on evidence from no-take area closures).

Benefits	• The non-regulated harvest cap in statistical areas 903 and 904 maintains commercial fishing effort to recently reduced levels following recent TACC reductions to limit pressure on rock lobster in areas of known urchin barrens on the east coast for the 2024/25 fishing year. Industry may offer a longer-term agreement.

[36] CRAMAC 1 was established as the commercial stakeholder organisation representing the interests of the quota share owners, ACE & fishing permit holders, Licenced Fish Receivers, and fishing crew in the CRA 1 and PHC 1 rock lobster industry.

[37] Accessible at: CRAMAC 1 Annual Operating Plan (AOP) 2024-2025

[38] FNZ is not aware of data that supports an increase in handling mortality over the summer period, although it has been observed by some commercial fishers.

[39] Tutukaka Harbour (North Side) to Bay of Islands and Hokianga Harbour mouth to Herekino Harbour mouth are voluntarily closed to commercial fishing but not to anchorage and holding pots. Three Kings Islands from the headland of North West Bay to the headland of South East Bay is voluntarily closed to commercial fishing but not to anchorage and holding pots as per agreement of 2016.

	• Industry plans generally have a high level of compliance and FNZ has the ability to monitor and report on adherence to the measures[40] which may also improve confidence in non-regulated measures with other sectors. • It has support from almost all CRA 1 commercial fishers who are already following the AOP. • In comparison to regulated measures, non-regulated measures are flexible which allows changes to be made more easily as our understanding of the issue develops.
Risks	• The AOP does not preclude future increases in commercial catch in statistical areas 903 and 904 through changes to the TACC or by industry agreement. • The AOP still allows for some (albeit limited) commercial catch in statistical areas 903 and 904. Given the uncertainties around the biomass of rock lobster required to enable them to meaningfully contribute as rocky reef predators (see '*Information Principles: section 10 of the Act'* in Part 3) any remaining commercial catch may still present a risk to achieving the draft goal and objectives. • Constraining commercial catch to five tonnes in statistical areas 903 and 904 may do little (if anything) to increase the abundance of rock lobster and the abundance of large rock lobster in areas of known urchin barrens in areas due to remaining recreational harvest. • Changes to the AOP can only occur with the agreement of CRAMAC 1. • Non-regulated measures cannot be enforced, however, FNZ can determine compliance by monitoring geospatial reporting of commercial catch data. • The AOP will be reviewed annually, in November, by CRAMAC 1 and the measures in the plan may change. This may not provide confidence the measures will persist for the length of time it takes to recover rock lobster abundance to levels that mitigate existing urchin barrens.
Do you agree with FNZ's initial view that the measures FNZ and the Minister have implemented to date, and the current non-regulated industry measures will not sufficiently address barren issues? If so, what measures could be used in conjunction?	

6. Regulatory measures being considered

QMA subdivision

45. Subdivision of a QMA is provided for by section 25 of the Act and may be undertaken following either written agreement supported by quota owners holding 75% of quota shares (section 25A) or following demonstration that doing so is necessary to ensure sustainability after considering all alternatives (section 25B).

46. Both pathways require consideration of the new QMA boundaries and the allocation of the quota shares in the new QMAs. FNZ would then undertake public consultation on the proposed subdivision. In the event that a subdivision is agreed upon, approval from Cabinet is required both to the subdivision and to the regulatory amendments that describe the new QMAs. FNZ would also consult on setting TACs, TACCs, allowances, and deemed value rates for the new QMAs as part of the sustainability round process, which would take effect from the start of the next April fishing year.

47. To guide feedback on this measure, FNZ notes that an option for quota allocation could be quota shares for the new QMAs to be apportioned in the same way the existing CRA 1 quota shares are apportioned (e.g. an entity that holds 1% of quota shares in CRA 1 would hold 1% of shares in each new QMA). Allocation of settlement quota will be a key consideration given the importance of proceeds from settlement quota for tangata whenua and some local communities in Northland.

48. Feedback from previous engagement has suggested that the boundary of the subdivision should align with the boundary between statistical areas 902 and 903 (with Manawatāwhi/Three Kings Islands in the western QMA; Figure 2). FNZ is seeking feedback on the placement of the boundary and the manner in which quota shares could be apportioned.

[40] For an example of how FNZ monitors and reports on industry non-regulated measures, see quarterly reports on the industry-developed Tarakihi Rebuild Plan https://www.mpi.govt.nz/fishing-aquaculture/sustainable-fisheries/east-coast-tarakihi-rebuilding-numbers/.

49. QMA subdivision would allow for more targeted management which acknowledges the different environmental conditions between the east and west coasts/Three Kings Islands and allow for the implementation of different regulatory measures, particularly TACs, TACCs, and recreational rules. FNZ's initial view is that QMA subdivision, alongside appropriate regulations in any new QMAs, provides a higher likelihood that the measures will be effective at mitigating urchin barrens because they allow us to limit harvest in more targeted areas of concern. However, interim measures may be required as QMA subdivision can take up to 12 months or more due to the multiple regulatory processes involved.

Benefits	• QMA subdivision allows for targeted management measures for increasing rock lobster abundance and size distribution on the east coast where urchin barrens are known to occur, while limiting impacts on the north and west coast fisheries. • It allows for more targeted management on the east and west (including the Three Kings Islands) coasts over a longer time period. • It would enable setting specific catch limits on the west and east coasts, reflecting differing environmental and fishery conditions. • There is initial support from representatives for the New Zealand Sport Fishing Council to subdivide the QMA at the boundary of statistical areas 902 and 903. • Some Iwi Fisheries Forums and some tangata whenua have previously expressed support for QMA subdivision, as they consider the scale of the QMA does not support addressing localised concerns (see *'Input and participation of tangata whenua'*). • No additional science information is required to subdivide the QMA. However, additional science may be desired to inform subsequent management measures implemented in the new QMAs.
Risks	• Under all measures proposed in this paper, fisheries-independent surveys are desirable to monitor rock lobster abundance on the east coast. • QMA subdivision is a large, time-consuming work programme that can take 12 months or more to complete because of the multiple regulatory steps involved. It could therefore require management measures addressing urchin barrens on the east coast to be implemented in the interim. • Commercial fishers who operate on the east coast may have to travel greater distances to fish on the west coast if the available Annual Catch Entitlement (**ACE**) on the east coast does not provide for them to fish their current catch. This would be expected to come at an increased time and financial cost for affected commercial fishers. • The rock lobster industry has expressed opposition to QMA subdivision, and they note that catch control can be exercised by mechanisms that do not involve QMA subdivision (i.e., harvest caps in the 2024/25 CRAMAC1 AOP). • Settlement quota accounts for 9.3% of the CRA 1 quota shares and can only be sold amongst iwi. The proceeds from settlement quota support important community functions, such as local health clinics. If the Minister chooses to progress with considering a QMA subdivision, a key consideration in this plan will be how quota allocation influences settlement quota.
Do you support QMA subdivision as a management measure FNZ should pursue? Do you consider QMA subdivision should be used in conjunction with another management measure? If so, which measure(s)? Do you have any views on where the CRA 1 QMA should be subdivided? Do you have any views on how quota should be allocated in any new QMAs?	

Legal size limit adjustments

50. Large rock lobsters are particularly important urchin predators because they are considered to be the only predator capable of feeding on the largest size classes of urchin (which are particularly implicated in the development and maintenance of urchin barrens).[41] In CRA 1, female lobsters larger than 83 mm TW and males larger than 68 mm TW are expected to be

[41] Doheny et al. (2023)

able to prey on kina of all sizes.[42] Managing CRA 1 to provide for an adequate abundance of lobsters greater than the above TW is expected to contribute to mitigating existing and future urchin barrens.

51. A minimum legal size of 60 mm TW for females and 54 mm TW for males currently applies for recreational and commercial fishers in CRA 1, but there is no maximum legal size. Customary fishing is managed by Kaitiaki who determine the size of lobster that can be taken according to tikanga.

Introducing a maximum legal size limit

52. Results of modelling commissioned by FNZ indicate that introducing a maximum legal size under current catch limits for the commercial fishery would have a counterproductive effect and reduce the abundance of large rock lobster over time (see *'Legal size limit modelling'* under Part 4). This is because commercial fishers would have to land more smaller rock lobster to achieve the same **weight** of annual catch when attempting to catch their ACE. This would result in increased fishing pressure on lobsters that are smaller than the maximum legal size, with fewer growing through to reach the protected size range of larger lobster.

53. Based on these results, FNZ does not recommend the introduction of a maximum legal size for the CRA 1 commercial fishery as it would not meet the draft objectives.

54. The same counterproductive effect may not occur if a maximum legal size requirement were applied to the recreational fishery, because recreational fishers are limited by the **number** of lobster a person can take per day (a daily bag limit) rather than an annual catch weight (such as ACE for commercial fishers). Due to the limited information available regarding the size distribution of recreational catch, it is unknown how effective a maximum legal size would be at increasing rock lobster abundance and size if applied to the recreational fishery. Generally, it would be expected to result in an increase in the abundance of larger lobster to an unknown degree over the long term.

55. Combining a maximum legal size for recreational fishers with area and/or seasonal closures may provide a higher likelihood that the abundance and size of rock lobster will increase in areas of known urchin barrens. If QMA subdivision were pursued, a maximum legal size limit for recreational fishers could be implemented for the new east coast QMA only, where urchin barrens need to be addressed.

Benefits	• A maximum legal size would be relatively easy to implement and enforce. • A maximum legal size for the recreational fishery could be beneficial as recreational fishers are limited by numbers and not weight of rock lobsters when fishing. • Iwi Fisheries Forums and tangata whenua often express support for protecting large lobster (and other species more generally) because it aligns with kaitiakitanga and tikanga principles (see *'Input and participation of tangata whenua'*).
Risks	• Modelling indicates that introducing a maximum legal size in the commercial fishery will have a counterproductive effect and reduce the abundance of large rock lobster. • It is unknown how effective a recreational maximum legal size would be at increasing the abundance and size of rock lobster however, it is expected that the effect would be positive. • Implementing a maximum legal size only for recreational fishers could be perceived as inequity between sectors, as differential size limits in other QMAs have been criticised previously by recreational fishing groups. This could be mitigated by implementing other tools specific to commercial fishers such as subdividing the QMA and setting a lower TACC on the east coast. • There is a cost for the Ministry associated with the production of new gauges for measuring rock lobster (approximately $200 per gauge and a one-off set-up cost) used by Fisheries Compliance, fishers, and Licenced Fish Receivers. There will also be a cost for fishery participants associated with replacing existing gauges (i.e., for LFRs and fishers).

[42] Andrew & MacDiarmid (1991) and Webber et al. (2024). A carapace length to tail width conversion for CRA 2 was used to infer the tail width for CRA 1 which would be roughly equivalent to 130 mm carapace length.

	• There are difficulties with enforcing legal size limits that differ between regions after the fishers have collected the lobsters because they would need to prove which QMA the lobsters were collected in.
Do you support implementing a maximum legal size for commercial and/or recreational fishers? Do you consider a maximum legal size should be used in conjunction with another management measure? If so, which measure(s)?	

Increasing the minimum legal size (MLS) limit

56. FNZ commissioned modelling to investigate the effect of increasing the minimum legal size (**MLS**) on rock lobster size structure and abundance (see *'Legal size limit modelling'* under Part 4).[43] Results indicated that, when managed using a fixed exploitation rate (the proportion of the numbers or biomass of lobster removed by fishing), an increase to the MLS is expected to lead to a higher vulnerable biomass (the portion of a stock's biomass that is available to fisheries, i.e., lobster greater than the MLS excluding berried females and moulting lobster) and more large rock lobster in the population. However, modelling also showed that increasing the MLS is expected to reduce CPUE in terms of numbers of lobster per pot lift, and lead to a lesser reduction in CPUE in terms of kilograms per pot lift. Increasing the MLS would also lead to a small reduction in overall yield from the stock.

57. Increasing the MLS is expected to lead to an increase in the overall abundance of lobsters and the abundance of large lobsters. Combining this measure with area and/or seasonal closures may provide greater likelihood of meeting the draft management objectives. If QMA subdivision were pursued, an increased MLS could be implemented for the new east coast QMA only, where urchin barrens need to be addressed.

Benefits	• Modelling suggests that increasing the MLS will increase vulnerable biomass and increase the abundance of large rock lobsters. Noting, it was predicted to take at least 15 to 20 years for the full effect on size distribution to be realised, depending on the MLS change. • Increasing the MLS is relatively easy to implement and enforce. • An increased MLS would be beneficial if applied to both recreational and commercial fishers, maintaining equity between sectors. These MLS limits do not apply to customary harvest authorised under Fisheries (Kaimoana Customary Fishing) Regulations 1998, the size of lobster to be taken is determined by Kaitiaki when authorising customary catch. • Average annual catch that could be expected if the MLS for each sex was increased by 5 mm was estimated to be slightly lower than expected under current MLS settings.
Risks	• Modelling suggests that increasing the MLS for each sex by 5 mm will slightly lower CPUE (expressed as the weight of lobster caught per pot), increasing costs to commercial fishers. • Increasing the MLS is expected to cause economic impacts for the rock lobster industry as smaller-sized lobster obtain higher prices in the export market at different times of the year. There is uncertainty in the magnitude of this impact as the rock lobster industry is not required to report on size/grading of rock lobsters exported or the quantity of lobsters to derive price variation of different size grades. The ability to tailor the size of landed lobster to export market demands provides flexibility for fishers to obtain the best economic return from their ACE, changes to the MLS will impact this ability. • It is unknown how effective an increase to the MLS for recreational fishers would be at increasing the abundance and size of rock lobster, although it is expected that this effect would be positive. • There is a cost for the Ministry associated with the production of new gauges for measuring rock lobster (approximately $200 per gauge and a one-off set-up cost) used by Fisheries Compliance, fishers, and Licenced Fish Receivers (**LFRs**). There will also be a cost for fishery participants associated with replacing existing gauges (i.e., for LFRs and fishers). • There is some difficulty with enforcing differential legal size during inspections at dealers in fish (such as fish distributors, retail outlets, and restaurants), where rock lobster landed from other QMAs may mix with rock lobster landed from CRA 1. In this case, ensuring compliance with a

[43] This modelling was undertaken for CRA 2 rather than CRA 1. The relative changes to numbers of lobsters, catch rate and catch are expected to have similar trends.

	different minimum legal size would require evidence of the location the rock lobsters were taken to account for the regional differences in size limits. This could be mitigated by drafting regulations to require that rock lobster landed from CRA 1 are identifiable and stored separately. Similar compliance programmes operate in CRA 3, 7, and 8, where commercial fishers can land rock lobsters smaller than the national minimum legal size.
Do you support increasing the MLS for commercial and/or recreational fishers? Do you consider increasing the MLS should be used in conjunction with another management measure? If so, which measure(s)?	

Area closures

58. Area closures to rock lobster fishing set under section 11 of the Act can apply to both recreational and/or commercial fishers and may be put in place to ensure sustainability. Section 11 closures would not impact customary fishing authorised under the Act and other regulations.

59. There are no section 11 area closures currently in place for rock lobster in CRA 1. There are several customary closures implemented under the Act including mātaitai reserves, taiāpure, and section 186A temporary closures (see *'Kaitiakitanga'* below). There is also a rāhui in Maitai Bay established in 2017 by Te Whānau Moana/Te Rorohuri hapū of Ngāti Kahu iwi making it a complete no-take area.[44] The rāhui was implemented to address the decline in fish numbers in the area and the spread of kina barrens along the coast. Whilst the rāhui cannot be legally enforced, it is considered effective and is respected by most people.

60. The introduction of further customary measures such as rāhui supported by temporary closures under section 186A of the Act, taiāpure, and mātaitai were suggested by some iwi and hapū in the 2023 review of CRA 1 sustainability measures as appropriate tools to manage localised depletion of rock lobster and associated urchin barrens. FNZ recognises that the management of important customary fishing grounds as mātaitai reserves, taiāpure, and s186A closures are important tools for tangata whenua to manage their fisheries in a way that best fits their rohe moana. As these are customary tools and are subject to specific criteria in their establishment, they are not proposed as part of this FNZ-led engagement. However, FNZ will continue to support tangata whenua to develop measures that align with their aspirations for fisheries management.

61. There are also two marine protected areas, Mimiwhangata and Rakaumangamanga, in which commercial and recreational fishing is prohibited.[45] These rules do not affect urchin harvest daily limits or Māori non-commercial customary fishing rights (with authorisation). The Poor Knights Marine Reserve and two marine reserves in the Whangarei Harbour (Motukaroro and Waikaraka) are protected under the Marine Reserves Act 1971. Inside these marine reserves fishing, shellfish gathering, and any other disturbance of marine life is prohibited (Figure 3).[46]

[44] For more information see: https://rahuimaitaibay.nz/
[45] For more information see: Marine protection areas - Northland Regional Council (nrc.govt.nz)
[46] Marine reserves are not fisheries management tools, but are included here as examples of area restrictions utilised within CRA 1.

