Supporting a Sustainable Fishery

Executive Summary of the Eastern Tarakihi Management Strategy and Rebuild Plan 2019

SOUTHERN INSHORE FISHERIES
MANAGEMENT COMPANY LIMITED

Te Ohu Kaimoana

FISHERIES INSHORE NEW ZEALAND

What does tarakihi mean to Aotearoa New Zealand?

Available for harvest year round and caught along entire East Coast

90%
Catch sold to local market

>80%
of Kiwis eat fish once a month

<12%
of Kiwis catch their own fish anually

Tarakihi | *Nemadactylus macropterus*

Major part of inshore mixed trawl fishery

38%
Iwi owned quota with other quota owners also providing a significant investment

Supports a diverse inshore fishing community

Our objective

Tarakihi is an important fishery for all New Zealanders; it is a staple fish supporting local markets and recreational interests. We propose to implement an effective strategy to rebuild and maintain a healthy fishery for our future generations.

Goal: *To rebuild and maintain the stock at or above the biomass that achieves maximum sustainable yield.*

Action: *Engaged and active management throughout entire rebuild timeframe and beyond.*

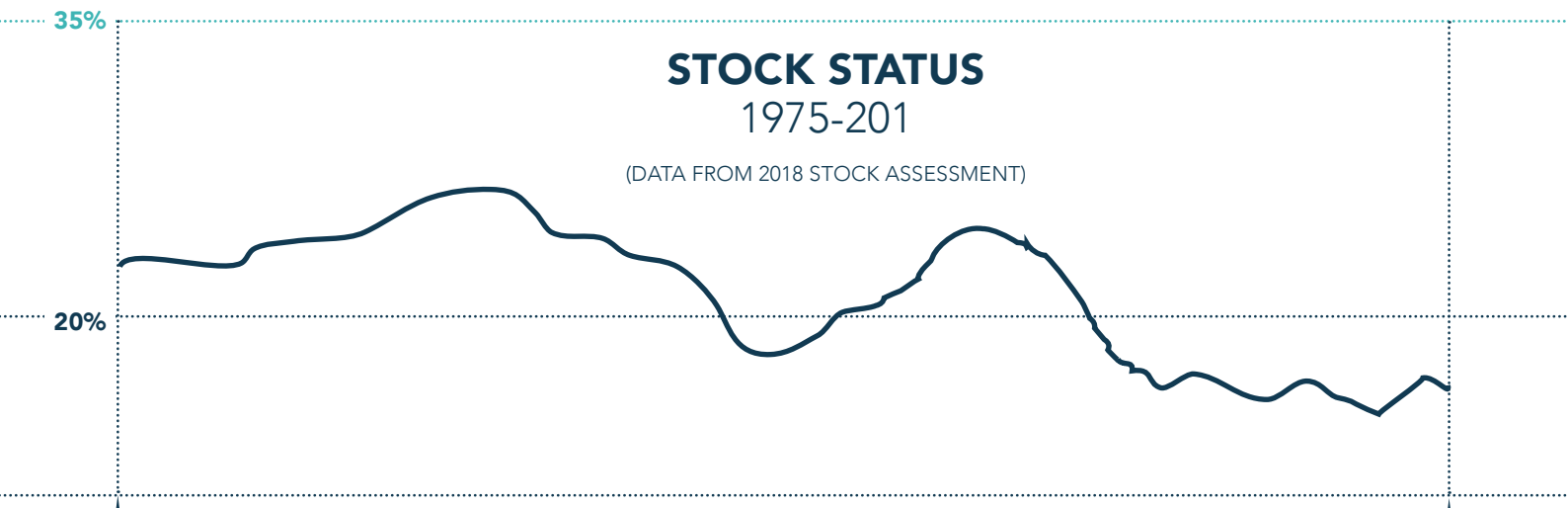
In this document we briefly outline the process to achieve our objective.

This paper is an executive summary of the full Eastern tarakihi management strategy and rebuild plan (the Strategy), which is available on the Fisheries Inshore New Zealand website - www.inshore.co.nz

Why we need a Rebuild Plan

Best available science has shown a long-term gradual decline of tarakihi on the east coast of New Zealand. We need to rebuild that tarakihi stock at a rate that continues to provide fish to our communities and preserves the capacity of fishers to provide necessary data to inform science for further management.

The first full stock assessment of east coast tarakihi in 2017-18 gave a new understanding about the nature of that tarakihi fishery. Tarakihi in the east coast shown on the map to the right (TAR1E,2,3,and7E) has been managed as four stocks since 1986. Research has indicated that these stocks have connections and are currently assumed to be one stock. The stock assessment showed this east coast stock to be below the level of biomass (20% unfished biomass) at which immediate action should be taken to reduce fishing mortality so the stock can recover; consequently a 25% reduction in commercial catch limit across the east coast was implemented starting 1 Oct 2018. The stock assessment showed that this stock has been near this limit since 1975 as shown below. An update of the stock assessment in 2019 showed the biomass in 2016-17 was 16.5% and 15.9% in 2017-18 before the catch reduction.

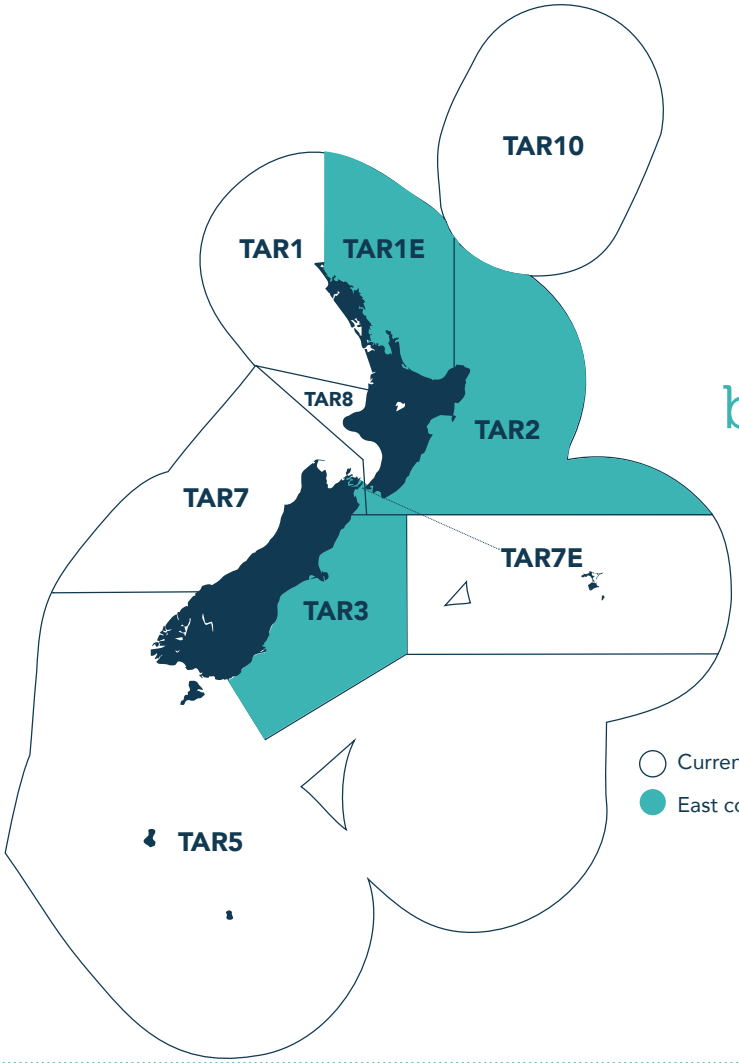


1975 - 2017

- Stock biomass unknown
- East coast tarakihi managed as four distinct stocks
- Stock hasn't been above 27% since 1975
- Below 20% since early 2000s.

2017 - 2018

- East coast tarakihi is assumed to be one stock
- Stock assessment in 2017 calculated tarakihi biomass for 2016-17 to be 17.1% (2019 update showed the 2016-17 biomass to be 16.5%)
- Tarakihi Management Strategy is developed with an option to reduce total allowable commercial catch limits by 25%.



Sustainable fisheries balance the biological, social, cultural and economic needs of Aotearoa NZ.

RESPOND - RESEARCH - REASSESS

2018-19

2018 - 2019

» Minister reduced catch in line with Industry Strategy recommendations

» Tarakihi Strategy commenced to rebuild and manage the fish stock in a manner that benefits all New Zealanders:

» Management measures **(Workstream 1)**

» Research **(Workstream 2).**

2019

2019 - onwards

» Updated assessment shows biomass is 15.9% in 2017-18

» Tarakihi Strategy continues research, monitoring and management measures that rebuild and maintain the fishery

» Adopt improved selectivity measures to increase rate of rebuild in addition to 2018 catch reduction

» Management procedure – flexible, timely decision making to rebuild and maintain the stock at or above the long-term target.

WORKSTREAM 1

Management Measures

Our inshore fisheries are diverse in terms of where species are found as well as the techniques used to harvest them. This makes management complex. A rebuild can be enhanced by a variety of measures that are appropriate for each vessel and where it is fishing.

New Zealand fishers know their fishery well. They understand where certain fish are and the best ways to catch them. Tarakihi has a wide depth range so it is regularly caught when targeting other fish such as snapper (North Island) and red cod (South Island). For this reason it is paramount to work with fishers to understand what happens on the water so fishers can implement measures that further support the tarakihi fishery. A 'one size fits all' approach won't work here so we are committed to providing and supporting a full suite of measures that reflect the complexity and importance of the fishery and collectively will be the most effective at rebuilding the fishery.

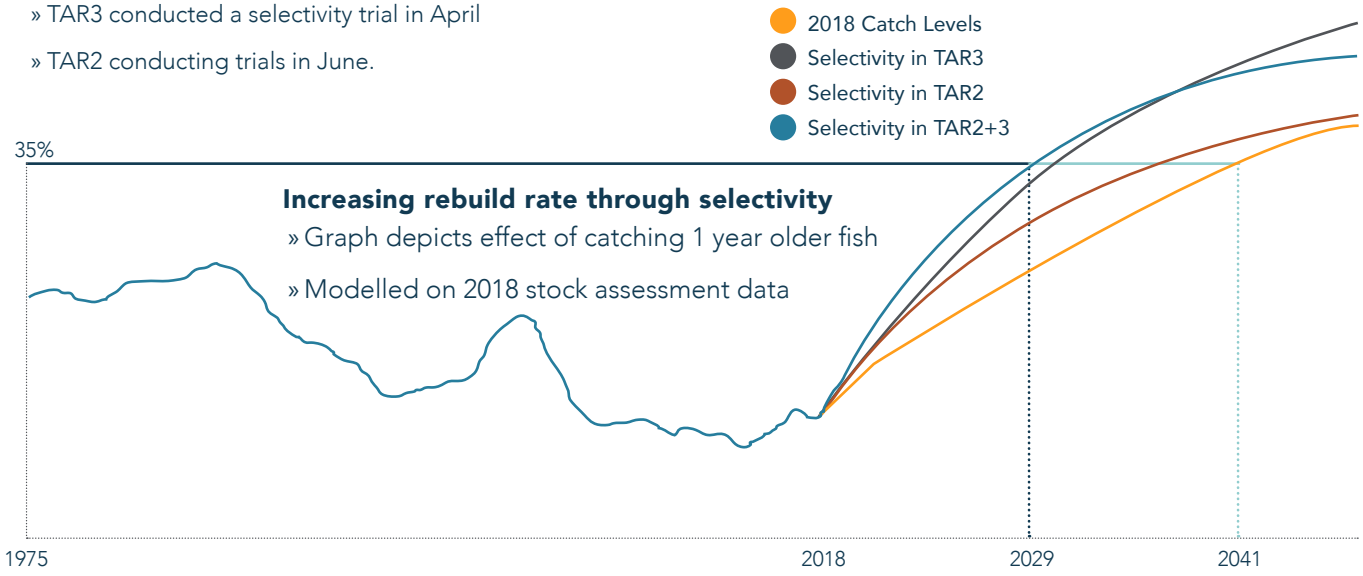
The figure below shows that with the reduction in catch from 1 Oct 2018 the fishery is recovering as required by the Fisheries Act. Industry considers no further cuts in catch should occur before the next stock assessment but we should continue to reduce mortalities through selectivity measures.

Selectivity measures

- Modelling indicates that improved selectivity from commercial gear can increase the rate of rebuild significantly.
- As part of the Strategy and specified in regional plans is a commitment to:
  - Selectivity research
  - Move-on rules to avoid juvenile tarakihi
  - Reduction of tarikihi targeting
  - Spatial measures – voluntary closed areas
- Industry proposes to set a portion of tarakihi catch to use in trials to improve selectivity
- TAR3 conducted a selectivity trial in April
- TAR2 conducting trials in June.

Catch reduction & catch spreading

- Total Allowable Catch reduction to allow recovery - 25% catch reduction from 1 Oct 2018
- Industry-led and implemented catch spreading further reduces pressure on the east - commenced 2018.



Reporting sub-minimum legal size (MLS) catches

» Reporting of sub-MLS - commenced November 2018

» Reporting indicates areas and times of high sub-MLS abundance

» Commitment to avoid these where possible and use move-on rules to reduce small tarakihi catch

» Having this information and using it to avoid small tarakihi contributes to a faster rebuild.