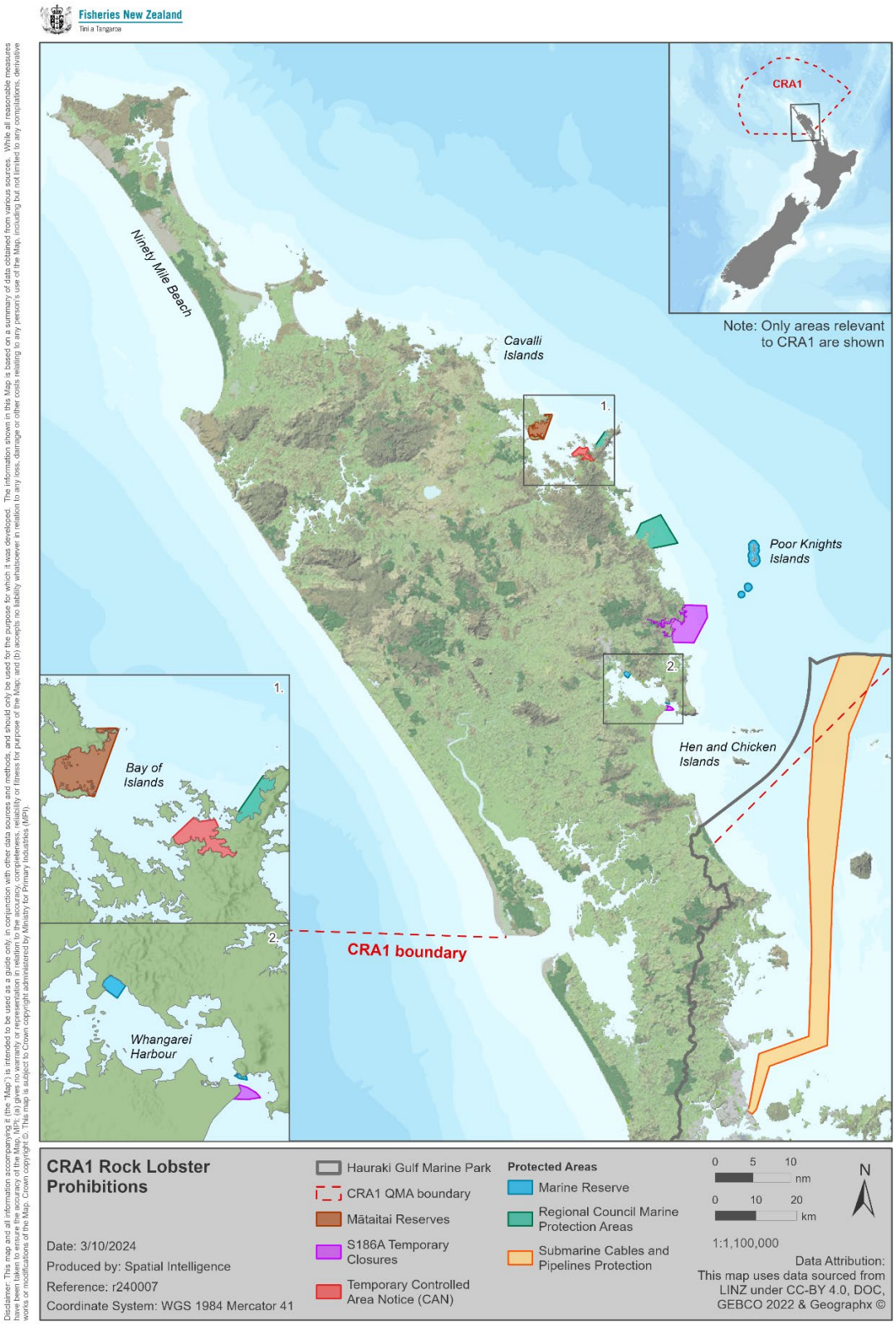


Figure 3. Closed or restricted fishing areas within the rock lobster CRA 1 Quota Management Area. Mātaitai reserves prohibit commercial fishing unless provided for in the conditions of the mātaitai. Section 186A temporary closures prohibit commercial and recreational rock lobster fishing. All types of fishing are prohibited within marine reserves. All forms of fishing and vessel anchorage are prohibited within the Te Rāwhiti Controlled Area Notice (the current notice expires on 30 September 2025). The Hauraki Gulf Marine Park indicates the area that operates under the Hauraki Gulf Marine Park Act 2000. Regional Council Marine Protected Areas prohibit all commercial and recreational fishing besides kina harvesting. Non-commercial Māori customary fishing is also permitted (with an authorisation under the Fisheries (Kaimoana Customary Fishing) Regulations 1998). All fishing and anchoring activities are illegal within submarine cable protection areas.

62. There is consensus among scientists that area closures at some scale will be effective measures to allow for the recovery of kelp forests. To guide feedback on this measure, FNZ notes two different types of closure could be considered for CRA 1:

    i. No-take area closures (closed to all types of fishing for all or a range of species)

    ii. Closures to rock lobster fishing only

63. No-take area closures have been demonstrated to be effective in terms of recovering predator abundance, including rock lobster and snapper, and reversing urchin barrens to kelp-dominated habitats within the closed areas.[47] There is no evidence from northeast New Zealand that recovery of predator abundance (e.g. rock lobster and snapper) and kelp forests would occur outside of the closed areas. Given the impacts on fishers and the scale of fishing effort for other species that would be displaced, no-take area closures are unlikely to be implemented across large areas of CRA 1 (e.g. entire statistical areas) but may be better supported by a network approach. No-take area closures would have the benefit of protecting other important urchin predators (e.g. snapper and packhorse lobster) but should be developed in collaboration with hapū, local fishers, and experts to ensure they meet tangata whenua and community aspirations, and can be effectively enforced. Baseline information on predator abundance (including snapper and rock lobster) and subsequent monitoring should be incorporated as part of the implementation plan for any agreed closures. A network of no-take closures would inevitably take time to develop and implement given the level of engagement, planning, and analysis that would be required.

64. Regulations to allow urchin fishing within the area closures could be implemented to facilitate urchin removals. This would be expected to enhance the effectiveness of area closures for recovery of kelp forests. This type of closure would be a partial-take reserve.

65. Closures to rock lobster fishing only would likely lead to an increase in rock lobster abundance and increase the abundance of large lobster, which may allow rock lobster to contribute to mitigating existing urchin barrens (particularly if supported by urchin removals). However, there are no examples in New Zealand of area closures to rock lobster fishing only that indicate how effective this type of closure would be in mitigating urchin barrens and restoring kelp forests. It will likely be easier to implement a large area closure if it applied to rock lobster fishing only rather than all fisheries. These closures could be implemented faster than multi-species no-take area closures, because one large closure with easily enforceable boundaries would be easier to develop due to a smaller number of interested stakeholders and less complexity involved with the design. However, tangata whenua involvement in the development and timeframes remains a key consideration (see *'Input and participation of tangata whenua')*.

66. Spatial management for ecosystem health was a key data gap identified in the FNZ-led Kina Barrens Science Workshop in March 2023.[48] Since the 2023 Workshop, the 2024 study cited at the beginning of this document (Figure 1) has provided valuable information on the location of urchin barrens on the east coast of CRA 1. Several of the locations that were considered fished at the time of data collection are now under some form of protection. However, some uncertainties in the location and extent of urchin barrens remain (see '*Information Principles: section 10 of the Act'* under Part 3).

67. An urchin barren mapping project was funded by FNZ in 2024 that is expected to provide more detailed and up to date information on the distribution of urchin barren in waters between 2 m and 10 m depth from Cape Reinga to East Cape. The spatial dataset will act as a baseline to monitor future change or recovery and facilitate the management of fishing effects on urchin barrens. It will also provide valuable information to help guide the type and extent of area closures should the Minister decide to progress this management measure. The initial results from this project are expected in December 2024 with presentation of final results expected in May 2025.

[47] Doheny et al. (2023)
[48] Doheny et al. (2023)

Benefits	• There is consensus among scientists that area closures at some scale, specifically no-take areas, will be effective measures for addressing urchin barrens in CRA 1. • Area closures can provide a flexible mechanism to reduce catch in specific regions of the QMA. As a result, sustainable levels of fishing could be reintroduced into closed areas if the area is shown to have recovered. In this way it may provide more flexibility for future management when compared to subdivision of the QMA. • Area closures provide a mechanism to target management on spatial scales smaller than the QMA. The effects of fishing vary regionally with environmental context and may be best addressed through localised spatial management which is targeted towards areas that will be most effective at addressing the issue of urchin barrens rather than QMA wide management. • Area closures could be implemented relatively quickly under section 11 (although co-developing a network of closures would inevitably take time to design).
Risks	• Displacement of fishing effort could occur, either within the east coast statistical areas or to the west coast statistical areas, and increase fishing pressure on rock lobster in those areas. Effort displacement to other parts of the east coast statistical areas may increase the risk of urchin barren formation in those regions. Effort displacement to the west coast or Three Kings Islands statistical areas is unlikely to increase the risk of urchin barren formation because these regions are considered to be less susceptible to urchin barrens. Some of these impacts could be mitigated if area closures are co-developed with local fishers. • Improved information on the location and extent of urchin barrens is due in May 2025. It will take time to co-develop an agreed approach with hapū, local fishers, and experts to develop a final area closure design and monitoring strategy. • FNZ is not aware of evidence from New Zealand on the effectiveness of closures only to rock lobster fishing for mitigating or reversing urchin barrens. Support for area closures comes from evidence of an increase in predator abundance, and a subsequent recovery of kelp, in no-take marine reserves but there is a lack of comparable evidence from areas closed to the harvest of rock lobster, but open to the harvest of other species. • Depending on the type of area closure, compliance can be difficult to enforce. Enforcing closures for commercial fishing is relatively straightforward because commercial fishers have geo-positional reporting of their fishing activity. It is more difficult to enforce closures for recreational fishing because it requires observations or detailed reports of fishing occurring in closed areas. However, if communities support the closures, then they are more likely to participate in enforcement. • Enforcement of large area closures is generally easier than networks of small area closures.
Do you support area closures for recreational and/or commercial fishers as a management measure FNZ should pursue? If yes, do you have any views on the location, scale, and type of closure (e.g. rock lobster fishing only or multi-species no-take areas) that should be implemented? Do you consider area closures should be used in conjunction with another management measure? If so, which measure(s)?	

Seasonal closures

68. Seasonal closures could also be set under section 11 of the Act. Seasonal closures are generally implemented for the purpose of mitigating conflict between sectors that use the same area (i.e., reducing overlap between sectors by separating fishing by sectors to different seasons). Alternatively, open seasons (closures which allow fishing during a limited period of the year) have been used in other fisheries to control fishing pressure on the stock. For example, an open season for the Kaikoura pāua fishery was implemented to assist in sustainable management following the 2016 earthquake.

69. Seasonal closures could apply to key rock lobster breeding periods (e.g. April-November). Although existing restrictions already protect females carrying eggs (known as 'in berry') and prevent rock lobsters from being fished while they are in soft-shell, a seasonal closure during the breeding period could reduce handling mortality. Closures associated with breeding periods have been identified by tangata whenua as being aligned with tikanga and kaitiakitanga.

70. If an April to November closure were applied to the commercial fishery however, it would have a significant counterproductive effect of disrupting the non-regulated closed season (December to February) already in operation as part of the industry AOP (see '*Industry non-regulated measures'* above). Effectively this would close the commercial fishery except for March. Approximately 82% of commercial catch is taken in the April to November period.

71. Another option for seasonal closures could be to formalise the non-regulated closed season in the industry AOP by implementing a regulated seasonal closure in statistical areas 903 and 904 to commercial and recreational fishers for a period over the summer months (e.g. December to February). This could be beneficial in increasing rock lobster abundance because it would remove recreational fishing pressure from areas of known urchin barrens when effort is typically highest. However, it is likely that commercial fishers could catch the remaining catch at other periods of the year. It could also reduce the incidence of returning lobster to the sea over the summer months when anecdotal reports by industry suggest that release mortality is higher because the water temperature is high.[49] It may, however, lead to an increase in conflict between sectors during the remaining open periods.

Benefits	• Seasonal closures could be implemented relatively quickly. • Seasonal closures during April-November, when males and females are moulting and females are egg bearing, has support from some iwi and hapū as it aligns with kaitiakitanga and tikanga to protect reproductive individuals. • Seasonal closures during April-November could reduce handling mortality of lobsters in soft-shell or of females carrying eggs. • Seasonal closures during the summer could have a positive impact on rock lobster abundance if high water temperatures are increasing handling mortality of lobsters.
Risks	• It is difficult to model the expected outcomes of seasonal closures for the recreational fishery on rock lobster abundance and size distribution. Seasonal closures for recreational fishing are expected to be most effective at increasing rock lobster size and abundance if applied to the summer months because this is period when recreational fishing is concentrated this would have a high impact on recreational fishers. Closures during winter would be expected to be less effective due to the limited fishing during that time. • A closure from April to November would coincide with the period where 90% of commercial catch is currently taken and would disrupt the existing non-regulated closed season (December to February). Commercial fishing would be forced into the remaining summer months with anecdotally reported higher fishing related mortality. • Enforcing compliance with seasonal closures would be easier if they applied over a large area rather than small areas where fishers could claim the rock lobster were taken in open areas.
Do you support seasonal closures for recreational and/or commercial fishers as a management measure FNZ should pursue? Do you have any views on the time period, location, or scale of seasonal closure that should be implemented? Do you consider seasonal closures should be used in conjunction with another management measure? If so, which measure(s)?	

7. Additional measures proposed by tangata whenua

Vessel and accumulation limits for recreational fishers

72. Section 11 of the Act allows the Minister to implement regulations to limit the number of lobster allowed to be taken by individuals on a single vessel (**a vessel limit**) or to limit the number of lobster a person can accumulate and possess over a period of more than one day (**an accumulation limit**). These measures would apply to recreational fishers and would be implemented through the Amateur Fishing Regulations.

[49] FNZ is not aware of data that supports this relationship.

73. When the CRA 1 TAC was reviewed in 2023, vessel or accumulation limits for CRA 1 were discussed however they were not recommended for further development at that time. However, tangata whenua have expressed support for vessel or accumulation limits to address concerns of high recreational fishing pressure on the east coast of CRA 1. FNZ is seeking input on whether vessel or accumulation limits for CRA 1 should be further considered.

74. Accumulation and vessel limits generally serve different purposes for fisheries management. Accumulation limits aim to limit the frequency of fishing trips or the amount of fishing that occurs on multi-day fishing trips and are also a useful tool to address illegal take, mitigating the ability to store and transport large quantities of rock lobster by fishers who deliberately exceed the daily limit or gather for sale or barter. Vessel limits aim to reduce fishing pressure by a group of people in a single fishing event. These could be particularly useful for offshore reefs that people travel to on a boat to collect their full daily limit. A vessel limit acts to reduce the cumulative amount that can be taken by a party of people on a vessel.

75. An accumulation limit of three daily limits (18 rock lobsters) currently applies to the Canterbury/Marlborough (CRA 5) rock lobster fishery. Accumulation limits also apply to other fisheries including pāua and blue cod, for which the limit is set at two daily limits in most regions.

76. Vessel limits for the number of fish that can be possessed on a vessel do not currently apply to any New Zealand fisheries. However, other rules for vessels, such as limits on the number of pots or long lines on a vessel, do currently apply to some New Zealand fisheries. For example, recreational rock lobster fishers are restricted to three pots, while two or more recreational fishers on a vessel are restricted to a combined total of six pots.

77. There are difficulties associated with enforcing vessel limits when inspections are carried out at boat ramps or after landing the boat, as it can be difficult to ascertain which individuals were associated with which vessels.

Measures for recreational fishing of packhorse lobster

78. Packhorse rock lobster are distributed around the northern North Island and are the biggest rock lobster in the world, growing to a much larger size than spiny rock lobster. Evidence from Australia, indicates packhorse rock lobster are generalist predators which consume sea urchins, including the long-spined urchin.[50] However, the feeding behaviour of packhorse rock lobster in New Zealand is not well understood.

79. Spiny and packhorse rock lobster are managed together within a combined recreational daily limit of 6 rock lobster per fisher per day. In 2023, the maximum limit of spiny rock lobster within the combined recreational daily limit was reduced to 3 spiny rock lobster per fisher per day.

80. Some tangata whenua in CRA 1 have requested the recreational daily limit for packhorse is reduced to prevent increased fishing pressure on packhorse rock lobster. Packhorse rock lobster are managed under a separate QMA (**PHC 1**) that covers the whole of New Zealand.

81. Accumulation or vessel limits could also pertain to packhorse rock lobster, given the species are managed together in the recreational daily limit.

82. FNZ is seeking feedback on whether tangata whenua and stakeholders consider additional measures for packhorse rock lobster are required.

8. Who will be affected by the measures being considered?

83. Commercial interests in CRA 1 include quota owners, vessel owner-operators and contract fishers in the catching sector, Licensed Fish Receivers (**LFRs**) (see Table 2 below) and retailers and exporters. The interests of these groups are represented through organisations such as CRAMAC 1 and the New Zealand Rock Lobster Industry Council (**NZ RLIC**).

[50] Day et al. (2021)

Table 2: Summary of quota owners, % settlement quota, permit holders, vessels landing the stock, and Licensed Fish Receivers (LFRs) involved with CRA 1 during the 2023/24 fishing year.

Stock	No. Quota owners	% of quota that is Settlement quota	No. permit holders landing the stock	No. vessels landing the stock	No. LFRs landed to
CRA 1	33	9.3%	16	15	8

84. There are longstanding recreational interests in CRA 1. These interests are represented by a range of individuals, groups such as the New Zealand Sport Fishing Council (**NZSFC**), and various local fishing clubs and associations. Many tangata whenua fish under recreational regulations, particularly in areas where rohe moana have not been gazetted (large portions of CRA 1 do not have gazetted rohe moana).

85. Tangata whenua have both commercial and customary interests in these stocks. Te Hiku o Te Ika, Mid-North East, Mid-North West Iwi Fisheries Forums represent tangata whenua with non-commercial interests in CRA 1.

9. Input and participation of tangata whenua

86. FNZ has provided for input and participation of tangata whenua through pre-engagement with the Iwi Fisheries Forums (listed above) on multiple occasions and additional targeted meetings. Input from these Forums has supported the initial development of the proposed management measures.

87. FNZ met with Te Uri o Hikihiki hapū (a member of the Mid-North East Fisheries Forum) during a series of management workshops in 2023 focused on addressing urchin barrens. Feedback from this hui is summarised below.

Te Uri o Hikihiki Hapū – August 2023	**Rock lobster management:** A maximum legal size aligns with tikanga to protect large rock lobster because they are important breeders, and large rock lobster need to be retained in the population to control the spread of kina barrens and restore ecosystem balance. Advocated for a reduction to the CRA 1 TACC and exclusion of commercial fishing from their rohe moana (particularly within shallow water) to protect customary and recreational access to the fishery. Expressed discomfort that there are no regulations to prevent commercial fishers returning to the east coast. **Wider urchin barren management:** Expressed doubt that increasing the TACC for kina (SUR 1A and SUR 1B) would result in increased harvest from kina barrens. Advocated for an increased focus on ecosystem-based management. Expressed concern about increasing dominance of long-spined urchin within their rohe moana, including within marine reserves. **Collaboration and partnership:** A strong desire to strengthen their customary rights to management, to protect their customary activities, and to be involved in research conducted in their rohe moana to inform fisheries science and management. Expressed concern that there has been limited involvement in previous implementation of spatial management and sought assurance that tangata whenua will be involved in the development and decision making used in spatial management (particularly timeframes for area closures).