Development and use of a management procedure

A management procedure is designed to identify fishery rebuild strategies and ongoing harvest strategies that are robust to both uncertainty and natural variation while balancing biological and socio-economic factors. We are committed to developing an east coast tarakihi management procedure informed by 2020-21 stock assessment. Further changes to the total allowable catch would be premature before this assessment.

» Development of a management procedure to ensure the rebuild of the stock within defined management timeframes

» Management procedure to be continually informed by science and our improved knowledge of the fishery

» Provides feedback loop to ensure continued effective informed management

» Commitment to use of ongoing timely, effective decision rules to manage the fishery.

Implementation at a regional scale

» Regional management plans in place to implement measures and monitor progress

» Implementing measures regionally in a way that best reflects the nature of the specific area as part of the overarching Strategy

» Improves ability to manage the complexity of the fishery as a whole

» Increases engagement as a collective agreement to support management strategy and rebuild initiatives

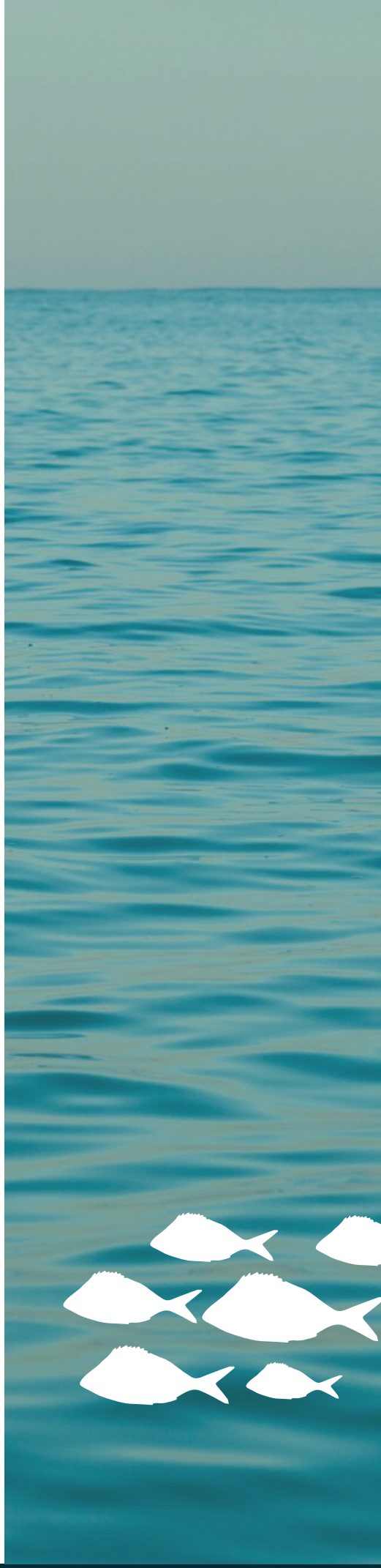
» Regional plans are deemed the minimum commitment for each area, additional management from individual companies or persons is fully supported.

Using Section 77 of the Fisheries Act

» Section 77 allows the Minister to implement effective controls on individual fishers that exceed pre-determined thresholds of over-catch

» This measure focusses on managing any fisher that demonstrates a disregard for the rebuild of the eastern tarakihi fishery

» We support the use of section 77 to incentivise collective action of the Strategy



WORKSTREAM 2

Enhancing Science

Best management decisions come from robust and comprehensive information. The Strategy provides additional research that improves our knowledge and reduces uncertainty around the eastern tarakihi stock.

The sustainability of New Zealand fisheries is supported by high quality science carried out each year. There are robust processes to ensure we make decisions with best available information. Implementing a successful strategy to rebuild and maintain the eastern tarakihi fishery requires a long-term research plan that provides us with the appropriate information we need to make wise decisions.

Improved understanding of fisheries data

» Inshore management of fisheries uses fisheries dependent data

» By use of complex calculations and modelling, data informs catch per unit effort. *(e.g. How many fish you catch per hour)*

» Incorporating information on changes in fishing gear and fisher behaviour improves this estimate. We are working alongside FNZ and fishers to collate this, integrated with electronic reporting

» Valuable for tarakihi and wider fisheries management.

Catch sampling

» Tarakihi catch from commercial fishing is sampled and measured

» Informs a more detailed estimate of the population

» Provides data on size and year classes

» Key information source for demographics predicting future abundance.

» Provides confirmation of one eastern stock and relationship with western tarakihi.

Management Strategy Evaluation

» A Management Strategy Evaluation (MSE) is the process carried out in order to develop a Management Procedure (Workstream 1)

» MSEs run thousands of simulations which enable the model to best deal with uncertainty and define target levels against accepted risk criteria

» The MSE run for east coast tarkihi produced a real-world biomass target of 35% that met the risk criteria

» The 35% model runs included making sure the risk of the stock going below the limit where the fishery is closed to be less than 2%, whilst providing for sustainable utilisation.

Fisheries Independent Surveys

» Fishery independent data supports and ground truths commercial fisheries data

» Currently conducted in the East Coast South Island

» Industry is committed to developing a survey design that can be used for East Coast North Island fish stocks, including tarakihi

» Provides better and more comprehensive information for robust managment

» Valuable for wider fisheries management.

Gear database

» Scientists and fishers have highlighted the need for better connection between scientific models and on the water practice

» Innovations have occurred in fishing gear, but this has not been recorded

» Propose to build database where fishers will record data on gear type and configuration through using electronic reporting to log important net details for each haul

» This data will be collected and applied to fisheries science.

Electronic monitoring

» Using electronic and global position reporting as part of a monitoring system

» Additional analysis of catch will show whether, where and how measures are effective

» Provides a more accurate data source for analysing sub-MLS and gear innovations

» Allows timely adjustment of measures based on the effectiveness reported.

Genetics study

» Supporting researchers to better understand the connectivity of tarakihi through genetics

» Will inform our understanding of stock structure for management purposes.

Fish behaviour

» Developing research to use cameras to assess fish behaviour in fishing gear

» Understanding behaviour is informative for how we manage fisheries, including improving selectivity of fishing gear

» Valuable for tarakihi and wider fisheries management.

Assessing impacts of changing environmental conditions

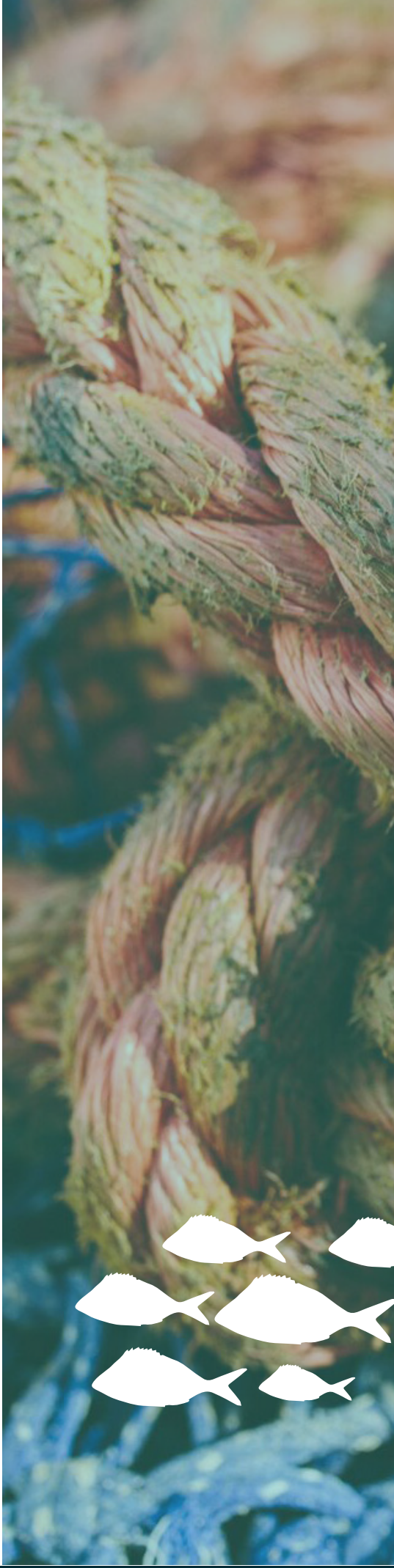
» Climate change is an ever increasing issue

» Research has started to understand the impacts of temperature change on species distribution

» Industry developing research to complement existing research to better understand this.

Collection of charter vessel catches

» Wider stakeholder engagement highlighted the potential for collaborative data collection.



Assessing Approaches

Ensuring tarakihi is sustainable for future generations is the purpose for developing and implementing the Strategy to rebuild and maintain the east coast fishery. There are many approaches that can be taken to rebuild a stock. Careful consideration needs to be taken in order to sustain the fishing community and associated local economy while moving the stock towards maximum sustainable yield.

One approach to the rebuild is to apply the timeframes and targets that are set out in Fisheries New Zealand's (FNZ) harvest strategy guidelines. These guidelines group all fish into five categories based on biological characteristics (V) - this approach is FNZ's generic default.

Instead, based on all available information we propose a tarakihi-specific target with management decisions that balance biological, social and economic factors (U). The latter approach has been used successfully in New Zealand and internationally.

Default Approach

The harvest strategy guidelines provide target and timeframe defaults from five ranks of biological characteristics. For tarakihi these defaults translate to a target of 40% unfished biomass in ten years. This would mean cutting the current allowable commercial catch by 50% and in ten years the stock should be at the 40% target. This would mean a substantial reduction in fish available to Kiwis through the local market as well as fishers losing their livelihoods. For small fishers it would not be possible to return to the fishery after the rebuild, reducing the diversity of New Zealand's fishing community.

Respond - Research - Reassess approach

The management strategy evaluation (Workstream 2) for tarakihi produced a stock-specific target of 35%. As part of our commitment to rebuilding to this target, we will actively manage on an annual basis. We will use our monitoring to assess the efficacy of our management in Workstreams 1 and 2 and adjust accordingly. This approach ensures the stock is rebuilt using the most effective combination of measures but minimises the negative effects on the fishing community and local markets.

Trade-offs

Sustains biological needs

- Meets biological requirements of the Fisheries Act
- Tarakihi stock is rebuilt
- Minimum time for rebuild (under HSS default)
- Less expensive and complicated for fisheries managers (cost is on fishers and community).

Minimises utilisation, impacting on livelihoods, local markets and progress

- Substantial reduction in fish available to local market (90% of tarakihi sold in Aotearoa NZ)
- Ten year rebuild causes fishers to lose their livelihoods, with impacts worse for small regional companies and operators. Potentially reducing diversity of inshore fishing fleet
- Tarakihi management target is set with no long-term strategy in place - 'set and forget' approach
- Using default options inhibits innovative and progressive management tools
- Fewer resources available for research and innovation due to loss of fisher economy
- Top down management – stick approach
- Doesn't account for the management measures from 2018; only accounts for allowable catch reduction not other measures
- Potential loss of voluntary industry measures
- Uncertainty in long-term (ten year) projections not managed.

Sustains biological, social, economic and cultural needs

- Meets both biological and utilisation parts of the Fisheries Act
- Tarakihi stock is rebuilt
- Active and engaged fisheries management is maximised
- Tarakihi is closely monitored throughout rebuild and beyond with long-term strategy
- Impact on local market minimised
- Enables fishers to adapt and retain their livelihoods
- Ensures managers are making more informed decisions frequently, mitigating effects of uncertainty of long-term projections
- Creates space for innovative fisheries management; accounts for and supports all measures to increase rebuild rate
- Resources invested into long-term management and research that contributes to tarakihi and progresses wider fisheries management
- Encourages responsibility and engagement from all stakeholders.
- Inclusive bottom up approach
- Continued management and ability to react to unforeseen changes.

Time and money for management

- Management strategy more expensive and time consuming to implement than default
- Rebuild longer than default but still meets the requirements of the Fisheries Act and potential to accelerate by using additional tools.

Ensuring success

We recognise that it is actions not just words that demonstrate our commitment to the rebuild and long-term management of the east coast tarakihi fishery.To ensure success we are focussed on providing a framework to collect and analyse relevant data to better inform management, to undertake agile decision-making on any needed adjustments and to be transparent about our performance. We intend the following approach to reporting on the measures set out in Workstreams 1 and 2.

Implementation of reporting and assessment framework

- Designed to openly report progress toward the rebuild and adherence to measures
- Regular reporting on:
    - Catch reduction monitoring
    - Catch spreading
    - Sub-MLS reporting
    - Selectivity measures

Engagement

- We have actively engaged with FNZ to ensure a transparent process where all parties can identify and address issues in a timely and cooperative manner.
- We provided opportunities for wider stakeholders to engage with the Strategy in April 2019 prior to its finalisation as a proposed option.
- Further engagement opportunities expected to be provided in May-June
- Open to building collaborative relationships for better management.

Sustainable fisheries balance the biological social, cultural and economic needs of Aotearoa NZ.

Summary

Tarakihi is an important fishery for all New Zealanders. It is truly a national fish being caught throughout New Zealand with the East Coast being the focus of this Strategy. It forms a significant part of the catch plan of many of our inshore vessels. More than 80% of us eat fish at least once a month but annually less than 12% of us catch our feed. For tarakihi more than 90% caught commercially is sold to Kiwis. We are implementing an effective Strategy to rebuild and maintain the fishery for this and future generations.