88. FNZ facilitated management meetings in Whangārei and Kaitaia on 23 and 24 January 2024 with Te Hiku o Te Ika Iwi Fisheries Forum and the Mid-North (East and West) Iwi Fisheries Forums as well as wider Kaitiaki in the region to discuss proposed measures for urchins. A summary of input is provided below.

Kaitaia hui – January 2024	**Rock lobster management:** Supported subdividing the CRA 1 QMA, implementing a maximum legal size, seasonal closures, closures or no-take zones for commercial fishing, and vessel limits and licenses/permits for recreational fishers.

	Wider urchin barren management: Expressed doubt that increases to the recreational daily limit for kina would yield meaningful results and indicated a preference for management strategies that avoid 'simply killing kina'. Viewed the new traditional fishing purpose as beneficial to strengthening customary power and rights. Support monitoring of areas to identify ecological imbalances before urchin barrens form. Recommend holistic reductions in fishing pressure (including commercial) to achieve balance in resource management. **Collaboration and partnership:** Emphasized the importance of local knowledge, historical context, and indigenous perspectives and supports collective action through initiatives like combined mātaitai and bylaws. Expressed concerns about equitable regulations, particularly regarding indigenous fishing rights and the need to consider the livelihoods of those who rely on fishing for sustenance, including Māori.
Whangārei hui – January 2024	**Rock lobster management:** Supported subdividing the CRA 1 QMA (east and west areas), vessel limits for recreational fishers, consideration of daily limits for predators including rock lobster, implementing no-take measures during specific seasons (did not specify which seasons). Differing opinion on the impact of commercial fishing, some advocated for its cessation. **Wider urchin barren management:** Considered a sequential approach to restoration is needed which involves an initial focus on reducing urchin barrens with assistance, followed by a longer-term goal of increasing predator numbers to regulate urchin populations. Opposed increasing the kina recreational daily limit due to doubt that it would lead to increased harvest in urchin barrens. Also considered it did not address underlying issues such as predator abundance. Suggested consideration of artificial reefs for translocations to support ecosystem restoration. **Collaboration and partnership:** Supported empowering tangata whenua and kaitiaki, incorporating indigenous knowledge (mātauranga hapu or whanau) and tikanga (such as maramataka and Matariki), and increasing autonomy for iwi. This includes requests for government to support community-driven initiatives.

89. FNZ attended multiple Iwi Fisheries Forums meetings in 2022, 2023, and 2024 where rock lobster and urchin barren management was discussed. Below is a summary of input from these meetings.

Te Hiku o Te Ika	**CRA 1 review 2023** The Forum supported taking an ecosystem-based approach to the management of rock lobster. It also raised concerns around localised depletion issues and that the scale of the QMA didn't support localised aspirations. The Forum broadly supported a more precautionary approach. **September 2022 hui** Requested consideration of reducing the recreational daily limit for packhorse due to concern of heavy fishing pressure. Suggested an accumulation limit per vessel for packhorse and spiny rock lobster. **November 30 2022 hui** Some members raised concern that closures in Mimiwhangata and Deepwater Cove would lead to displacement of fishing effort, particularly commercial fishing, into their rohe. Also noted on multiple occasions, the group has expressed concerns about large take of packhorse rock lobster and have suggested management to reduce commercial and recreational take. Specific measures suggested for packhorse included a catch limit per vessel. **January 2024 kina daily limit review** Indicated that restoring populations of kina predators should be a priority and that communications about the issue of urchin barrens should be available so people can engage in the issue and get involved. **February 2024 hui** Indicated the Forum would support a split in the CRA QMA. Packhorse in North Cape are a concern to Ngāti Kuri.

	Suggested areas that should have more restrictions on spiny rock lobster and packhorse include Ahipara and Murimotu Island in the North Cape. Expressed concern that raising recreational daily limits for kina will not impact urchin barrens. **May 2024 hui** Some forum members expressed support for seasonal closures from April to November, when males and females are moulting, and females are egg bearing. Some members suggested a permit system for recreational fishers to obtain better information on recreational fishing. The Forum also expressed support for the approach that eastern iwi might want to take in relation to potential closures.
Mid-North (input before the Forum split into two separate Forums)	**CRA 1 review 2023** The Mid-North Forum stressed the importance of local area management, acknowledging that a mainstream western science approach cuts across the Māori worldview lens and does not take into account local hapū level knowledge. At the time, the Forum suggested CRA 1 could be broken into four areas. Concern was expressed that the large scale of the CRA 1 QMA does not support addressing localised concerns. It was recognised there are a wide range of different local environments and pressures that exist within CRA 1 and the QMA scale does not support local area management to respond to localised depletion. During the CRA 1 recreational daily limit review, the Forum expressed concerns that these limits would not address the concern of localised depletion by commercial fishers. The Forum also suggested consideration of a maximum size limit for recreational fishers to support the breeding stock, as well as consideration of an accumulation limit.
Mid North East	**January 2024 kina daily limit review** The key measure to address urchin barrens is restoring predator numbers to maintain ecosystem balance. There was also a strong desire for iwi and hapū to be directly involved in monitoring and management of urchin barrens within their respective rohe moana. **February 2024 hui** Expressed a need to create resources to educate around urchin barrens and expressed a desire to be involved in monitoring of urchin barrens. Could not indicate support for a CRA 1 QMA subdivision without further information on how quota would be allocated between the west and east coasts. **May 2024 hui** Forum members requested extra information including how many kina rock lobster eat and maps with information on commercial and recreational harvest within CRA 1. Some Forum members expressed a desire for FNZ engage on a hapū by hapū basis to best derive the scope and nature of potential local scale closures to rock lobster fishing.
Mid North West	**February 2024 hui** Expressed concern about the types of monitoring being undertaken and the accuracy of surveys. They consider their local experience does not align with some survey results. Mātauranga/ kōrero tuko iho led research in their rohe moana and involving hau kāinga and hapū directly in the research is a high priority because it is critical that they provide input into the information being used to inform decisions. Some support for area and seasonal closures, and consideration of closures around the time of spawning, particularly when females drop their eggs. Some members noted the non-regulated measures being progressed by commercial fishers. Some members suggested urchin barrens do not appear to be an issue on the west coast. **May 2024 hui** Some members suggested that DNA testing has indicated rock lobster on the east and west coast were different, and considered this raised uncertainty as to whether rock lobster from the west coast would populate the east coast. Some members expressed support for subdividing the QMA, noting that it would better reflect the whakapapa of rock lobster for each coast, and atua (the gods) of the moana of each coast. Further,

	some iwi felt whakamā (uncomfortable) when required to provide input for decisions being made regarding a fish stock in someone else's rohe.

90. Additional input was provided by Te Ūkaipo – Iwi Environmental Management Unit of Te Rūnanga o Whaingaroa, a member of the Te Hiku o Te Ika Iwi Fisheries Forum, by email in September 2024. They view subdividing the CRA 1 QMA as an important step towards better rock lobster management. Smaller areas allow more concentrated management to be applied with iwi support and local knowledge. They consider there is a host of positive outcomes to be achieved through subdivision of the CRA 1 QMA, including strengthening of relationships with iwi who have whakapapa and mātauranga to ensure the industry stays viable. They also consider inclusion of iwi input in the determination of sub-division areas is critical.

91. A hapū representative at the Mid-North West forum also provided further input by email in September 2024. This member suggested potential opposition to legal size limit changes from recreational fishers because they may value large trophy lobster. In addition, they noted that non-regulated seasonal closures have been implemented by industry and that commercial effort on the east coast is low with most fishers targeting the west coast. They also questioned whether the potential benefits of subdividing the CRA 1 QMA would outweigh potential costs.

10. Kaitiakitanga

92. Information provided by the Forums, and iwi views on the management of fisheries resources and fish stocks, as set out in Iwi Fisheries Plans, are among the ways that tangata whenua can exercise kaitiakitanga in respect of fish stocks.

93. Te Hiku o Te Ika Iwi Fisheries Forum has a fisheries plan which lists spiny rock lobster, kina, and kelp as taonga species. The plan also sets out objectives for management of fish stocks. Objectives relevant to this review include:

    (a) Iwi management systems support Te Hiku iwi in their fisheries decision making.
    (b) To ensure fish stocks are healthy and support the social, cultural, and economic prosperity of Te Hiku iwi and hapū.
    (c) To maximise iwi influence on all key environmental decisions that impact on fisheries.

94. FNZ considers that the proposed management measures presented in this paper contribute to progress towards the achievement of Objectives (a) and (c) and are consistent with Objective (b). However, FNZ is seeking input from tangata whenua on whether the measures presented in this paper align with the Objectives outlined in the plan.

95. Customary tools under the Fisheries (Kaimoana Customary Fishing) Regulations 1998 and the Act enable tangata whenua to autonomously manage important customary fishing grounds in ways that best fit local customary practices in the form of mātaitai reserves, taiāpure, and temporary closures. These tools contribute to progressing Objectives (a) and (b).

96. Where a hapū or iwi manage their customary fishing activities under the Fisheries (Kaimoana Customary Fishing) Regulations 1998 they are able to determine their own customary practices, which can include the exercise of kaitiakitanga to remove urchins to rebalance the ecosystem of their customary fishing grounds.

97. In addition, recent approval of a traditional non-commercial fishing use under regulation 52(1) of the Amateur Fishing Regulations enables the taking, disposal, culling, or translocation of kina from traditional fishing grounds to manage the population of kina to maintain the balance of the ecosystem.

Table 3: Customary fisheries management areas in CRA 1.

Mātaitai reserves and other customary management tools	
Customary area	**Management type**
Te Puna	**Mātaitai reserve** Commercial fishing is not permitted within mātaitai reserves unless regulations state otherwise.

Rehuotane Ki Tai[51] Marsden Bank and Mair Bank Temporary Closure[52] Maunganui Bay[53]	**Temporary closures** These areas are temporarily closed to all fishing or certain fishing methods, for everyone. These closures are issued under section 186A of the Act and apply for up to 2 years, but can be renewed.
Waikare Inlet Taiāpure Waka-te-hāua Taiāpure	**Taiāpure** All types of fishing are permitted within a taiāpure. The management committee can recommend regulations to manage commercial, recreational, and customary fishing.

98. FNZ is seeking input from tangata whenua on how the management measures being considered for CRA 1 may or may not assist tangata whenua to exercise kaitiakitanga, and how the measures may affect the rights and interests of tangata whenua in CRA 1.

11. Fisheries New Zealand's Initial View

99. FNZ's initial assessment, subject to further engagement and analysis, is that the non-regulated measures in the 2024/25 industry AOP, and the measures the Government has put in place to date, will not sufficiently address urchin barren issues, and a package of further regulated measures is required.

100. Subdivision of the CRA 1 QMA would likely better provide for the utilisation of the west coast rock lobster fishery whilst limiting harvest in the east coast where urchin barrens are known to occur. Despite the complexities and time taken to implement, FNZ believes this measure should be pursued because it would facilitate independent actions for each coast in response to changing rock lobster abundance and urchin barren distribution.

101. In addition, increasing the MLS for commercial and recreational fishers has a high likelihood of meeting the draft management objectives, as it is expected to lead to an increase in the overall abundance of lobsters and the abundance of large lobsters. An increased MLS could be implemented for the east coast only, where urchin barrens need to be addressed. FNZ does not recommend implementing a maximum legal size for the commercial fishery. The TACC is weight based, so a maximum legal size would mean commercial fishers would take more smaller rock lobsters before they were able to grow through to a larger size, in order to catch their Annual Catch Entitlement, which would reduce the abundance of large rock lobster over time. However, there may be some benefits to a maximum legal size implemented in the recreational fishery, because recreational harvest of rock lobster is managed by a daily limit rather than an annual weight limit.

102. FNZ also considers there is merit in exploring some area closures in Northland. No-take area closures have been demonstrated to be effective in terms of recovering predator abundance, including rock lobster and snapper, and in mitigating urchin barrens. Determining the type and extent of possible area closures would benefit from improved science information on the distribution of urchin barrens, which is expected in May 2025. Recognising the importance of other urchin predators, FNZ's initial view is also that there would be benefits in reducing the recreational daily limit for packhorse lobster (it is currently in a combined daily limit of six rock lobster per day in which the maximum of spiny rock lobster is three, however up to six packhorse lobster can be collected daily).

12. Additional supporting information and legal context

103. There are additional figures and more information below in Part 4 (*Supporting information*) which support the above analysis and management measures being considered.

104. In the following Part 3 (*Assessment against relevant legal provisions*), FNZ has provided a series of tables outlining key matters that support an initial assessment of the management measures being considered against relevant provisions of the Act. This includes matters relevant to sections 9, 10, 11, and 25 of the Act.

105. For information on the relevance of sections 5 (Application of international obligations and Treaty of Waitangi (Fisheries Claims) Settlement Act 1992, and 8 (Purpose) of the Act, as well

[51] Applies to all shellfish (excluding kina).
[52] Applies to all shellfish (including rock lobster and kina).
[53] Applies to all species of fish, aquatic life or seaweed, except kina.

as detail on the statutory considerations relevant to sustainability decisions, please see the Overview of legislative requirements and other considerations in relation to sustainability measures.

13. How to have your say

106. We welcome your views on the measures being considered. Please provide detailed information and sources to support your views where possible. Questions for submitters specific to each measure are summarised under the respective measures in *'Proposed management measures'*. Additional general questions include:

- If you do not support any of the management measures proposed, what alternative(s) should be considered?
- Is there any relevant literature or research you are aware of that you think should have been referred to in this paper?
- Do you have any further information to share on the location of urchin barrens in Northland?

107. FNZ invites you to make a submission on the measures set out in this discussion document. Deadline for feedback is **5pm on Sunday 15 December 2024** and should be sent to FMSubmissions@mpi.govt.nz or the postal address below.

2024 Management measures for CRA 1
Fisheries Management
Fisheries New Zealand
PO BOX 2526
Wellington 6140
New Zealand

108. Please see FNZ's consultation webpage for related information including a non-technical summary document, an optional submission template, and information on how to submit your feedback. If you cannot access the webpage or require any other information, please email FMSubmissions@mpi.govt.nz.

Part 3: Assessment against relevant legal provisions

14. Overview

109. The measures discussed in this paper would be implemented under different sections of the Act, and therefore have different relevant legal provisions.

110. All management under the Act requires the Minister to act consistently with the requirements in section 5 (Application of international obligations and Treaty of Waitangi (Fisheries Claims) Settlement Act 1992); section 8 (Purpose); section 9 (Environmental principles); and section 10 (Information principles).

111. Guidance on the meaning of sections 5 and 8 and how they should be applied for decision making is provided in the Overview of legislative requirements and other considerations in relation to sustainability measures.

112. On the following pages, FNZ has provided a series of tables outlining our assessment of the management measures being considered against sections 9, 10, 11, and 25 of the Act. Information to support this assessment can be found in Part 4 (*Supporting information*).

15. Initial assessment of the measures against section 9 of the Act

113. Table 4 below outlines FNZ's initial assessment of the measures being considered against the environmental principles in section 9 of the Act, which the Minister must take into account when making decisions regarding QMA subdivision, changes to legal size requirements, section 11 closures or recreational limits (daily, vessel, and accumulation limits). This assessment has been informed by our knowledge of the current environmental impacts of this fishery, which is discussed in Part 4 under *'Information on environmental impacts'*.

Table 4: Initial assessment of the proposed management measures under section 9 of the Act.

The Minister must take into account:	
Associated or dependent species should be maintained above a level that ensures their long-term viability - Section 9 (a) of the Act	'Associated or dependent species' is defined in section 2(1) of the Act as any non-harvested species taken or otherwise affected by the taking of any harvested species. The methods associated with both commercial and recreational rock lobster fishing (potting and hand-gathering by diving, respectively) are relatively low-impact (in comparison to higher-impact methods such as trawling). Marine mammal entanglements can occur in potting gear, but recorded interactions of this nature are extremely low (see '*Information on environmental impacts*'). Some of the proposed measures (e.g. size limit adjustments) may result in decreased CPUE. Commercial fishers may then increase their fishing effort (e.g. through a higher number of pot lifts) to maintain the same catch, which may result in a higher risk of mammal interactions. However, because the number of recorded interactions of this nature are extremely low, FNZ considers any increased risk associated with an increase in pot lifts to also be extremely low. Any increase in direct benthic impacts resulting from increased pot lifts is also expected to be low (see '*Information on environmental impacts*'). Similarly, some proposed measures (such as area or seasonal closures) may act to displace fishing effort on the east coast of CRA 1. This could lead to increased fishing effort in other regions of CRA 1, but it is difficult to predict where and to what extent those spatial changes in effort could occur as this would be dependent on which measures are progressed. Any displacement of commercial effort and therefore risk to associated and dependent species may be small, given the current low level of commercial effort on the east coast and the already low risk posed to associated and dependent species through commercial potting. Displacement of recreational effort on the east coast of CRA 1 may increase recreational fishing pressure in other areas. However, because the majority of recreationally caught rock lobster is harvested by hand gathering (diving) which is highly selective, it is also considered unlikely that there will be an increase in interactions with associated or dependent species in the recreational fishery.