Thank you to Seafood New Zealand for providing the photos on the front and back covers and pages 6, 8 and 12.

Contents

SECTION A: INTRODUCTION

Overview

1. This document sets out industry and Te Ohu Kaimoana's *Tarakihi Management Strategy and Rebuild Plan* (Strategy). It is a continuation of our commitment to managing the east coast tarakihi (TAR) fishery.

2. The Strategy is a coherent proposal that provides a suite of measures to both improve fishing operations and enhance the science needed for management. It is a staged rebuild that reflects the history of the fishery, its importance to New Zealanders and reflects the Minister's obligations under the Act.

Structure

3. In addition to the Executive Summary, the Strategy is set out in the following sections:

- Section A: Introduction
- Section B: Our Commitment and Objectives
- Section C: Why we need a rebuild plan
- Section D: Management Measures to Reduce Mortality (Workstream 1)
- Section E: Enhancing Science (Workstream 2)
- Section F: Assessing Approaches
- Section G: Ensuring Success
- Section H: Implementation Plan
- Section I: Appendices

Legal framework

4. This Strategy reflects the legal framework provided in the Fisheries Act 1996 (the Act). The core sections that guide the Minister's key decisions are:

Section 8(1)

The purpose of this Act is to provide for the utilisation of fisheries resources while ensuring sustainability.

Section 13(2)

The Minister shall set a total allowable catch that—

(a) maintains the stock at or above a level that can produce the maximum sustainable yield, having regard to the interdependence of stocks; or

(b) enables the level of any stock whose current level is below that which can produce the maximum sustainable yield to be altered—

(i) in a way and at a rate that will result in the stock being restored to or above a level that can produce the maximum sustainable yield, having regard to the interdependence of stocks; and

(ii) within a period appropriate to the stock, having regard to the biological characteristics of the stock and any environmental conditions affecting the stock; or

(c) enables the level of any stock whose current level is above that which can produce the maximum sustainable yield to be altered in a way and at a rate that will result in the stock moving towards or above a level that can produce the maximum sustainable yield, having regard to the interdependence of stocks.

Section 13(3)

In considering the way in which and rate at which a stock is moved towards or above a level that can produce maximum sustainable yield under subsection (2)(b) or (c), or (2A) (if applicable), the Minister shall have regard to such social, cultural, and economic factors as he or she considers relevant.

Section 10

All persons exercising or performing functions, duties, or powers under this Act, in relation to the utilisation of fisheries resources or ensuring sustainability, shall take into account the following information principles:

(a) decisions should be based on the best available information:

(b) decision makers should consider any uncertainty in the information available in any case:

(c) decision makers should be cautious when information is uncertain, unreliable, or inadequate:

(d) the absence of, or any uncertainty in, any information should not be used as a reason for postponing or failing to take any measure to achieve the purpose of this Act.

Policy context

5. The stock assessment for tarakihi off the east coast of mainland New Zealand indicates that biomass is lower than desired levels. This required the Minister to institute measures to ensure the biomass of the stock increases. This rebuild can be done using a combination of management interventions that collectively rebuild the stock at a rate that the Minister considers is reasonable given the social, economic and cultural factors at play. The aim of those management measures is to rebuild the biomass of the stock to a level that can produce the maximum sustainable yield for that fishery.

6. MPI uses its Harvest Strategy Standard (HSS) as the default policy guidance document to develop a rebuild plan for a fishery in this position.[1] The HSS sets a broad framework to guide decisions. In general terms, it establishes a default target for the rebuild (B_{MSY}) and a default timeframe to rebuild to that target.

7. While these defaults are useful guidance, they are no substitute for fishery-specific information. The HSS should not be considered determinative, particularly in the face of fishery-specific information on target biomass. Similarly, it cannot be determinative regarding the rate of rebuild as the HSS does not consider the relevant social, economic and cultural considerations that must guide the Minister's decision.

[1] Harvest Strategy Standard for New Zealand Fisheries (2008). Ministry of Fisheries – October 2008 at [24].

SECTION B: OUR COMMITMENT AND OBJECTIVES

8. Tarakihi is an important fishery for all New Zealanders; it is a staple that supports local markets and recreational interests. Industry proposes the Strategy as the most effective approach to rebuild and maintain tarakihi as a healthy fishery for future generations. This Strategy specifically addresses the East Coast fishery.

9. Tarakihi is truly a national fish being caught and eaten throughout New Zealand.

10. Earlier research has shown that more than 80% of New Zealanders eat fish at least once a month (with more than 45% percent of us eating it every week); while the best estimates have about 12% of us catching fish at least once a year ourselves. This means that a substantial portion of us rely on the commercial sector to buy the fish we eat. More than 90% of tarakihi caught commercially is sold here to New Zealanders.

11. Commercially, east coast tarakihi is a very important component of inshore fisheries. It is predominantly caught as part of a mixed finfish fishery. It forms a significant part of the catch plans of many of our inshore vessels and is therefore the economic backbone for many fishers. Reductions on the scale proposed by MPI, if adopted, would mean significant reductions in the fleet. There is a very limited ability to swap catch to other fishstocks to maintain viable commercial operations.

12. Our Strategy recognises the need to rebuild the fishery but proposes to do so at a rate that reduces not just the direct impacts on the commercial fishing industry, but also the flow-on effects to the wider seafood sector and community within New Zealand.

13. A fishery as important to New Zealand as tarakihi deserves an active and informed rebuild plan that uses the most effective combination of measures in order to sustain the biological, social, economic and cultural factors associated with it.

Our Goal and Objectives

14. This Strategy is our proposal to enable well-informed and agile fisheries management decisions that move the fishery towards B_{MSY} for the benefit of all New Zealanders, and in accordance with statutory requirements of the Fisheries Act. In doing so we will preserve the capacity of inshore fishers to continue operating and, importantly, provide the necessary monitoring information to guide ongoing management.

    Our goal is to rebuild and maintain the biomass of the eastern Tarakihi fishery at or above maximum sustainable yield

    Our actions will implement a combination of management measures that are monitored for effectiveness and adjusted as needed throughout entire rebuild timeframe and beyond

15. Our specific objectives are:

    a) A short-term objective to increase the biomass of east coast TAR, and determine the effectiveness of additional management measures, by the next stock assessment in 2020/21.

       This will be achieved by maintaining the current TAC and TACC until the next stock assessment, further implementing measures to reduce mortality, and related monitoring and analysis to check the effectiveness of these management measures. This will provide time for industry to trial innovative management to reduce mortality while the stock is rebuilding as a result of the Minister's TAC cuts from 1 October 2018. At current catch levels, the fishery is projected to rebuild (Sections C & F).

    b) A short to medium term objective to improve the knowledge about the stock to inform the next stock assessment in 2020/21, to reduce uncertainties, fine tune management measures to ensure their effectiveness, and allow more informed management decisions in future.

    c) A long-term objective to manage the stock at 35% B_0 to provide sustainable utilisation in line with the requirements of the Act.

16. Two Workstreams have been identified as necessary to provide a robust and effective Strategy that will meet the Minister's obligations, give effect to his directions to industry in 2018, and to allow the inshore fishery to operate effectively as the rebuild progresses. These are:

    - Workstream 1: Management measures to reduce tarakihi mortality
    - Workstream 2: Research to increase our understanding of the fishery

17. The Workstreams are not independent of each other and within each Workstream there is cross-over and synergies.

SECTION C: WHY WE NEED A REBUILD PLAN

18. The first fully quantitative assessment for east coast TAR (Project TAR2016-01) was completed in November 2017.

19. The stock assessment showed linkages between the east coast TAR management areas with east coast tarakihi assumed to be one stock.

20. The stock assessment assumes that tarakihi spawn in three main spawning grounds: Cape Runaway to East Cape, Cape Campbell to Pegasus Bay, and the west coast of the South Island near Jackson Bay. To explain the productivity of the fishery, the hypothesis is that significant numbers of these larvae then move southward from East Cape (across Cook Strait) and Campbell Bay by some unknown mechanism to recruit into the nursery for east coast TAR fishery found south of Banks Peninsula.

21. The current stock hypothesis is that the Canterbury Bight/Pegasus Bay area represents the main nursery ground for the entire eastern stock unit. The hypothesis regarding stock structure is that there is considerable northward movement of fish from the east coast of the South Island to the Wairarapa coast, East Cape and Bay of Plenty.

22. This hypothesis is supported by the available age composition data that shows a progressive increase in the proportion of older fish in the catches as you move north. CPUE analysis indicates a time lag in CPUE trends that supports the observed age composition.

23. The results of the stock assessment also indicate that the stock biomass has been reasonably stable with a moderate declining trend for over 40 years since 1975. It also now shows that the spawning biomass (SB) has remained below the default soft limit of 20% since the mid-2000s and reached its most recent peak of approximately 27% SB_0 in the mid-1980s (Figure 1). The spawning biomass has increased slightly from its lowest level in 2014 following above average recruitment in 2011–2012.

2019 Stock status update (stock status as at September 2018)

24. In April 2019, an update to the 2017 assessment model was completed to ensure the most up to date information is available. The same base model for the assessment was used: a single region model starting in 1975. This was presented to the MPI Science Working Group for peer review.

25. The updated assessment model (base case) include the following 2017/18 data: actual catches from 2017/18; updated CPUE indices (2017/18) and latest recruitment estimates from the TAR 3 recruitment data from the East Coast South Island trawl survey – conducted in March 2018 (i.e. length composition and abundance index).

26. The new CPUE analysis does not include 2018/19 data. As such, it does not yet reflect the catch reductions that the Minister made in 2018 that applied from 1 October that year.

27. The updated (more informed) stock assessment shows that in 2017 the stock biomass was estimated to be 16.5% SB_0. The original stock assessment had the stock status at 17.1% SB_0.

28. The updated stock status in 2018 estimated to be 15.9% SB_0. The original model predicted that in 2018 the stock status would be 15.8% SB_0. The stock status in 2018 is very similar to previous projections from the original stock assessment.

29. The new 2018 catch levels (i.e. a 20% catch reduction / 25% TACC reduction) was used for stock projections. These show that based on current catch, the stock will rebuild (Figure). Projections are from 2018/19 onwards. Results of catch-based projections are very similar to those presented in 2018.

30. These projections are based on catch alone and do not account for the range of other measures that we propose in this Strategy. These will rebuild the fishery even faster; in particular selectivity measures discussed in Section D.

31. The 2019 update noted some inconsistencies in model fit to recent CPUE indices. This highlighted the importance of the current catch sampling programme that will provide the additional commercial age composition data (from 2018/19 and 2019/20) for the next full assessment.

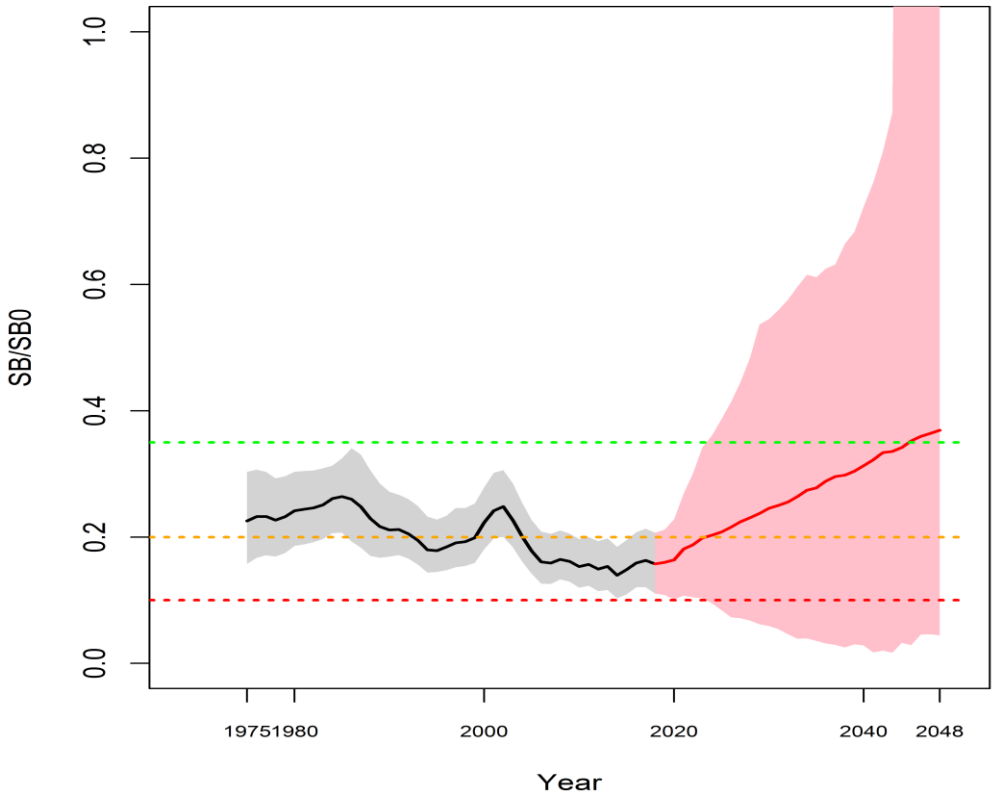


Figure 1: Spawning biomass (SB) as a proportion of unfished biomass (SB_0) as per the updated assessment model in 2019. The red line indicates the projected biomass rebuild based on current catch levels. The green dotted line indicates the management target of 35%, orange line is the soft limit and red line is the hard limit. The grey and red areas banding the stock status line is the level of uncertainty.