	An increase in pot lifts in response to decreased CPUE or fishing effort displacement could lead to an increase in fish and invertebrate bycatch, although FNZ also considers this risk to be low given the low commercial effort on the east coast. Most stocks managed under the QMS commonly caught as bycatch in the CRA 1 fishery are considered to be fished at sustainable levels under current catch limits. Some kelp are non-harvested species taken or otherwise affected by the taking of rock lobster, so can be considered associated or dependent species. The proposed measures intend to address the role of rock lobster abundance on urchin barren formation, so are consistent with intending to maintain kelp at a level that ensures their long-term viability. The likelihood that each measure or combination of measures is expected to fulfil this is discussed in more detail in Part 2 under *'Proposed management measures'.*
Biological diversity of the aquatic environment should be maintained - Section 9(b) of the Act	The measures proposed in this document are designed to mitigate the impacts of fishing on biological diversity by increasing rock lobster abundance and, in particular, increasing the abundance of large lobster to levels where they can assist in mitigating existing urchin barrens. Relative to the kelp forests they replace, urchin barrens support a far lower level of biodiversity, therefore measures which aim to reduce or reverse urchin barrens are expected to maintain or increase biological diversity of the aquatic environment. As discussed in Part 2 under *'Proposed management measures'*, measures used in isolation or in combination provide different likelihoods of mitigating urchin barrens, and therefore maintaining biological diversity of the aquatic environment. FNZ's initial view is that relying on non-regulatory measures alone would not be consistent with the principle that biological diversity should be maintained. This is because these measures alone are unlikely to sufficiently mitigate existing urchin barrens or the formation of new urchin barrens. Similarly, implementing a maximum legal size in the commercial fishery has been shown to be counterproductive in that it would reduce the abundance of large rock lobster (without additional TAC reductions) because fishers would have to take more small lobsters to catch their equivalent ACE tonnage. All other measures and combinations of measures have some potential of maintaining the biological diversity of the aquatic environment (discussed in more detail in Part 2 under *'Proposed management measures'*). Some proposed measures (such as area or seasonal closures) may act to displace fishing effort from the east coast of CRA 1 to other areas of CRA 1, although it is hard to predict where and to what extent those spatial changes in effort could occur as this would be dependent on which measures are progressed. FNZ notes that habitat loss as a result of urchin barrens and continued low abundance of rock lobsters can also cause spatial changes in fishing effort and, as a result, effort displacement is likely to occur to some degree even in the absence of management measures. Potential effort displacement will be a key consideration of the development of options for consultation for any measures which are progressed following this engagement.
Habitat of particular significance for fisheries management should be protected - Section 9(c) of the Act	Using the best available information, FNZ have identified ten habitats of particular significance for fisheries management (**HoPS**) in CRA 1. A description of those areas and their sensitivities, why they are considered particularly significant, and the current measures in place that restrict fishing in those areas can be found in under *'Identified habitats of particular significance for fisheries management within the CRA 1 QMA'* in Part 4. Rock lobster fishing is primarily done through potting or hand-gathering by diving. Both methods are considered low benthic impact fishing methods, and FNZ has not identified any current adverse effects on these habitats caused by rock lobster fishing. The measures proposed in this document intend to decrease fishing effort on the east coast of CRA 1. FNZ therefore considers that these measures are unlikely to result in a risk of adverse effects from rock lobster potting and hand gathering on HoPS on the east coast of CRA 1. Some proposed measures (such as area or seasonal closures) may act to displace fishing effort which could increase fishing effort in regions of CRA 1. However, FNZ considers there is minimal risk of adverse effects for the identified potential HoPS in these regions of CRA 1

	because rock lobster potting is considered a low benthic impact fishing method. There are also a range of measures to mitigate impacts of fishing for other species in these areas. It is worth noting that a number of potential HoPS for snapper have been identified in the CRA 1 QMA. Given the role of snapper as a predator of kina and in the formation of kina barrens in northeast New Zealand, there may be implications for rocky reef ecosystems in CRA 1 if snapper spawning and juvenile habitat were damaged. However, the proposed measures are not expected to result in a risk of adverse effects on HoPS for snapper and these potential HoPS for snapper already have restrictions on some bottom contact fishing methods. While FNZ does not currently have evidence available to support the identification of specific (spatially defined) areas of kelp-dominated habitat as habitat of particular significance for fisheries management, we recognise the likely importance of kelp-dominated habitat in supporting settlement, recruitment, and productivity of a number of species, including rock lobster. The management measures proposed are intended to mitigate the role of rock lobster fishing in urchin barren formation and support recovery of kelp forests and their function at some scale. Kelp forest recovery, as a result of urchin barren mitigation, could have flow-on benefits to kelp-dominated habitat, some of which may be potential habitat of particular significance. As evidence becomes available to identify specific areas of kelp-dominated habitat as being particularly significant for fisheries management, FNZ can explore whether further, targeted management measures are needed to protect these areas.

16. Initial assessment of the measures against section 11 of the Act

114. Table 5 below outlines FNZ's initial assessment of the measures being considered against provisions of section 11 of the Act, which the Minister must either take into account or have regard to when considering possible area or seasonal closures, changes to legal size requirements or recreational limits (daily, vessel, and accumulation limits). This section of the Act is not relevant to decisions to change QMA boundaries.

Table 5: Initial assessment of the proposed management measures under section 11 of the Act.

The Minister must take into account:	
Effects of fishing on any stock and the aquatic environment – section 11(1)(a)	"Effect" is defined widely in the Act.[54] The direct effects of fishing for rock lobster need to be considered, as well as the indirect effects of this fishing for associated stocks and species, and the surrounding ecosystem. The effects of the CRA 1 fishery for associated stocks and species, and the wider ecosystems, are summarised in Part 1 under *'Why are we considering additional management measures for the CRA 1 fishery?'*, in Part 2 under *'Proposed management measures'*, and detailed further in Part 4 under *'Information on biology'* and *'Information on environmental impacts'*. FNZ's initial assessment of how the proposed management measures might influence the effects of fishing on any stock and the aquatic environment is provided above under '*Initial assessment of the measures against section 9 of the Act*'.

[54] 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.

Existing controls that apply to the stock or area – section 11(1)(b)	A range of existing management controls apply to CRA 1. These are listed below and apply to both recreational and commercial fishers unless noted otherwise. (a) **Gear restrictions**: the use of spears for taking rock lobsters is prohibited. Recreational fishers are also prohibited from using spring loaded loops or lassos, or from using set or baited nets for taking 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. Recreational fishers are restricted to three pots. Two or more recreational fishers on a vessel are restricted to a combined total of six pots. (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 rock lobsters are able to escape. (d) **Must be measurable**: rock lobster must be possessed in a state that can be measured. (e) **Size restrictions**: spiny rock lobsters have a minimum legal size of 60 mm tail width for females and 54 mm tail width for males. (f) **Prohibited states:** it is illegal to take or possess rock lobsters carrying external eggs (in berry), or rock lobsters in the soft-shell stage (post moulting). (g) **Area closures:** There are several mātaitai reserves, taiāpure, and section 186A area closures within CRA 1 (see Table 3 under *'Kaitiakitanga'* and Figure 3 under '*Area closures*' in Part 2). Two marine protected areas, Mimiwhangata and Rakaumangamanga, in CRA 1 prevent commercial and recreational fishing (not including urchin harvest or Māori non-commercial customary fishing rights). There are also two marine reserves in the Whangārei Harbour (Motukaroro Island and Waikaraka) and one marine reserve at the Poor Knights Islands protected under the Marine Reserves Act (1971), in which all types of fishing are prohibited. Marine reserves are not fisheries management tools but are included here as examples of area restrictions that apply to CRA 1. (h) **Daily limits (recreational only)**: no person may take or possess more than three spiny rock lobsters within the combined daily limit of six rock lobsters (spiny rock lobster and packhorse combined).

The natural variability of the stock – section 11(1)(c)	Various environmental factors are thought to influence the productivity of rock lobster populations, including water temperature, ocean currents, shelter availability, and food availability.[55] Rock lobster grow at different rates around New Zealand and female lobster mature at different sizes.[56] Spiny rock lobster spend an extended time in the planktonic larval phase, swimming and drifting in the ocean for up to 24 months. Therefore, 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. 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. 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. Evidence from Australia suggests that kelp habitat may be critical to the settlement success of rock lobster (*Jasus edwardsii*) pueruli, providing important settlement cues, food, and refuge.[57] The same relationship has yet to be observed in New Zealand[58] and further research is needed to test this. However, given the similarity between ecosystems in Tasmania and New Zealand these potential relationships are important to consider for the management of rock lobster. Kelp does support both food sources and shelter for later life stages of rock lobster in New Zealand,[59] suggesting the health of coastal kelp forests is likely tightly linked to the health of the rock lobster population. Information on variability in rock lobster growth, size at maturity, available abundance, mortality, and recruitment is incorporated into the stock assessments that inform rock lobster management. **Climate change** The ocean around New Zealand is, in some regions, warming at a rate well in excess of the global average.[60] 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 rock lobster, including their spatial variability. Recent assessment indicates a potentially negative relationship between sea surface temperature and rock lobster recruitment in northern New Zealand.[61] This work is preliminary and requires further investigation, however this could be a significant development. Organisms such as rock lobsters are particularly susceptible to ocean acidification because it lessens their ability to lay down calcified body structures during each moult.[62] Changes to ocean circulation patterns also have the potential to affect the recruitment of the rock lobster, given the extended larval stage. Extended periods of extremely warm ocean temperatures known as marine heatwaves are increasing in intensity and frequency across the globe with trends predicted to accelerate under future climate change. New Zealand experienced several extended periods of marine heatwaves in recent years,[63] causing a range of impacts including temporary southern migrations of warm-water fish and loss of ecologically important seaweeds.[64] Marine heatwaves may have direct effects on rock lobster through temperature stress affecting their physiological condition[65] or indirect effects through impacts on associated habitats e.g., kelp forests.

[55] Linnane et al. (2010)
[56] Annala (1983)
[57] Hinojosa et al. (2015), Hinojosa et al. (2018) and Shelamoff et al. (2022)
[58] Stanley et al. (2015) and Hesse et al. (2015)
[59] MacDiarmid & Kelly (2013)
[60] Sutton & Bowen (2019)
[61] Roberts & Webber (2024)
[62] Bell et al. (2023) and Hepburn et al. (2011)
[63] Salinger et al. (2019) and Bell et al. (2023)
[64] Thomsen et al. (2019), Salinger et al. (2020) and Thomsen et al. (2021)
[65] Oellermann et al. (2020)

Fisheries plans and conservation and fisheries services – section 11(2A)	There are no fisheries plans approved under section 11(2A) of the Act specific to CRA 1. **Hauraki Gulf Fisheries Plan:** Approximately 6 km of coastline in the southeastern portion of the CRA 1 QMA overlaps with the Hauraki Gulf Marine Park (**HGMP**). The Hauraki Gulf Fisheries Plan is therefore relevant to the measures being considered. It defines long-term outcomes and sets out objectives to guide the management of fisheries in the HGMP, particularly Management Objective 1.3 which is to mitigate the direct and indirect impacts of fishing on the marine food chain. FNZ considers that the proposed measures all generally align with the management objectives of the Hauraki Gulf Fisheries Plan as they intend to mitigate the role of rock lobster fishing in trophic cascades which have resulted in the formation of urchin barrens in northeastern New Zealand. **Fisheries and conservation services:** The fisheries and conservation services of significance have been described throughout this paper in relevant sections. Fisheries services of relevance include the research used to monitor stock abundance, (full quantitative stock assessments and rapid assessment updates), aquatic environment and biodiversity research, and the tools used to enforce compliance with management controls. Relevant conservation services include research and monitoring necessary to manage and mitigate the effects of fishing on the aquatic environmental and biodiversity, including protected species. FNZ is not aware of any decisions not to require conservation services or fisheries services. A catch-at-sea sampling programme has been hosted on CRA 1 fishing vessels since 1997, primarily for biological data collection. There is minimal observer coverage in the fishery, and it is not covered by the onboard camera programme. Fisheries Compliance regularly monitors the CRA 1 area to ensure that management controls are being adhered to.
The Minister must have regard to:	
Relevant statements, plans, strategies, provisions, and documents - section 11(2)	There is one Regional Council with coastline within the CRA 1 boundary. The Northland Regional Council has multiple plans and rules to manage coastal and freshwater environments, including terrestrial and coastal linkages, ecosystems, and habitats. The Proposed Regional Plan for Northland is now operative following the resolution of all appeals before the Environment Court in 2023. FNZ has reviewed the documents and the provisions that might be considered relevant and a summary of these can be found on our website here. FNZ considers the management measures being considered are consistent with the objectives of these relevant plans, which generally relate to the maintenance of healthy and sustainable ecosystems to provide for the needs of current and future generations.
Sections 7 and 8 of the Hauraki Gulf Marine Park Act 2000 - Section 11(2)	Due to the slight overlap with the HGMP**,** sections 7 (recognition of national significance of Hauraki Gulf) and 8 (management of Hauraki Gulf) of the Hauraki Gulf Marine Park Act 2000 (**HGMPA**) apply to the management of this fishery. FNZ considers that the measures proposed for the portion of CRA 1 that overlaps with the HGMP are generally consistent with obligations under sections 7 and 8 of the HGMPA in that the proposed management measures aim to increase the abundance and effective predation role of rock lobster with the aim of reducing urchin densities and potentially allowing for algal regrowth within the southeastern portion of CRA 1. This is intended to better provide for the historic, traditional, cultural, and spiritual relationship of the tangata whenua of the Hauraki Gulf as well as the social, economic, recreational, and cultural well-being of people and communities within the Hauraki Gulf.
Non-mandatory relevant considerations	
Other plans and strategies	Te Mana o te Taiao (Aotearoa New Zealand Biodiversity Strategy) FNZ considers that the measures being considered are generally consistent with this strategy – including Objective 10, which is to ensure that ecosystems are protected, restored, resilient and connected from mountain tops to ocean depths, and Objective 12, which is to manage natural resources sustainably.

17. Initial assessment of a QMA subdivision against section 25 of the Act

115. Sections 25 and 26 of the Act provide for the subdivision of QMAs and set out certain roles and responsibilities to be undertaken by the Minister before a subdivision can take place. Section 25(3)(a) sets out various matters that the Minister must have regard to before recommending the alteration of any quota management area.

Table 6: Initial assessment of subdividing the CRA 1 QMA under section 25 of the Act.

Matters for initial assessment under section 25 of the Act	
Section 25(3)a(i) non-commercial fishing interests in the affected area	The majority of the recreational catch in CRA 1 occurs on the east coast, where urchin barrens are known to occur (see '*Spatial characteristics of the CRA 1 fishery'* in Part 1). Subdividing the QMA and targeting management measures to the east coast could impact recreational fishers heavily in the short term if measures that reduce recreational harvest are implemented, although the extent of that impact depends on other management measures adopted in the subdivided QMA and the associated TAC settings. In the long term, subdividing the CRA 1 QMA and implementing measures to increase the abundance of rock lobster will benefit recreational fishers by providing better access to a healthy fishery in the future. Subdividing the QMA has previously been supported by some Iwi Fisheries Forums (see *'Input and participation of tangata whenua'* in Part 2) who support management at smaller scales than the existing QMA to address localised depletion of rock lobster. It would also meet the expectations of some iwi and hapū to reflect the whakapapa of rock lobster for each coast and remove some of the discomfort expressed by west coast iwi and hapū around having input into management that may impact the rohe moana of east coast iwi and hapū (see *'Input and participation of tangata whenua'* in Part 2).
Section 25(3)a(ii) biological characteristics of each stock affected	Biological characteristics are summarised under *'Information on biology'* in Part 4. Spiny rock lobsters have high site fidelity, low mobility, and require specific habitat types for settlement and adult life stages. These biological characteristics likely make rock lobster particularly susceptible to environmental disturbance e.g. loss of supporting habitat. A regime shift from productive, structurally complex kelp forests to urchin barren-dominated reef systems has a negative impact on the suitability of rocky reef habitat for adult rock lobsters as a source of shelter and food. This susceptibility should be taken into account when assessing the need for QMA subdivision. Evidence from marine reserves suggests that building the abundance of predators in the complete absence of fishing can facilitate the reversal from a state of urchin barren dominance within decades.[66] Creating two smaller QMAs allows management measures to increase the abundance of spiny rock lobster to be targeted towards the region with known urchin barrens over the long term, which reflects that addressing urchin barrens will likely require management actions to be in place for a long period of time (e.g., decades).

18. Information principles: section 10 of the Act

116. The best available information to inform management of CRA 1 is presented throughout this paper, and in various sections FNZ has noted where information is uncertain. As per section 10(c) of the Act, caution is required in decision making where information is uncertain, unreliable, or inadequate. However, as per section 10(d) of the Act, the absence of, or any uncertainty in, any information must also not be used as a reason for postponing or failing to take any measure to achieve the purpose of the Act.

117. Beyond catch reductions, only no-take area closures and legal-size limit alterations have peer-reviewed scientific evidence supporting their effectiveness at increasing rock lobster abundance and size. Only no-take area closures have been proven to mitigate urchin barrens. FNZ is not aware of empirical or reported evidence supporting the effectiveness of the other measures discussed in mitigating urchin barrens. However, in most cases, they are assumed to have a positive impact to an unknown degree. The likelihood that each measure is expected

[66] Leleu et al. (2012), Babcock et al. (2010), and Shears & Babcock (2003)

to increase the size and abundance of rock lobster is described above in Part 2 under 'Proposed management measures'.

Table 7: Best available information and key areas of uncertainty.

Best available information	Key areas of uncertainty, unreliability or inadequacy
Stock status of CRA 1: The best available information on the status of CRA 1 (in relation to *MSY*) comes from a full scientific stock assessment using standardised CPUE. The most recent full stock assessment was conducted in 2019, based on data up to the 2018 April fishing year. Subsequent updates to the stock assessment have been undertaken annually, with the most recent rapid assessment update undertaken in 2023. The results of these assessments are described in detail within the November 2023 Fisheries Assessment Plenary and have been summarised throughout this paper where relevant (in particular, under *'CRA 1 stock status'* in Part 1 and Figure 4 in Part 4).	The majority of the data used in the stock assessment to assess stock status relies on fishery-dependent data (data collected by commercial fishers). Fishery-dependent data can be biased by changes in fishing efficiency. There are almost no fisheries independent data available from CRA 1. As discussed under '*CRA 1 stock status'* the last full stock assessment was conducted in 2019, with rapid assessment updates occurring in 2020, 2021, 2022, and 2023. Rapid assessment updates repeat the previous full stock assessment model with all of the same settings and assumptions, but with updated input data. Given the ongoing limited commercial fishing on the east coast of CRA 1 since the 2019 stock assessment, and the absence of an index of CRA 1 rock lobster abundance since 2019, there is uncertainty as to how well the 2025 assessment model will be able to estimate CRA 1 biomass and particularly for the east coast regions. Noted uncertainties at the time of the last stock assessment summarised in the November 2023 Plenary Report (pages 295 – 317) are outlined as the following: a) Levels of illegal, customary, and recreational take are poorly known in years without surveys. b) Length frequency samples may not be representative of the fishery throughout all areas. c) Growth rate estimates are uncertain due to a limited amount of tag data. d) The model is unable to predict sex ratios during spring-summer due to limited data. e) The spatial distribution of the observations used to inform this assessment in each statistical area may not be representative of the spatial distribution of the population in these areas.
Customary, recreational, and illegal fishing estimates: The best available information on CRA 1 customary and recreational fishing is presented in Part 1 under *'Spatial characteristics of the CRA 1 fishery* and in Part 4 under *'Fishery characteristics and settings'*. The best available information on illegal fishing is presented in Part 4 under *'Fishery characteristics and settings'*. Recreational catch information relies heavily on the results of the 2022/23 NPS, additional information is provided by Holdsworth (2014) and Johnson et al. (2024).	The NPS provides some spatial information (see *'Spatial characteristics of the CRA 1 fishery'*) but does not provide detailed spatial data on the distribution of recreational fishing across the CRA 1 QMA. The NPS panel tends to have low participation in specialised fisheries like rock lobster which can result in lower precision for harvest estimates. Spatial information on recreational harvest for the east coast is provided in Holdsworth (2014). However, these data are ten years old now and may not represent recent recreational harvest. Therefore, there is some uncertainty in the amount of recreational fishing occurring in areas of concern or of known urchin barrens. FNZ has contracted additional recreational surveys for CRA 1 for 2024/25 which will provide an annual estimate of recreational harvest. Additional surveys through to at least 2027/28 are being considered. There is uncertainty in the magnitude and distribution of customary, recreational, and illegal fishing occurring in each statistical area of CRA 1, and how much fishing occurs along the east coast where urchin barrens are of concern.
Location and extent of urchin barrens: *Estimating the extent of urchin barrens and kelp forest loss in*	Kerr et al. (2024) estimated the percentage of shallow rocky reef habitat that comprises urchin barrens at seven sites between Maitai Bay at the Northland Peninsula to Tāwharanui Peninsula in the Hauraki Gulf and then extrapolated this information to estimate the extent of urchin barrens across the region (30% urchin barren coverage) based on the extent of rocky reef habitat. FNZ has

Best available information	Key areas of uncertainty, unreliability or inadequacy
northeastern Aotearoa, New Zealand (Kerr et al., 2024). New Zealand Aquatic Environment and Biodiversity Chapter 13 '*Trophic and ecosystem-level effects'* (in review), and Doheny et al. (2023).	contracted a research project to measure the extent of urchin barrens between 2 m and 10 m water depth from Cape Reinga to East Cape. The results are expected to provide a spatially comprehensive and current map of urchin barren distribution for the entire area (initial results expected in December 2024 with final results expected in May 2025). Other information on the location and extent of urchin barrens in CRA 1 is cited in Doheny et al. (2023). Particular areas of uncertainty in defining the percent cover of barrens for a given location relate to the depth cut off for shallow reefs which can be different depending on the study. FNZ notes that there are no existing or planned surveys that estimate the location and extent of urchin barrens on the west coast of CRA 1 or Three Kings Islands, however, urchin barrens are considered less likely to occur on the west coast or Three Kings Islands because of high wave action.
The effect of fishing on urchin barren formation and the efficacy of marine reserves in reversing barrens and restoring kelp forest habitat: New Zealand Aquatic Environment and Biodiversity Chapter 13 '*Trophic and ecosystem-level effects'*, and Doheny et al. (2023).	Key information knowledge gaps pertaining to the relationship between rock lobster, other predators, and urchin barrens, as well as the management required to mitigate urchin barrens are outlined in pages (66 to 73 and 78) of Doheny et al. (2023). Information gaps most relevant to this discussion document include: (a) The biomass threshold and size frequency distribution of rock lobsters (as one of several key urchin predators) required to enable them to meaningfully contribute as rocky reef predators, including helping mitigate urchin barren formation. (b) The relative importance of rock lobster to other urchin predators in reducing or reversing barren formation, e.g., how packhorse lobster contribute to urchin predation across urchin size classes. (c) The extent to which the trophic effects of fishing interact with changing sea temperatures, ocean acidification, eutrophication, sedimentation, and invasive species needs to be further explored. Including the impact that climate change and marine heat waves will have on spiny rock lobsters, kina and macroalgae abundance and distribution. (d) The design of closures required to support ecosystem recovery.
Adjusted size limit modelling: The best available information on the effects of implementing a maximum legal size or changing the minimum legal size is modelling presented in Part 2 under *'Proposed management measures'* and Part 4 under *'Legal size limit modelling'*.	The maximum legal size modelling assumed constant catch. Possible alternative results would have been observed if substantial reductions to the TAC were modelled. The minimum legal size modelling was conducted using data from the neighbouring CRA 2 rock lobster fishery. It was inferred that due to similar characteristics, the results from CRA 2 could be assumed to reflect what would occur in CRA 1. There were differences in the modelling used to assess impacts of changing the maximum legal size and minimum legal size, these include different projections periods, different stocks, and using constant catch or constant exploitation.

118. A catch-at-sea sampling programme has been hosted on CRA 1 fishing vessels since 1997, primarily for data collection. However, the CRA 1 fishery has not had on-board camera coverage and has only had FNZ fisheries observer coverage in 2020/21. Therefore, there is uncertainty in data on environmental interactions for the fishery.

119. Given the difficulty of modelling the combined impacts of implementing multiple management measures, there is some uncertainty as to the effects if multiple measures are implemented in conjunction.

19. CRA 1 stock status (for more information, see the Plenary)

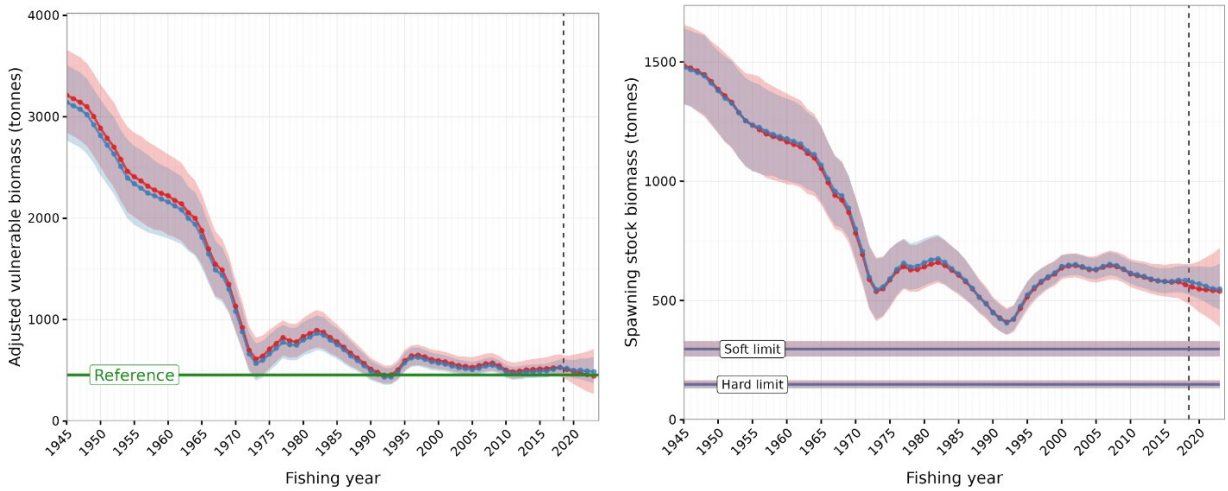


Figure 4. The 2019 stock assessment (red) and 2023 rapid assessment update (blue) estimates of trends in vulnerable biomass (left) and spawning stock biomass (right) in CRA 1 since 1945. The solid line and points show the median, and the shaded region indicates 90% credible intervals. The distributions of the interim target (left) and the soft (20% SSB_0) and hard limits (10% SSB_0) (right) are also shown.

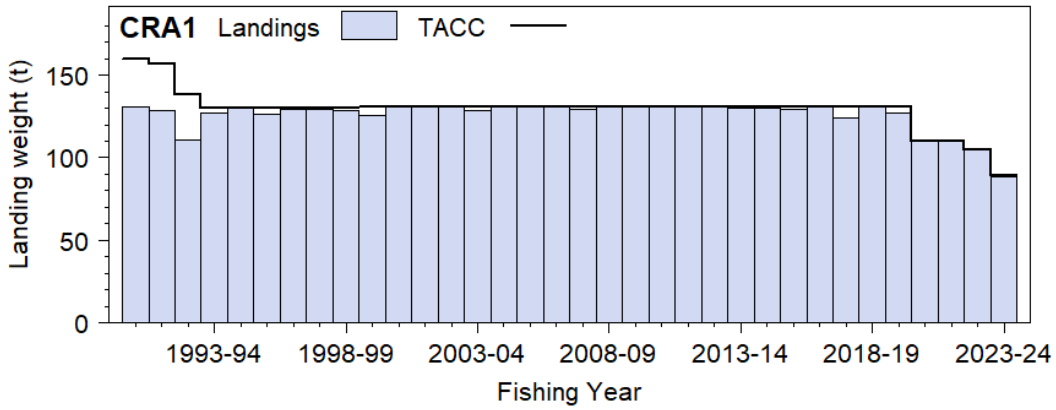


Figure 5: Historical commercial landings and TACC for CRA 1. This figure does not show the 2023 TACC reduction.

20. Fishery characteristics and settings

Commercial (TACC)
CRA 1 commercial landings remained at or near the TACC of 131 tonnes from April 1993, until the TACC was reduced to 110 tonnes in April 2020. In April 2022, the CRA 1 TACC was further reduced to 105 tonnes as part of a TAC review that reduced both commercial and recreational catch settings. This decision, along with the April 2021 TAC decision where the TAC remained unchanged, was successfully challenged at the High Court and the Minister at the time was directed to reconsider the TAC decision. In April 2023, the TAC was further reduced from 193 tonnes to 172 tonnes, and within that the TACC from 105 tonnes to 89 tonnes. This decision has since been challenged (see *'2022 High Court Judgment, 2023 TAC decision, and 2024 High Court hearing'*).
Customary Māori
CRA 1 customary catch is provided for by the Fisheries (Kaimoana Customary Fishing) Regulations 1998, and regulation 50 of the Amateur Fishing Regulations. FNZ has no records of customary authorisations issued for CRA 1 since 2022. Between 2018 and 2022, 520 unspecified units of rock lobster were authorised for customary harvest from CRA 1 on average each year. This information is considered incomplete, because customary take that occurs under the Amateur Fishing Regulations for the purpose of hui and tangi is not required to be reported. An estimate of 10 tonnes was used in the 2019 CRA 1 stock assessment model and the subsequent rapid assessment updates to represent customary catches. The current customary allowance is 20 tonnes.

Recreational
The best available information on recreational harvest in CRA 1 is summarised in Part 1 under *'Spatial characteristics of the CRA 1 fishery'*. The most recent NPS (2022/23) estimated 8.00 tonnes were harvested across the whole QMA, with approximately 75% taken from the east coast. An additional 2.02 tonnes were reported to have been landed by commercial fishers for personal use under section 111 of the Act and 160 kg reported as landed by amateur charter vessels in 2022/23. The total estimated recreational catch in CRA 1 in 2022/23 from all sources was 10.2 tonnes. The current recreational allowance is 22 tonnes.
Other sources of mortality caused by fishing
Other sources of mortality to CRA 1 caused by fishing include: illegal catch, handling mortality following the return of under-sized lobsters, berried female lobsters, and high-grading, as well as predation on lobsters by predators within pots. The stock assessment assumed that handling mortality was 10% of returned lobsters until 1990 and then 5% afterwards, and that predation within pots is negligible. In the 2019 stock assessment, illegal catch was assumed to be a fixed percentage of the total commercial catch from 1981 to 2018 set at 20% of the commercial catch, and then scaled proportionately to the annual standardised CPUE index over the time period. This acknowledged that illegal take was likely to be influenced by abundance and factors such as prevailing weather conditions that can influence harvesting effort. The 2023 rapid assessment update assumed 33.65 tonnes of illegal catch for the 2022/23 fishing year. The current allowance for all other sources of mortality caused by fishing is 41 tonnes.

21. 2022 High Court judgment, 2023 TAC decision, and 2024 High Court hearing

2022 High Court judgment

121. In November 2021, The Environmental Law Initiative (**ELI**), and Te Uri o Hikihiki hapū filed proceedings seeking a judicial review of the (then) Minister's 2021/22 decision for CRA 1. This was amended in April 2022 to include the 2022/23 decision.

122. In November 2022, the High Court found in favour of the applicants on four of the five grounds for review[67] and directed the Minister to reconsider the 2022/23 decision in accordance with the findings in the judgment.

123. The High Court was satisfied that the evidence before the Court showed that:

    a) rock lobsters have an important ecological role in coastal ecosystems;

    b) their primary ecological role is as a predator in shallow water areas;

    c) in New Zealand, rock lobsters prey upon sea urchins/kina;

    d) kina are an important herbivore on rocky reefs in north-eastern New Zealand because they can consume entire kelp forests and other seaweeds;

    e) generally, the ecological role of rock lobsters as a predator influences the ecological role of the species they prey on;

    f) where there are fewer rock lobsters, there is an increased population of kina, thereby increasing the grazing activity of kina, and resulting in the loss of stands of seaweed, particularly kelp forests, in coastal areas, described as a "trophic cascade";

    g) trophic cascades have been reported in New Zealand, and areas affected by them are described as 'kina barrens', which can take decades to reverse;

    h) loss of kelp forests is ecologically damaging for surrounding coastal systems, in fisheries production, biodiversity, and ocean carbon sequestration;

    i) there is strong evidence that trophic cascade has significantly contributed to the presence of kina barrens in the north-east of New Zealand, within both CRA 1 and CRA 2;

[67] The Environmental Law Initiative v Minister for Oceans and Fisheries [2022] NZHC 2969 [11 November 2022].

j) there are other factors, such as water temperature, water depth, storm damage, sediment and kelp disease that may impact on the prevalence of kina barrens; and

k) there is a lack of evidence as to this relationship around the remainder of New Zealand.

124. The key finding of the Court was that the advice provided to the Minister about the effects of rock lobster fishing on the aquatic environment, particularly with regard to the formation of kina barrens in CRA 1, was not consistent with the best available information. In particular, the Court found the advice to the previous Minister misleadingly conflated the information in relation to kina barrens and trophic cascades in the subject area (CRA 1) with the situation pertaining to the rest of New Zealand.[68]

125. The Court also held that the purposes of the Act appear to create what could be described as an environmental bottom-line and are complemented by a scheme that favours precaution.[69]

126. The Court observed that "*The reality in the present case is that the Minister will be required to reconsider the 2022/23 decision in light of the best available information, and in accordance with the purposes and principles of the Act. However, the result of that decision, and the weight to be accorded to the various factors will remain a decision for the Minister*".[70]

CRA 1 April 2023 Minster's decision

127. On 30 March 2023 the (then) Minister remade his decision and reduced the TAC from 193 tonnes to 172 tonnes, the TACC from 105 tonnes to 89 tonnes, the recreational allowance from 27 tonnes to 22 tonnes, and the recreational daily limit from six to three spiny rock lobsters per person.

128. These reductions were intended to allow rock lobster to increase in abundance, to an as yet unknown level, in order to play their part in controlling kina populations and delivering other ecosystem functions in CRA 1.

129. In making his decision the Minister also noted that reductions to the TAC, TACC, and the allowance for recreational fishing alone were unlikely to be enough to address the issue of kina barrens and directed FNZ to consider further measures regarding kina barrens.

2024 High Court hearing

130. On 31 August 2023 ELI, Ngāti Hau, and Ngāti Kaharau Hapū ki Hokianga commenced further proceedings seeking a judicial review of the Minister's decision for April 2023 on the basis that it once again failed to address adequately the role of rock lobster in avoiding, remedying or mitigating kina barrens.

131. The proceedings were heard on 19 and 20 August 2024. At this stage there is no timeframe for determination of an outcome or receiving the Court's judgment.

22. Legal size limit modelling

132. FNZ contracted modelling to understand the potential fishery impacts of altering the existing minimum legal size or implementing a maximum legal size.[71] Important characteristics of the modelling are outlined in Table 8.

133. The modelling for alternate minimum legal sizes was conducted using the stock assessment and data for the CRA 2 fishery because the assessment for this stock was thought to provide a more informed and better representation of both recreational and commercial fishing population dynamics than could be inferred from the CRA 1 assessment model (which was mostly informed by data from the predominantly commercially fished west coast component of the CRA 1 fishery).

[68] At [115].
[69] At [108].
[70] At [99].
[71] Analysis presented to and reviewed by the Rock Lobster Working Group in 2023 and 2024, for the maximum legal size limit and minimum legal size limit modelling, respectively. The Rock Lobster Working Group is a Science Working group convened by FNZ.

Table 8. Data and design of the modelling used to estimate impacts of altering the existing minimum legal size or implementing a maximum legal size.

Characteristic	Minimum legal size (MLS) modelling	Maximum legal size modelling
Base case model	2023 rapid update of CRA 2 (Hauraki Gulf / Bay of Plenty) rock lobster fishery	2022 rapid update of CRA 1 (Northland) rock lobster fishery
Years projected	100 years (2022 to 2122)	33 years (2022 to 2054)
Seasonal split for commercial catch	52% autumn winter (based on split in 2021)	53% autumn winter (based on split in 2021)
Assumed recruitment	Recruitment drawn from mean and standard deviation from last 10 years of estimated recruitment deviates.	Recruitment is drawn from mean and standard deviation from the last 10 years of estimated recruitment deviates (2009 to 2018).
Assumed mortality of returned lobsters	5% handling mortality and natural mortality (estimated at an annual instantaneous rate of 18.1%)	5% handling mortality and natural mortality (estimated at an annual instantaneous rate of 10.8%)
Fixed catch or fixed exploitation rate	Fixed exploitation rate (50.5%) – equivalent to the rate associated with managing at the B_{MSY} vulnerable biomass reference level.	Fixed catch
Modelled catch (tonnes)	**Commercial:** 80 tonnes (9 tonnes lower than CRA 1). **Recreational**: 34.2 tonnes **Illegal:** 22.5 tonnes **Customary**: 5 tonnes	**Commercial:** 105 tonnes (higher than the current TACC of 89 tonnes, as was based on the TACC in 2022 prior to the 2023 TAC review). **Recreational:** 28.3 tonnes. **Illegal:** 35.3 tonnes. **Customary:** 10 tonnes.
Modelled scenarios	Four MLS scenarios: (a) **Current:** 54 mm TW for males and 60 mm TW for females (b) **5 mm reduction:** 49 mm TW for males and 55 mm TW for females (c) **5 mm addition:** 59 mm TW for males and 65 mm TW for females (d) **10 mm addition:** 64 mm TW for males and 70 mm TW for females	Five maximum legal size scenarios (all with a minimum legal size of 54 mm TW for males and 60 mm TW for females): a. No maximum legal size b. 71 mm TW male and 87 mm TW female (equivalent to 135 mm CL) c. 68 mm TW male and 83 mm TW female (equivalent to 130 mm CL) d. 66 mm TW male and 80 mm TW female (equivalent to 125 mm CL) e. 64 mm TW male and 77 mm TW female (equivalent to 120 mm CL)

Maximum legal size modelling results

134. Over the long term, an increase in the abundance of large rock lobsters is expected given recent reductions to the TACC, given the current MLS for each sex (red line in Figures 6 and 7). Modelling suggests, however, that the number of rock lobster in the population would decrease by 21.1% if the lowest maximum size were imposed (64 mm TW for males and 77 mm TW for females) and by 39.7% if the highest maximum size were imposed (71 mm TW for males and 87 mm TW for females). The modelling also predicted lower abundances of larger lobster, and lower levels of vulnerable and spawning stock biomass for each of the maximum size options being evaluated (as indicated by the other coloured lines in Figures 6 and 7).