SECTION D: MANAGEMENT MEASURES TO REDUCE MORTALITY (Workstream 1)

32. The purpose of this Workstream is to reduce fishing mortality on specific parts of the east coast fishery. This will help the fishery recover using the best combination of management measures.

33. Our inshore fisheries are diverse both in terms of where species are found as well as the techniques used to harvest them. This makes management complex. A rebuild will be enhanced by a variety of measures that are appropriate for each vessel and where it is fishing.

34. The key objectives of Workstream 1 are:

    a) Set up an effective and long-standing management regime for east coast TAR fishery

    b) Provide overarching and regional management measures that reduce mortalities

    c) Ensure timely and active adjustment to the management measures as needed to rebuild the east coast TAR fishery within the agreed timeframe

    The key actions that collectively achieve these objectives are:

    1. Catch reduction
    2. Catch spreading
    3. Reporting sub-minimum legal size (MLS) TAR (TAX)
    4. Assessing of maximum sustainable yield for East Coast tarakihi fishery
    5. Selectivity measures
    6. Regional Management and Monitoring measures
    7. Enacting Section 77 of the Fisheries Act
    8. Developing a Management Procedure

1. Catch reduction

Why it matters

35. A catch reduction is a key component of the Strategy. The Minister's decisions that took effect from 1 October 2018 reduced the commercial catch by 20%. This catch reduction is projected to rebuild the stock. It is therefore a key aspect of the Strategy to implement the current levels and monitor that they are rebuilding the fishery.

36. The 2018/19 catch levels as per the Minister's 2018 decision are:

	Old TACC	Current 'TACC' in EASTERN*	Current catch in east	Industry Management Strategy proposal (2018)	New TACC as per Minister's decision	New catch limit in EASTERN	New catch limit in WESTERN
TAR1	1,447	868	740	30%	1,097	518	579
TAR2	1,796	1,796	1,796	16%	1,500		
TAR3	1,403	1,403	1,287	19%	1,040		
TAR7	1,088	225	225	20%	1,042	179	863
TOTAL	5,734	4,292	4,047	20%	4,677		

Progress to date (Milestones and KPIs)

- Provide updates on the status of TAR1 E/W and TAR7 E/W catch spreading to MPI managers, during the last quarter these reports will be provided monthly to MPI
- The current progress update is provided in Appendix 1

2. Catch spreading

Why it matters

37. The east coast TAR assessment includes the eastern portions of both TAR1 and TAR7. The catch spreading measures relate specifically to the division of catch within these two quota management areas (Figure 2).

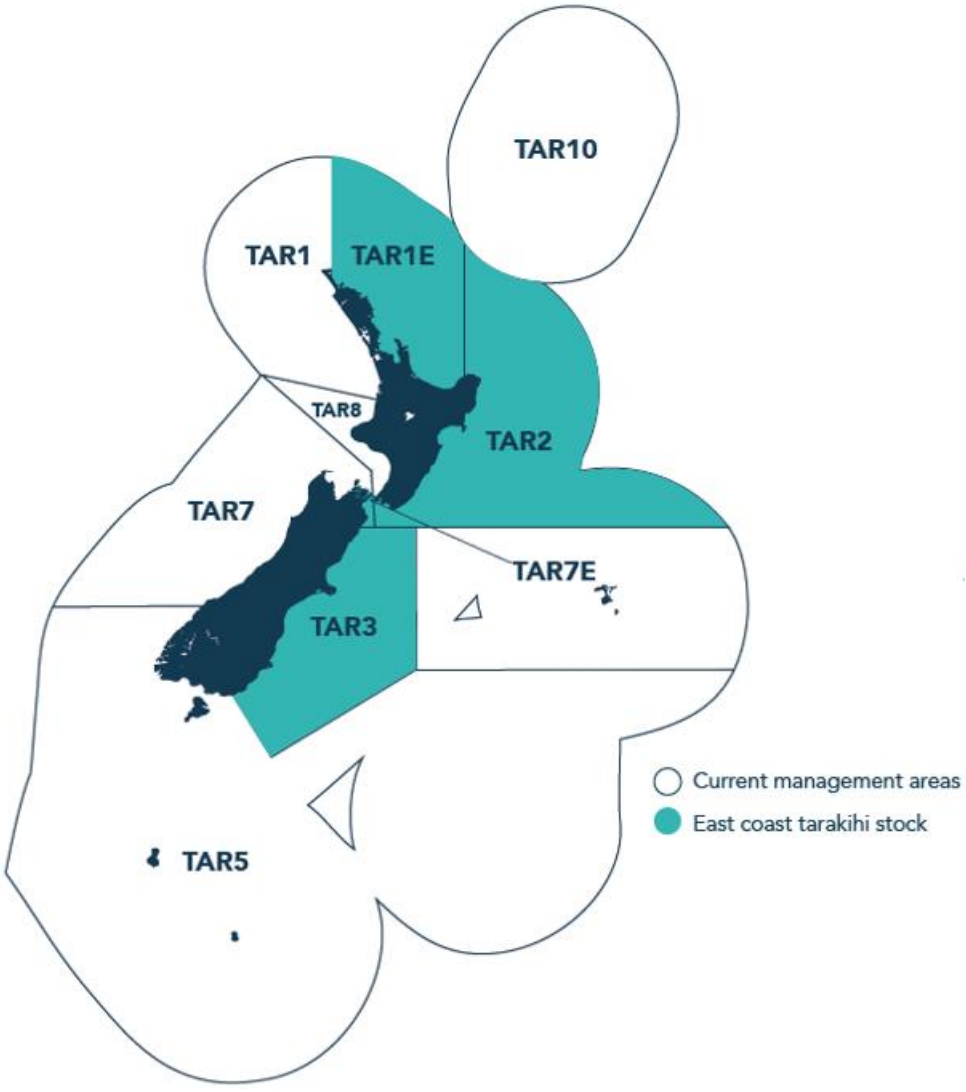


Figure 2: QMAs and sub-areas (TAR 1E & TAR 7E) covered by the east coast tarakihi stock assessment.