135. This outcome occurs because of the assumption that the commercial fishery will take the same TACC every year despite the introduction of a maximum legal size. The commercial fishery would therefore have to harvest greater numbers of smaller lobster (and lobster overall) in order to catch the same tonnage, and consequently, fewer lobster were predicted to have survived in the population by the time that they had grown through to any of the evaluated maximum sizes.

136. The introduction of a maximum legal size for recreational fishers may still result in an increased abundance of larger rock lobster, however, as their catch is constrained by a daily limit, and they will not keep fishing to catch an annual catch entitlement in the same way that commercial fishers attempt to do. The benefits of introducing a maximum size for the recreational fishery may be relatively low at least initially, given the low annual recreational catch at this time.

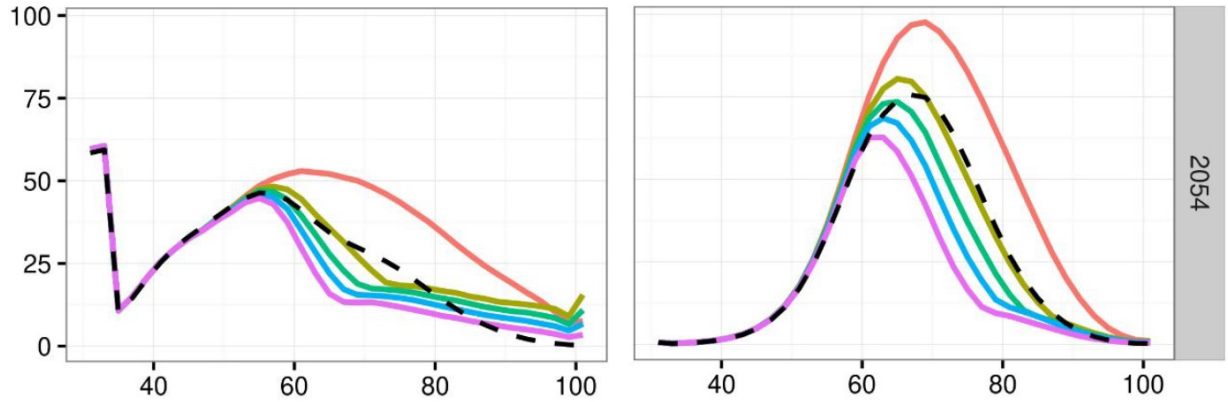


Figure 6. The numbers (1000s) of male (left) and female (right) lobsters in CRA 1 after a 30 year projection period based on managing without a maximum legal size (red), and with maximum tail width sizes that are approximately equivalent to carapace lengths of 135 mm (yellow), 130 mm (green), 125 mm (blue), and 120 mm (purple). The black dashed line indicates estimated numbers of lobster by size in 2019.

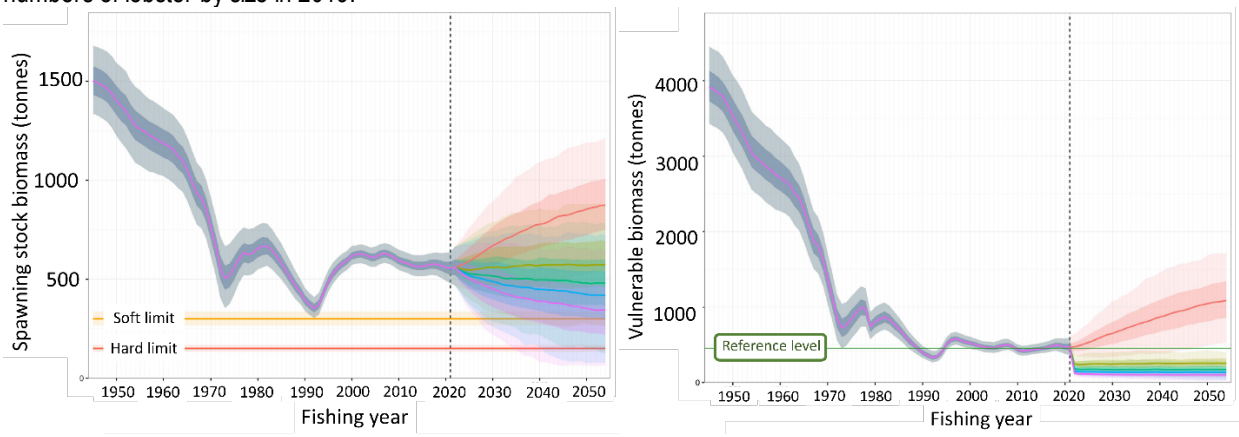


Figure 7. The estimated spawning stock biomass in tonnes (left) and vulnerable biomass in tonnes (right) of CRA 1 from 1945 to 2022 and the projected spawning stock biomass (tonnes) of CRA 1 from 2022 to 2054 based on managing without a maximum legal size (red) and with maximum tail width sizes that are approximately equivalent to carapace lengths of 135 mm (yellow), 130 mm (green), 125 mm (blue), and 120 mm (purple).

Minimum legal size modelling results

137. When the stock is managed to be at or around the current reference level target, increasing the minimum legal size (**MLS**) would be expected to lead to higher vulnerable biomass and spawning stock biomass and more larger individuals in the population in the long term (Figures 8 and 9). However, this is expected to result in a reduced CPUE in terms of number of lobster retained (Figure 10). When considering CPUE in terms of kg per potlift, catch rates would still be lower at a higher MLS, but the reduced number of lobster that could be legally retained would be partially offset by the increased abundance of larger heavier rock lobsters that are caught over the long term (Figure 11). It was predicted that it would take at least 15 to 20 years for these changes to be fully realised, depending on the MLS change being evaluated.

138. Spawning stock biomass is estimated to be 27.1% higher when the MLS for each sex is increased by 5 mm, and 47.7% higher when the MLS is increased by 10 mm, relative to that

expected under current MLS settings. Similarly, vulnerable biomass is estimated to be 46.2% and 82.3% higher if the MLS for each sex is increased by 5 mm and 10 mm respectively.

139. CPUE (numbers of lobster per pot) is estimated to be 0.970 lobster per pot under the current MLS, which is estimated to decrease by 24.2% to 0.735 lobster per pot if the MLS for each sex was increased by 5 mm, and to decrease by 41.2% to 0.570 lobster per pot if the MLS is increased by 10 mm.

140. CPUE (kg per pot) is estimated to be 0.928 kg of lobster per pot under the current MLS, which is estimated to decrease by 1.9% to 0.910 kg of lobster per pot if the MLS for each sex was increased by 5 mm, and to decrease by 8.4% to 0.850 kg of lobster per pot if the MLS is increased by 10 mm.

141. As discussed in paragraphs 17 and 50, lobsters with carapace length greater than 130 mm are estimated to be able to prey on kina of all sizes. The numbers of lobsters with carapace length greater than 130 mm (using 83 mm tail width and 68 mm tail width as a proxy for females and males, respectively) is estimated to be 20% higher when the MLS for each sex is increased by 5 mm and 37% higher when the MLS is increased by 10 mm, relative to that expected under the current MLS settings. Modelling conducted with lower exploitation rates (as estimated for 2023 – 33.6% of the reference level exploitation rate estimate) indicates that increases to the MLS are more likely to result in greater numbers of large lobsters when the fishery is managed to a higher biomass.

142. The average annual catch across all sectors combined would be expected to decline with larger MLS limits. The total catch tonnage is estimated to decrease by 2.2% if the MLS for each sex is increased by 5 mm, and to decrease by 5.7% if the MLS is increased by 10 mm.

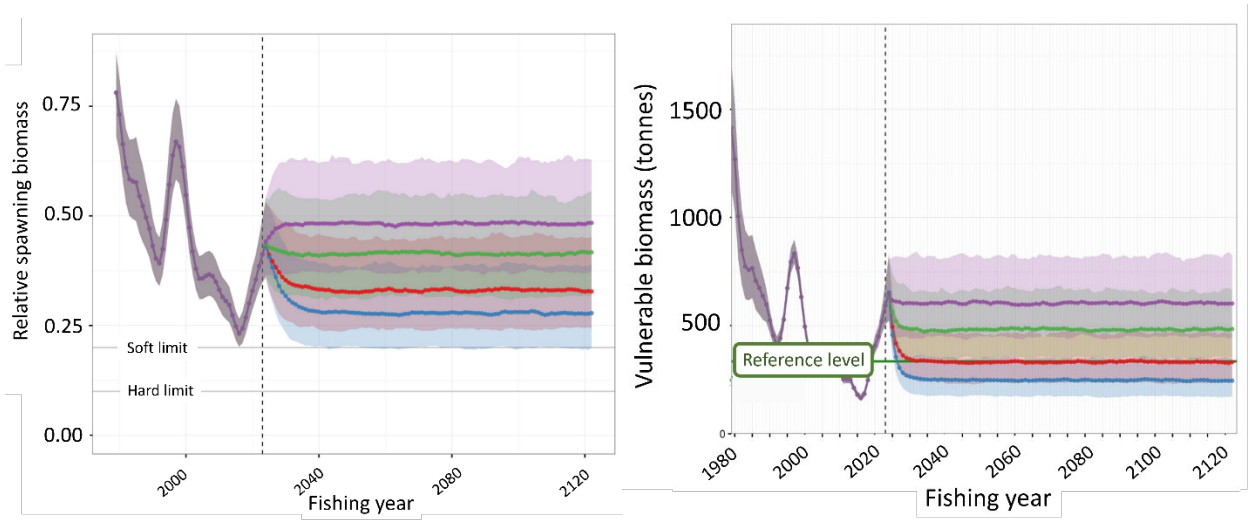


Figure 8. Estimated relative spawning stock biomass (left) and vulnerable biomass in tonnes (right) from 1980 to 2023 for the CRA 2 (Hauraki Gulf / Bay of Plenty) fishery and projected spawning stock biomass (left) and vulnerable biomass (right) from 2024 to 2120 if catch is managed at a constant exploitation rate of approximately 50.5% annually, under four different MLS scenarios; the current MLS (red), a 5 mm addition to the current MLS (green), a 10 mm addition to the current MLS (purple), and a 5 mm reduction to the current MLS (blue).

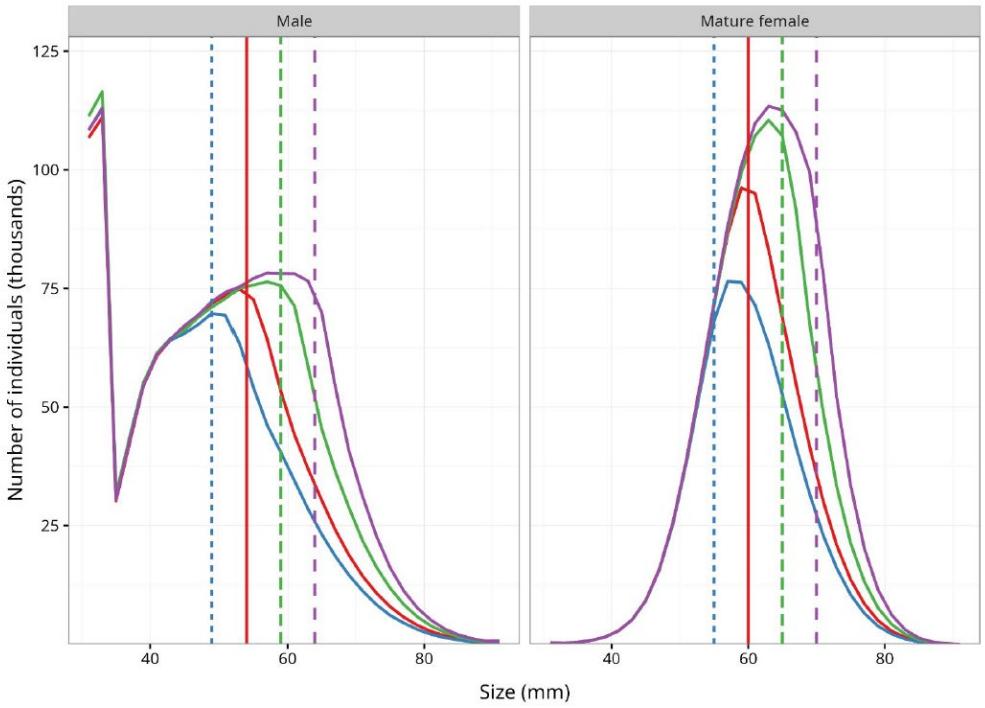


Figure 9. Estimated numbers of male (left) and female (right) rock lobster for the CRA 2 (Hauraki Gulf / Bay of Plenty) fishery in the year 2122 if catch is managed at a constant exploitation rate of approximately 50.5% annually, under four different MLS scenarios; the current MLS (red), a 5 mm addition to the current MLS (green), a 10 mm addition to the current MLS (purple), and a 5 mm reduction to the current MLS (blue). The dotted vertical lines show the MLS for each model.

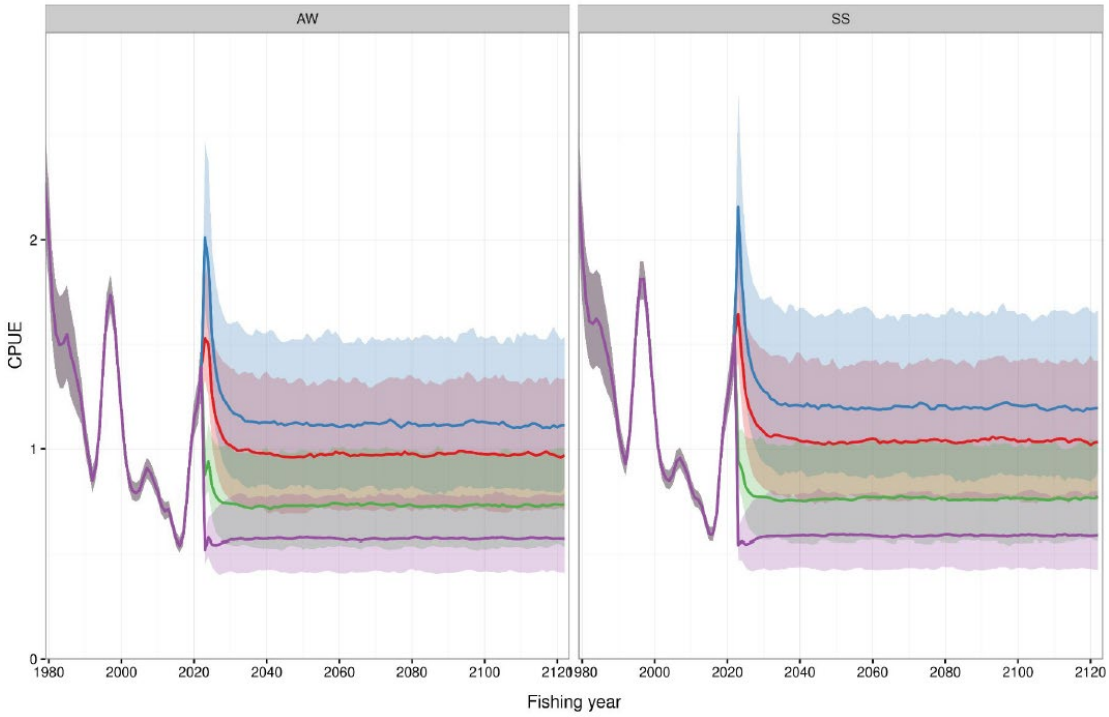


Figure 10. Estimated autumn-winter (left) and spring-summer (right) Catch-Per-Unit-Effort (CPUE) in numbers of lobster per potlift from 1980 to 2023 for the CRA 2 (Hauraki Gulf / Bay of Plenty) fishery and projected CPUE from 2024 to 2120 if catch is managed at a constant exploitation rate of approximately 50.5% annually, under four different MLS scenarios; the current MLS (red), a 5 mm addition to the current MLS (green), a 10 mm addition to the current MLS (purple), and a 5 mm reduction to the current MLS (blue).

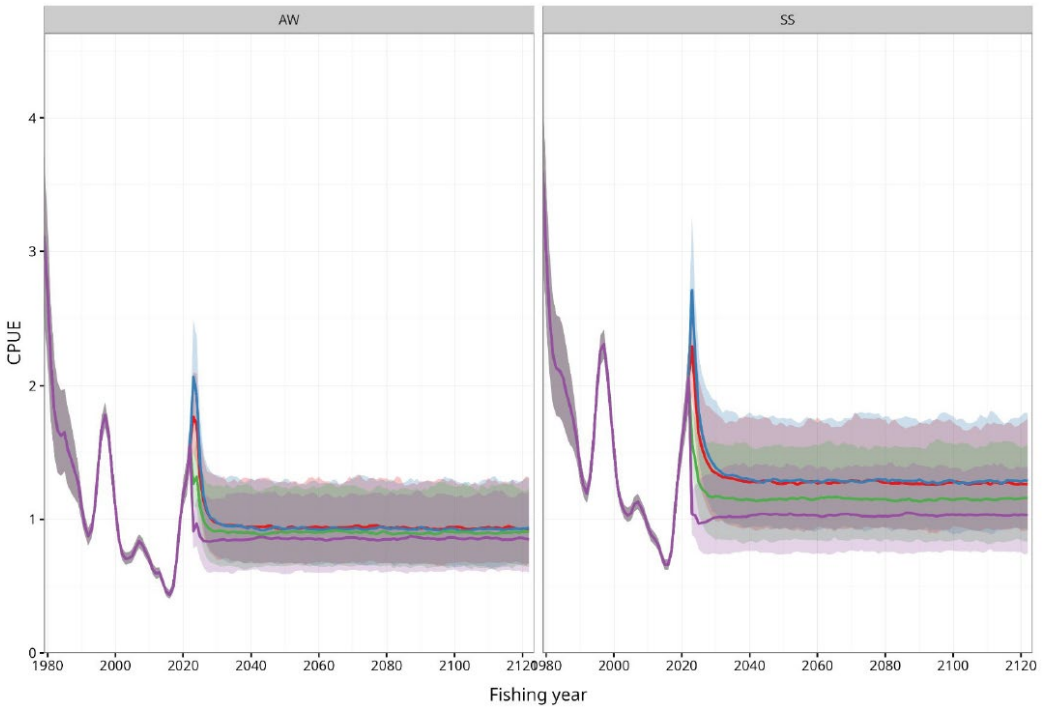


Figure 11. Estimated autumn-winter (left) and spring-summer (right) Catch-Per-Unit-Effort (CPUE) in kilogram per potlift from 1980 to 2023 for the CRA 2 (Hauraki Gulf / Bay of Plenty) fishery and projected CPUE from 2024 to 2120 if catch is managed at a constant exploitation rate of approximately 50.5% annually, under four different MLS scenarios; the current MLS (red), a 5 mm addition to the current MLS (green), a 10 mm addition to the current MLS (purple), and a 5 mm reduction to the current MLS (blue).

23. Information on biology (for more information see the Plenary)

Distribution and movement

143. Spiny rock lobsters are mainly found on reef habitat and sometimes on sandy seafloor down to 200 m water depth.

144. Macroalgae (kelp) increases structural complexity and provides habitat and food for prey species of spiny rock lobster. Kelp is also consumed directly by rock lobster.[72]

145. 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 move to the edges of reefs to spawn their eggs. Some migrations consist of large numbers of spiny rock lobsters moving together.

Growth, maturity, and reproduction

146. Although spiny rock lobsters have not been aged, they are thought to be relatively long-lived. Individuals in Australia are considered to live at least 20 years.[73] Size at maturity varies between rock lobster stocks with 50% of CRA 1 females being potentially egg bearing in the mid 50 mm tail width class.

147. 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 females.[74] Eggs incubate for 3 to 4 months on the underside of the female's tail, held in place by small hairs.[75]

[72] MacDiarmid et al. (2013)
[73] Linnane et al. (2021)
[74] Green et al. (2009)
[75] Kelly et al. (1999)

148. Mating occurs in autumn, with the eggs hatching in spring. Larval development can last 12 to 24 months and occurs far offshore.[76] 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.

149. A study which modelled the locations that rock lobster hatch and settle around New Zealand estimated that the majority of rock lobster which hatch in CRA 1 become entrained in the East Cape and Wairarapa Eddies and settle downstream in CRA 2, 3, and 4. However, rock lobster that settle in CRA 1 appear to originate from the south, mainly from the west coast of both islands.[77]

150. After the larval phase, puerulus settle on coastal rocky reef and less frequently on complex seaweeds and bryozoans. Rocky reef in shallow water less than 20 metres deep is critical settlement habitat for rock lobsters and provides the conditions and substrates key for kelp habitat in New Zealand.[78] Pueruli of rock lobsters use chemical cues associated with coastal waters to help locate settlement habitats.[79]

151. Evidence from Australia suggests that kelp habitat is important for spiny rock lobster settlement, and that declines in kelp habitat could negatively affect spiny rock lobster productivity.[80] For example, in Tasmania juvenile spiny rock lobster showed increased recruitment and survival in kelp compared to long-spined urchin barren habitat[81] and larger reefs with kelp appear critical to the recruitment of spiny rock lobsters.[82]

152. In New Zealand, pueruli have been observed to detect and respond to both underwater sounds (acoustic cues) and substrate or chemical cues from different habitats, with seaweed and rock substrates increasing settlement and speeding up moulting.[83] Underwater sounds can provide orientation cues for pelagic crustacean larvae, expedite settlement and initiate settlement behaviour.[84]

153. Juvenile rock lobster are more vulnerable to predation in kina barrens compared to kelp habitats during the day and potentially during dusk/dawn, but not during the night when they are typically active.[85] Kelp habitats also provide more of the preferred invertebrate prey for juvenile lobsters,[86] potentially increasing nutrition and growth, further research is required to confirm this relationship.

154. Recent analysis indicates a potential relationship between sea surface temperature and rock lobster recruitment, where relatively warm years were associated with poorer recruitment in northern regions.[87]

Predator-prey interactions

155. Spiny rock lobsters are ecologically important predators in New Zealand's rocky reef ecosystems, where they can exert top-down regulation of prey populations.[88] They consume a broad range of prey, including molluscs, crustaceans, annelid worms, macroalgae, echinoderms, sponges, bryozoans, fish, foraminifera, and brachiopods.[89] They strongly prefer soft-sediment bivalves over rocky reef prey and make nocturnal foraging movements away from the reef.[90] Their feeding rates vary seasonally in relation to moulting and reproductive cycles.[91]

[76] Bradford et al. (2014) and Chiswell & Booth (2008)
[77] Chiswell & Booth (2008)
[78] Booth et al. (1991)
[79] Hinojosa et al. (2018)
[80] Hinojosa et al. (2015), Hinojosa et al. (2018), Shelamoff et al. (2022)
[81] Hinojosa et al. (2015)
[82] Shelamoff et al (2022)
[83] Stanley et al. (2015)
[84] Stanley et al. (2012)
[85] Hesse et al. (2016)
[86] Taylor (1998)
[87] Roberts & Webber (2024)
[88] Pinkerton et al. (2008) and Pinkerton et al. (2015)
[89] MacDiarmid et al. (2013)
[90] Flood (2021)
[91] Kelly et al. (1999)

156. Spiny rock lobsters can also consume kina. While spiny lobsters prefer soft-sediment bivalves over urchins and consumption of kina varies seasonally with moulting stage they are one of the few predators that can eat large kina.[92] Laboratory experiments found that predation on large sea urchins is limited to large rock lobsters. [93]

157. Evidence from Australia suggests that spiny rock lobsters of all sizes (including small lobsters: 65-109 mm carapace length) consume the long-spined sea urchin *Centrostephanus rodgersii* Although the size of long-spined urchins consumed by lobsters was not investigated by this study, they were found to be less prominent in the diet of lobsters sampled from the established urchin barren site suggesting that long-spined urchins in barrens may exceed the size suitable for spiny rock lobster predation.[94]

158. In addition to consuming sea urchins, the presence of rock lobster and snapper can influence urchins indirectly. A study by Spyksma et al. (2017) in northern New Zealand found that increased presence of predators such as spiny rock lobster and snapper inside marine reserves increases cryptic behaviour (hiding in crevices) by sea urchins.

159. More information on the role of rock lobster as a predator of sea urchins is summarised under *'Why are we considering additional management measures for the CRA 1 fishery?'* in Part 1.

160. Predation on spiny rock lobsters is known to occur 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.[95]

24. Information on environmental impacts

Protected species

Seabirds

161. 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.

162. 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 population by fishery groups. The most recent seabird risk assessment was published in 2020. There have been no reported interactions with seabirds in CRA 1 fishery in the last 10 years. This is likely due to the primary method being potting, with pots usually set too deep for seabirds to enter.

Marine mammals

163. In New Zealand waters, marine mammal entanglements with pot fishing gear have been documented since 1980. A recent study on cetacean interactions with pot fisheries found that from 1980 to the present, 1-2 entanglement events of cetaceans per year were reported on average.[96] However more recently, from 2010 – 2020, an average of 4-5 entanglement events per year have been recorded.

164. Nationally, the most recorded entanglements over time have involved humpback whales, followed by orca. In CRA 1, there have been two interactions reported in the last 10 years, however these could not be attributed to the commercial or recreational sector.

165. 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 practise approaches to mitigation and reporting requirements.

166. The Hector's and Maui dolphin Threat Management Plan 2020 guides management approaches for addressing both non-fishing and fishing-related impacts on Hector's and Māui dolphins. To date, with regard to the spiny rock lobster fishery, there have been no reported

[92] Flood (2021) and Andrew & MacDiarmid (1991)
[93] Andrew & MacDiarmid (1991)
[94] Smith et al (2023)
[95] MacDiarmid et al. (2013)
[96] Pierre et al. (2022)

interactions with Hector's or Maui dolphins in CRA 1. The residual risk to the Hector's and Māui dolphin from potting in CRA 1 is considered low.

Fish and invertebrate bycatch

167. When spiny rock lobsters were targeted in CRA 1 from the 2019/20 to 2023/24 fishing years, the most frequently reported incidental species caught in the CRA 1 target fishery were: packhorse rock lobster, southern bastard cod, carpet shark, snapper, pink maomao, conger eel, blue cod, red scorpion fish, northern bastard cod, porae, and octopus.

168. Packhorse rock lobster (PHC 1), blue cod (BCO 1), snapper (SNA 1 and SNA 8), and porae (POR 1) are managed under the QMS. Stock status of POR 1 is unknown. PHC 1, BCO 1, SNA 1 and SNA 8 are considered to be sustainable under current catch levels.

Biological diversity of the environment

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

Benthic impacts from potting

170. Potting is the main method of targeting 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.

171. A study on the effects of lobster pots was completed in a report on the South Australian rock lobster fisheries.[97] This fishery is likely to be the most comparable to 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. The report concluded that the amount of algae removed by pots probably has no ecological significance.

172. Several studies on the effects of potting on temperate rocky reefs have been completed in the UK, most of which have not identified any significant impacts to benthic assemblages or benthic species abundance.[98] A study did observe damage or disturbance to 25 – 30% of seabed species and highlighted concerns about long-lived, slow-growing species which may not have sufficient time to recover between fishing events.[99]

Impact of fishing on kelp distribution

173. Species within an ecosystem interact through a number of mechanisms including feeding or predation commonly referred to as trophic links within an overall 'food web.' Changes to the abundance, size structure, and functional type[100] of a species can affect both its predators and prey through trophic interactions.[101] Changes in the abundance of one species may go on to affect other species that are neither its predators nor its prey.[102] Changes within an ecosystem are therefore linked and can impact multiple trophic levels, affecting biodiversity and ecosystem resilience.

174. Fishing for reef predators such as rock lobster can directly impact the biological diversity of the aquatic environment because of the relationship between predator abundance and urchins (which graze on kelp). Reduced abundance of urchin predators leads to an increase in urchin abundance and an increase in grazing pressure 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 seawater chemistry (among others).[103] In northeastern New Zealand (CRA 1 & CRA 2), fishing of urchin predators has been identified as a key factor contributing to the development of urchin barrens. Once established, urchin barrens are stable and persistent. Loss of kelp forests is ecologically damaging for surrounding coastal systems, fisheries production, biodiversity, and ocean carbon sequestration.

[97] Casement & Svane (1999)
[98] Eno et al (2001), Coleman et al. (2013) and Stephenson et al. (2017)
[99] Gall et al (2020)
[100] 'Functional type' refers to the collection of life history and ecological characteristics of an organism, including whether it is an herbivore, carnivore or omnivore, its feeding behaviour (including size of prey) location in the water column/benthos, and mobility.
[101] Rosas-Luis et al. (2017)
[102] Aquatic Environment Biodiversity Report, Chapter 13: Trophic and Ecosystem Level Effects (2024) – in review.
[103] Doheny et al. (2023)

Identified habitats of particular significance for fisheries management within the CRA 1 QMA

Habitat of particular significance	Attributes of habitat	Reasons for particular significance	Risks/Threats	Existing protection measures	Evidence
Ahipara	Rocky intertidal reefs, subtidal mussel beds to a depth of 25m, and subtidal macroalgal beds, sponges, bryozoans and hydroids are important habitat for green-lipped mussels.	Supports the source of green lipped mussel spat which ensures the sustainability of an important customary fishery (Ngāi Takoto fisheries protocol) and potentially mussel stocks in the wider area (wild Te Hiku (90 Mile Beach) seaweed/spat fishery and associated mussel farms around New Zealand).	Mobile bottom-contact fishing methods, such as bottom trawling and amateur scallop dredging, can impact biogenic habitats. Inputs of pollutants and sediments from land-based sources: • High nutrient load can lead to eutrophication. • Sedimentation can smother biogenic habitats. • Chemical pollution Adverse effects from non-indigenous/invasive species such as the Asian date mussel. Additional aquaculture facilities both on land and marine, including additional facilities over seagrass. Algal blooms, sand extraction, parasites and viral disease have been identified as risks for Ahipara specifically.	Trawl and set net restrictions along the North Island West Coast. The National Policy Statement on Freshwater Management and the National Environmental Standards for Freshwater which came into effect on 3 September 2020 should lead to improved water quality in shallow harbours and estuaries and other shallower inshore waters. FNZ engages with the RMA coastal planning processes to support marine management decisions to manage land-based impacts on habitat of particular significance for fisheries management.	Alfaro et al. (2011) Chaput et al. (2023)
Houhora Harbour Pārengarenga Harbour Rangaunu Harbour Rāwhiti Channel Te Rāwhiti Straight Whangārei Harbour Whangaruru Harbour	**Snapper spawning habitat:** occurs in coastal water adjacent to harbours/estuaries or coastal embayments. This habitat has high connectivity to other habitats important to other life cycle stages. **Snapper juvenile habitat:** seagrass beds, muddy seafloor, burrow complexes, and horse mussel beds provide areas with emergent benthic fauna/flora or biogenic structure to provide structure, feeding opportunities and refuge from predation for juvenile snapper.	Spawning aggregations of snapper. Juvenile nursery area. Juvenile habitats are in close proximity to spawning areas. Ecologically intact seagrass habitat / biogenic habitat. Habitat is also associated with other juvenile fish (e.g. trevally and parore)			Zeldis (1993) Morrison et al. (2014)a Jones et al. (2016) Mark Morrison pers coms Clinton Duffy pers coms
Dargaville Beach Ninety Mile Beach	Low salinity areas and uncompacted sands of correct grain size provide important habitats for toheroa.	Toheroa are taonga, endemic, and has a low population status which has not improved despite fishery closures. These beaches and Oreti and Bluecliffs Beaches (in southern New Zealand) are thought to support populations of toheroa that could help regenerate populations in other areas.	Vehicles on beaches. Land use changes potentially leading to reduction of freshwater seeps and nutrients reaching the beach. Loss of sands of suitable grain.size. Climatic events and/or cyclical weather patterns	Trawl, set net, and Danish seining prohibited along the coast. Commercial take of pipi, tuatua, and cockle prohibited.	Berkenbusch and Neubauer (2018) Ross et al., 2018 Beentjes (2020)

25. Summary of work programme to date

175. During the 2023 TAC review of CRA 1 the Minister at the time acknowledged that the TAC reduction alone would not be sufficient to address urchin barrens, and directed FNZ to provide advice on four further measures;

    a. Maximum legal size for CRA 1,

    b. QMA split or sub-area catch limits for CRA 1,

    c. Spatial restrictions for CRA 1, and

    d. Targeted culling of kina.

176. It is important to note that potential sustainability measures for rock lobster are not intended as the sole measure to address urchin barrens. FNZ acknowledges a comprehensive set of measures is required to respond to the causes and effects of urchin barrens, these measures should aim to:

    a. Reduce the number of urchins found in barrens to allow kelp to regrow, and

    b. Increase the abundance and efficacy of urchin predators (including but not limited to rock lobster) to provide for more predation of urchins.

177. A number of measures have been approved to facilitate removal of urchins (kina and *Centrostephanus rodgersii*) from areas of concern. These include:

    a. An increase to the TAC and TACC of the Northland (SUR 1A) and Auckland, Hauraki Gulf, and Bay of Plenty (SUR 1B) kina fisheries on 1 October 2023.[104]

    b. An increase to the recreational daily limit for kina (combined *Evechinus chloroticus* and *Centrostephanus rodgersii*) in Fishery Management Area 1 from 50 kina per fisher per day to 150 kina per fisher per day.[105]

    c. Approval of a traditional non-commercial fishing use under regulation 52(1) of the Amateur Fishing Regulations to allow the taking, disposal, culling, or translocation of kina from traditional fishing grounds to manage the population of kina to maintain the balance of the ecosystem as a traditional non-commercial fishing use.

    d. Approval of a new special permit purpose to enable the removal of sea urchins for the management or prevention of urchin barrens.[106]

178. In addition, measures to increase rock lobster abundance in Northland have already been implemented. These include:

    a. The TAC, TACC, and recreational allowance for the CRA 1 fishery have been reduced three times (in 2020, 2022, and 2023) in response to ongoing concerns related to the abundance of rock lobster (in 2020) and the role of rock lobster in urchin barren formation in CRA 1 (in 2022 and 2023).[107, 108, 109] The cumulative reductions equate to a 37% overall reduction to the TAC since 2019. There has not been sufficient time for the results of these successive reductions to be fully reflected in stock abundance or size structure.

    b. As part of the CRA 1 2023 sustainability review, the Minister at the time also decided to reduce the daily limit from 6 to 3 spiny rock lobster (within the combined daily limit of 6 rock lobsters) to manage recreational harvest within the 22-tonne allowance. At the time of review, it was estimated that the daily limit reduction would reduce recreational harvest by 15% to 19%.

    c. In January 2024, the Minister approved a two-year fishing closure and fishing method prohibition at Tutukaka Harbour, Ngunguru Bay, Ngunguru River, Horahora River, and surrounding areas to help increase the abundance of rock lobster.[110] During

[104] Available at: Review of sustainability measures for fisheries – October 2023 round
[105] Available at: Review of the recreational daily kina limit in fishery management area 1 (the east coast of the upper North Island)
[106] Available at: Enabling the removal of sea urchins for the management or prevention of urchin barrens
[107] Available at: Review of sustainability measures for 1 April 2020
[108] Available at: Review of sustainability measures for selected fish stocks – April 2022 round
[109] Available at: Review of sustainability measures for fisheries – April 2023 round
[110] Available at: Proposed temporary fishery closure and a netting ban at Tutukaka Harbour, Ngunguru Bay and Ngunguru River, Northland

2024, FNZ provided funding for local hapū/community to conduct a kina mapping, management, and monitoring project in the recently implemented section 186A closure at Tututaka and Ngunguru.

d. In August 2024, the Minister approved a two-year fishing closure at Waiheke Island to help increase the abundance of rock lobster.[111]

179. FNZ has also sought input and participation from tangata whenua and undertaken pre-engagement with stakeholders on a range of measures both specific to rock lobster and wider measures. This included;

a. In July and August 2023, held a series of management workshops with the National Rock Lobster Management Group and the joint applicants on the 2022 CRA 1 Judicial Review (ELI, Forest & Bird, and Te Uri o Hikihiki Hapū). The workshops were to discuss the management tools identified in paragraph 175 above for the purpose of facilitating input from tangata whenua and stakeholders regarding the costs and benefits of these proposed tools and to identify additional tools they may propose for consideration.

b. Attending a hui in May 2024 hosted by the Minister to engage with the local community in Northland to discuss initiatives and management tools to reduce the spread and extent of kina barrens.

c. FNZ attended Iwi Fisheries Forums in Northland on multiple occasions to provide information on research undertaken and progress with the wider kina barren work programme and to gain input on rock lobster management measures.

180. FNZ has contracted a range of research and facilitated workshops to assist in identifying and filling these knowledge gaps. Relevant research and work include:

a. In 2023, FNZ funded a literature review to better understand the current state of knowledge informing the trophic cascade hypothesis and fishing pressure in relation to sea urchin barren habitat on coastal rocky reef systems within New Zealand.[112]

b. During 2023 and 2024, FNZ participated in a Sustainable Seas National Science Challenge case study to develop a decision making tool for evaluating management approaches to kina barrens.

c. In March 2023, FNZ facilitated a national kina barren science workshop to prioritise science needs to address sea urchin barrens in fisheries management decisions.[113]

d. In 2024, FNZ contracted research project ZBD2023-03: Summarising and updating knowledge on the distribution of kina barrens in key regions of New Zealand. This project is expected to collate existing data on the spatial and temporal extent of sea urchin barrens in NZ, identify information gaps, and collect additional data for the upper North Island (Cape Reinga to East Cape) to inform management and monitor future change.

[111] Available at: Proposed temporary fishery closures in the Hauraki Gulf | NZ Government (mpi.govt.nz)
[112] Available at: AEBR 324 Fishery-induced trophic cascades and sea urchin barrens in New Zealand: a review and discussion for management (mpi.govt.nz)
[113] See section 8 in AEBR 324 Fishery-induced trophic cascades and sea urchin barrens in New Zealand: a review and discussion for management (mpi.govt.nz)

26. References

Alfaro, A.C., Jeffs, A.G., Gardner, J.P.A., Bollard Breen, B.A., and Wilkin, J. (2011). Green-lipped Mussels in GLM 9. New Zealand Fisheries Assessment Report 2011/48.

Andrew, N. L. & MacDiarmid, A. B. (1991). Interrelations between sea urchins and spiny lobsters in northeastern New Zealand. *Marine Ecology Progress Series, 70*, 211–222. https://doi.org/10.3354/meps070211

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: 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.

Babcock, R. C., Shears, N.T., Alcala A. C., Barrett, N. S., Edgar, G. J., Lafferty, K.D., McClanahan, T.R., and Russ, G. R. (2010). "Decadal Trends in Marine Reserves Reveal Differential Rates of Change in Direct and Indirect Effects." *Proceedings of the National Academy of Sciences of the United States of America* **107**: 18256–61.

Balemi, C. A. & Shears, N. T. (2023). Emergence of the subtropical sea urchin Centrostephanus rodgersii as a threat to kelp forest ecosystems in northern New Zealand. *Frontiers in Marine Science, 10*:1224067. doi: 10.3389/fmars.2023.1224067

Beentjes, M.P. (2020). Distribution and abundance of toheroa at Oreti Beach in 2019 and review of historical surveys. New Zealand Fisheries Assessment Report 2020/23. Ministry for Primary Industries, Wellington. 43 pp.

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.

Berkenbusch, K. and Neubauer, P. (2018). Distribution and abundance of toheroa at Oreti Beach, Murihiku/Southland, 2016–17. New Zealand Fisheries Assessment Report 2018/26. Ministry for Primary Industries, Wellington. 22 pp.

Booth J.D., Carruthers, A.D., Bolt, C.D., and Stewart, R.A. (1991). Measuring depth of settlement in the red rock lobster, Jasus edwardsii. New Zealand Journal of Marine and Freshwater Research, 25, (2), 123-132. DOI: 10.1080/00288330.1991.9516462

Booth, J.D. (2017). Characterising fisheries and other marine harvesting in the Bay of Islands, with ecological consequences, from first human settlement to the present. New Zealand Aquatic Environment and Biodiversity Report No. 186. 86 p.

Bradford R.W., Griffin D., Bruce B.D. (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.

Chaput, R., Quigley, C. N., Weppe, S. B., Jeffs, A. G., de Souza, J. M., and Gardner, J. P. (2023). Identifying the source populations supplying a vital economic marine species for the New Zealand aquaculture industry. *Scientific Reports*, *13*(1), 9344

Chiswell, S. M., and 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.

Choat, J. H. and Schiel, D.R. (1982). Patterns of distribution and abundance of large brown algae and invertebrate herbivores in subtidal regions of northern New Zealand. Journal of Experimental Marine Biology and Ecology 60:129–162.

Coleman, R.A., Hoskin, M.G., von Carlshausen, E., Davis, C.M. (2013). Using a no-take zone to assess the impacts of fishing: sessile epifauna appear insensitive to environmental disturbances from commercial potting. *J. Exp. Mar. Biol. Ecol. 440*, 100–107.

Day, J. K., Knott, N. A., Swadling, D. S., & Ayre, D. J. (2021). Dietary analysis and mesocosm feeding trials confirm the eastern rock lobster (Sagmariasus verreauxi) as a generalist predator that can avoid ingesting urchin spines during feeding. *Marine and Freshwater Research*, *72*(8), 1220-1232.

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

Denny C.M., Babcock R.C. (2004). Do partial marine reserves protect reef fish assemblages? Biological Conservation. 116:119–129. doi:10.1016/S0006-3207(03)00183-6.

Department of Conservation and Fisheries New Zealand. (2020a). 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. (2020b). 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., and 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. 324*. 110 p. Accessible at: AEBR 324 Fishery-induced trophic cascades and sea urchin barrens in New Zealand: a review and discussion for management

Edgar G.J., Stuart-Smith R.D., Thomson R.J., and Freeman D.J. (2017). Consistent multi-level trophic effects of marine reserve protection across northern New Zealand. *PLoS ONE 12*: e0177216.

Eno, N.C., MacDonald, D.S., Kinnear, J.A.M., Amos, S.C., Chapman, C.J., Clark, R.A., Bunker, F.S.P.D., Munro, C., (2001). Effects of crustacean traps on benthic fauna. ICES (Int. Counc. Explor. Sea) J. Mar. Sci.: J. Conseil 58, 11–20.

Filbee-Dexter, K., & Scheibling, R. (2014). Sea urchin barrens as alternative stable states of collapsed kelp ecosystems. *Marine Ecology Progress Series, 495*, 1–25. https://doi.org/10.3354/meps10573

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. 689.p

Fisheries New Zealand. (2024). Aquatic Environment and Biodiversity Annual Review. Chapter 13: Trophic and Ecosystem Level Effects (in review).

Flood, A. S. (2021). Gut Instincts: Feeding behaviour of the rock lobster, *Jasus edwardsii* [Doctor of Philosophy]. The University of Auckland.

Froude, V. A. (2016). Kelp cover and urchin barrens in the Bay of Islands: A 2016 Baseline (71 p.) [A report prepared for the Bay of Islands Maritime Park Fish Forever Working Group]. Pacific Eco-Logic Ltd.

Gall S. C., Rodwell L. D., Clark S., Robbins T., Attrill M. J., Holmes L. A., et al. (2020). The impact of potting for crustaceans on temperate rocky reef habitats: Implications for management. *Mar. Environ. Res. 162*, 105134. doi: 10.1016/j.marenvres.2020.105134

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.

Heinemann, A.; Gray, A. (2024). National Panel Survey of Marine Recreational Fishers 2022– 2023. New Zealand Fisheries Assessment Report 2024/51. 116 p.

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 J.A., 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

Hesse, J., Stanley, J., & Jeffs, A. (2016). Relative predation risk in two types of habitat for juvenile Australasian spiny lobsters, *Jasus edwardsii,* Marine Biology Research, 12:9, 895-906, DOI: 10.1080/17451000.2016.1236200

Hinojosa, I.A., Green, B., Gardner, C., Jeffs, A. (2015). Settlement and early survival of southern rock lobster, Jasus edwardsii, under climate-driven decline of kelp habitats. ICES J Mar Sci. 72(Supplement 1): i59-i68.

Hinojosa, I.A., Gardner, C., Green, B.S., Jeffs, A.G. (2018). Coastal chemical cues for settlement of the southern rock lobster, Jasus edwardsii. Bulletin of Marine Science. 94:619-634.

Holdsworth, J.C. (2014). Rock lobster amateur harvest estimates for Northland, New Zealand in 2013-14. New Zealand Fisheries Assessment Report 2014/70. 31p.

Johnson, K.S.; Maggs, J.Q.; Taylor, R.; Evans, O.E.; Armiger, H. (2024). Estimation of recreational harvest of red and packhorse rock lobster in the CRA 1 area (2022–23). New Zealand Fisheries Assessment Report 2024/54. 21 p.

Jones, E.G., Morrison, M.A., Davey, N., Hartill, B.W., and Sutton, C. (2016). Biogenic habitats on New Zealand's continental shelf. Part I: Local ecological knowledge. New Zealand Aquatic Environment and Biodiversity Report No. 174. Ministry for Primary Industries, Wellington. 99 pp.

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

Kerr et al (2024) Estimating the extent of urchin barrens and kelp forest loss in northeastern Aotearoa, New Zealand.

Leleu, K., Remy-Zephir, B., Grace, R., & Costello, M. J. (2012). Mapping habitats in a marine reserve showed how a 30-year trophic cascade altered ecosystem structure. *Biological Conservation*, *155*, 193-201.

Ling, S. D., Scheibling, R. E., Rassweiler, A., Johnson, C. R., Shears, N., Connell, S. D., Salomon, A. K., Norderhaug, K. M., Pérez-Matus, A., Hernández, J. C., Clemente, S., Blamey, L. K., Hereu, B., Ballesteros, E., Sala, E., Garrabou, J., Cebrian, E., Zabala, M., Fujita, D., & Johnson, L. E. (2015). Global regime shift dynamics of catastrophic sea urchin overgrazing. *Philosophical Transactions of the Royal Society B: Biological Sciences, 370* (1659), 20130269. https://doi.org/10.1098/rstb.2013.0269

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. B., Freeman, D., & Kelly, S. (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(3)*, 313–333. https://doi.org/10.1080/00288330.2013.810651

Marinovich J., Shears, N., & Parsons, D. (2023). Snapper Snacks: Rocky reef snapper (*Chrysophrys auratus*) diet in northeastern New Zealand. A poster presentation at New Zealand Marine Sciences Society Conference, Wellington, June 2023.

Miller, K. I., Balemi, C. A., Bell, D. R., Blain, C. O., Caiger, P. E., Hanns, B. J., ... & Shears, N. T. (2024). Large-scale one-off sea urchin removal promotes rapid kelp recovery in urchin barrens. *Restoration Ecology*, *32*(1), e14060.

Morrison, M.A., Jones, E.G., Parsons, D.P., and Grant, C.M. (2014a). Habitats and areas of particular significance for coastal finfish fisheries management in New Zealand: A review of concepts and life history knowledge, and suggestions for future research. New Zealand Aquatic Environment and Biodiversity Report No. 125. Ministry for Primary Industries, Wellington. 205 pp.

NZHC 2969: The Environmental Law Initiative v Minister For Oceans And Fisheries (2022). High Court judgment decision for Northland rock lobster (New Zealand High Court). Available online at: https://www.mpi.govt.nz/dmsdocument/55012-2022-High-Court-judgment-decision-for-Northland-rock-lobster.

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.

Peleg, O., Blain, C. O., & Shears, N. T. (2023). Long-term marine protection enhances kelp forest ecosystem stability. *Ecological Applications*, *33*(7), e2895.

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

Roberts, J.O.; Webber, D.N. (2024). Review of red rock lobster (*Jasus edwardsii*) recruitment processes and the puerulus collector programme. *New Zealand Fisheries Assessment Report 2024/68.* 108 p. Accessible at: FAR 2024/68 Review of red rock lobster (Jasus edwardsii) recruitment processes and the puerulus collector programme

Rosas-Luis, R., Navarro, J., Loor-Andrade, P., & Forero, M. G. (2017). Feeding ecology and trophic relationships of pelagic sharks and billfishes coexisting in the central eastern Pacific Ocean. Marine Ecology Progress Series, 573, 191-201.

Ross, P. M., Beentjes, M. P., Cope, J., W. P. de Lange, B. G. McFadgen, P. Redfearn, B. Searle, M. Skerrett, H. Smith, S. Smith, J. Te Tuhi, J. Tamihana & J. R. Williams (2018) The biology, ecology and history of toheroa (Paphiesventricosa): a review of scientific, local and customary knowledge, New Zealand Journal of Marine and Freshwater Research, 52:2, 196-231.

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.

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. https://doi.org/10.3354/meps246001

Shears, N.T. & Babcock, R. C. (2004). Community composition and structure of shallow subtidal reefs in northeastern New Zealand. Science for Conservation 245. Department of Conservation, Wellington, New Zealand.

Shears, N. T., Babcock, R. C., Duffy, C. A. J., & Walker, J. W. (2004). Validation of qualitative habitat descriptors commonly used to classify subtidal reef assemblages in north-eastern New Zealand. New Zealand Journal of Marine and Freshwater Research, 38(4), 743–752. https://doi.org/10.1080/00288330.2004.9517273

Shears NT, Grace RV, Usmar NR, Kerr VC, Babcock RC. (2006). Long-term trends in lobster populations in a partially protected vs. no-take Marine Park. *Biological Conservation.* :221–231. doi:10.1016/j.biocon.2006.04.001.

Shelamoff, V., Layton, C., Tatsumi, M., Cameron, M.J., Wright, J.T., and Johnson, C.R. (2022). Restored kelp facilitates lobster recruitment but not other mid-trophic macroinvertebrates. Aquatic Conservation: Marine and Freshwater Ecosystems. 32: 1 115-1125.

Smith J. E., Keane J., Oellermann M., Mundy C., Gardner C. (2023) Lobster predation on barren-forming sea urchins is more prevalent in habitats where small urchins are common: a multi-method diet analysis. *Marine and Freshwater Research* 74, 1493-1505.

Spyksma, A. J., Taylor, R. B., & Shears, N. T. (2017). Predation cues rather than resource availability promote cryptic behaviour in a habitat-forming sea urchin. *Oecologia*, *183*, 821-829.

Stanley, J.A., Radford, C.A., Jeffs, A.G. (2012). Location, location, location: finding a suitable home among the noise. Proceedings of the Royal Society B: Biological Sciences 279: 3622-3631.

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

Starr, P.J. (2024) Rock lobster catch and effort data: 1979 - 80 to 2022-23. New Zealand Fisheries Assessment Report 2024/10. 146 p.

Stephenson, F., Mill, A.C., Scott, C.L., Polunin, N.V.C., Fitzsimmons, C. (2017). Experimental potting impacts on common UK reef habitats in areas of high and low fishing pressure. ICES (Int. Counc. Explor. Sea) *J. Mar. Sci. 74 (6),* 1648–1659.

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.

Sweatman, J. A. (2021). The population history and demography of the long-spined sea urchin (Centrostephanus rodgersii) in Aotearoa New Zealand [Master of Science in Biological Science]. Massey University.

Taylor R. B. (1998). Density, biomass and productivity of animals in four subtidal rocky reef habitats: the importance of small mobile invertebrates. Marine Ecology Progress Series.172: 37-51. doi: 10.3354/meps172037.

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

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., Wing, S., O'Connell-Milne, S., Kolodzey, S., McMullin, R., Durante, L., & Frew, R. (2019). Organic matter derived from kelp supports a large proportion of biomass in temperate rocky reef fish communities: Implications for ecosystem-based management. *Aquatic Conservation: Marine and Freshwater Ecosystems*, *29*(9), 1503-1519.

Webber, D.N.; Roberts, J.O.; Starr, P.J.; Rudd, M.B.; Pons, M. (2024). Data for the 2023 stock assessment of red rock lobsters (*Jasus edwardsii*) in CRA 6. *New Zealand Fisheries Assessment Report 2024/19*. 73 p.

Williams, J.; Ferguson, H.; Tuck, I. (2013). Distribution and abundance of toheroa (Paphies ventricosa) and tuatua (P. subtriangulata) at Ninety Mile Beach in 2010 and Dargaville Beach in 2011. New Zealand Fisheries Assessment Report 2013/39. 52 p.

Wynne-Jones, J.; Gray, A.; Hill, L.; Heinemann, A. (2014). National Panel Survey Of Marine Recreational Fishers 2011–12: Harvest Estimates.

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. 104 p.

Zeldis, J.R., Murdoch, R.C., Cordue, P.L., Page, M.J. (1998). Distribution of hoki (Macruronus novaezelandiae) eggs, larvae, and adults off Westland, New Zealand, and the design of an egg production survey to estimate hoki biomass. Canadian Journal of Fisheries and Aquatic Sciences 55: 1682–1694.

Reviews of rock lobster and kina stocks:

CRA 1 Sustainability Round Review April 2023: Review of sustainability measures for fisheries – April 2023 round | NZ Government (mpi.govt.nz)

CRA 1 Sustainability Round Review April 2022: https://www.mpi.govt.nz/consultations/review-of-sustainability-measures-2022-april-round/

CRA 1 Sustainability Round Review April 2021: Review of sustainability measures – 2021 April round | NZ Government (mpi.govt.nz)

CRA 1, 3, 4, 7 and 8 Sustainability Round Review April 2020: Review of sustainability measures for 1 April 2020

SUR 1A & 1B Sustainability Round Review October 2023: Review of sustainability measures for fisheries – October 2023 round | NZ Government (mpi.govt.nz)

Fisheries Management Area 1 kina recreational daily limit review July 2024: Review of the recreational daily kina limit in fishery management area 1 (the east coast of the upper North Island) | NZ Government (mpi.govt.nz)

Special permit purpose to enable removal of sea urchins for the management or prevention of urchin barrens July 2024: Enabling the removal of sea urchins for the management or prevention of urchin barrens | NZ Government (mpi.govt.nz)