38. To address management complexities around TAR1E and TAR1W, and TAR7 eastern Cook Strait, industry is implementing voluntary catch spreading measures. These encourage catches to be reduced in the areas covered by the assessment whilst not affecting those areas that are not incorporated into the stock

assessment. Precedent exists for industry to conduct catch-spreading agreements including in the hoki and orange roughy fisheries—these have operated successfully for many years.

39. Without the implementation of an industry catch spreading arrangement the government has limited ability to effectively manage the catch in the east coast fishery. The industry managed catch spreading approach provides for effective management of this fishery. Responding to a request sought in 2018 by MPI industry proposed and has subsequently implemented catch spreading in TAR 1 and TAR 7 and then focused catch reductions into the eastern areas of these QMAs.

40. Industry is monitoring catch vs TACC across all areas (including TAR1E and TAR7E) looking at cumulative biomass caught and cumulative % ACE caught. This information is being provided to MPI and industry participants.

41. Based on historic catch we have implemented the following catch split:

    - TAR1 is split into TAR1E and TAR1W: providing each quota owner with 47.22% of TAR1 as TAR1E ACE and 52.78% as TAR1W ACE (by taking the reductions out of TAR1E this means only 36% of the previous year)
    - TAR7 is split into TAR7E and TAR7W: providing each quota owner with 17.16% of TAR7 as TAR7E ACE and 82.84% as TAR7W ACE
    - We requested that quota owners and fishers operate their ACE sales and catches within this arrangement while noting that:
        - this is a voluntary measure encouraged by industry but acknowledging it is not illegal for quota owners to sell TAR1 and TAR7 without restriction; and
        - nor is it illegal for fishers to take a greater proportion of their catch in TAR1E or TAR7E

	Total ACE 2017/18	Total ACE available after 2018 TACC cut	Total Eastern ACE available for 2018/19	Total Western ACE available for 2018/19
TAR1	1,447	1,097	518	579
TAR7	1,088	1,043	179	864

42. For the 2018/19 fishing year, Fisheries Inshore New Zealand has contracted FishServe to monitor TAR1E / TAR1W and TAR7E / TAR7W catches against the East / West catch limits. This includes recording and balancing catch with ACE and reporting to Fisheries Inshore New Zealand who in turn will report performance to MPI as per the assessment and reporting framework in this Strategy.

43. The industry instructions and methodology for catch spreading are provided in Appendices 2 and 3.

44. The monitoring and implementation of catch spreading will be developed for 1 October 2019 and integrated with the new ER and GPR reporting requirements. The benefit of this being that automated reporting templates can be set up to enable MPI to monitor the collection of these data to ensure success through transparency (see Section G).

Progress to date (Milestones and KPIs)

- 1st October 2018: start of the TAR1 E/W and TAR7 E/W catch spreading arrangements
- October 2018 to present: update reports presented to MPI
- July 2019: review and refine catch spreading limits to ensure they are equitable across the fishery to not further disadvantage smaller operators
- October 2019: integrate existing catch spreading arrangements with ER & GPR reporting and ongoing automated monthly reporting of catch spreading reports

3. Reporting sub-minimum legal size (MLS) tarakihi (TAX)

Why it matters

45. Understanding the level of TAX caught in the east coast TAR fishery is important information that inform managers and industry participants about the quantity of TAX and its distribution. This will be used to inform the management decisions aimed at reducing the amount of TAX caught.

46. Reducing the catch of TAX will ensure that a greater portion of the TAR population will feed into the wider fishery and subsequently contribute to a faster rebuild.

47. Furthermore, recording TAX is essential to develop effective selectivity measures (which could include mesh size, orientation, move on rules, spatial and temporal management).

48. If large catches of TAX are recorded, it will identify the need for improved management to reduce the levels of this undersize catch. The location of TAX would also be an additional data source to address uncertainty around connectivity.

49. The data analysis will provide fleet-wide reports and enable investigation to a vessel level so that industry can identify and assist vessels catching higher proportions of TAX.

50. Data will also be used to provide recruitment indicators for the next stock assessment (noting that a recruitment is a key uncertainty in the model and future management of the stock).

51. There has been mandatory reporting under the TAX code since 10 November 2018. Notwithstanding the date of commencement, this data is only just becoming available for analysis. Fisheries Inshore New Zealand is conducting TAX analysis to assess the location and scale of undersize TAR catches and provide data that could potentially be beneficial in identifying recruitment pulses in the fishery as well as other management measures.

52. MPI has not implemented validation rules for TAX. This means that any catch reports by fishers that record TAR catches but do not also record TAX (as is required) would be non-compliant but would be accepted in the database. If there was a validation rule, the reporting returns would not be accepted but sent back to the fishers for correction. In the absence of the validation rule, industry is currently undertaking validation to ensure the TAX reporting is being completed correctly.

53. Analysis will be conducted on catches of sub-legal TAR to enable an evaluation of the sensitivity of the model results to this source of mortality. This is an important data source to address the key uncertainty about recruitment in the next stock assessment. The Fisheries Assessment Report (2018/05) acknowledges that "There is anecdotal evidence that the trawl fisheries off the east coast of the South Island may catch substantial quantities of tarakihi below the Minimum Legal Size (MLS) of 25 cm (F.L.). These catches are discarded [as required by law], *and their magnitude has not been quantified. Thus, no information was available to explicitly account for this additional source of mortality in the assessment models".*

54. Introduction of ER & GPR will enable further analysis of fleet adherence to regional management initiatives around move on rules for TAX. This will foster confidence in the implementation process and ensure success through transparency (see Section G).

55. Reporting of sub-legal fish will provide data on a portion of the fishery that the model currently does not account for and has had to assume is constant over time. The preliminary analysis conducted at industry's request demonstrates this has not been constant.

Progress to date (Milestones & KPIs)

- 10th November 2018: TAX reporting requirement promulgated
- 9th May: Preliminary reporting of TAX analysis presented to MPI science working group

  - The working group noted that the data are considered for trips that have reported landings of TAR 1, 2, 3 and 7 since 10 November 2018 with most recent effort data in report from 13 March returns
  - MPI has not implemented any validation rules for TAX reporting. Consequently, industry is following up on TAX reporting to ensure vessels are recording as per requirements
- 29th May: Update of TAX analysis to be provided to the MPI science working group
- June: Commitment to quarterly reports on the estimates of TAX and mapped spatially to illustrate the location of high TAX catch and high TAX proportions
- October 2019: Integration of TAX reporting with ER & GPR to produce automated reporting templates and a commitment to quarterly reports on the estimates of TAX; mapped spatially to demonstrate the location of high TAX catch and high TAX proportions

4. Assessment of maximum sustainable yield for East Coast tarakihi fishery

Why it matters

56. Determining the appropriate level of target biomass is important and is related to biological characteristics, the harvest strategy adopted, and the data available. It also determines the yield that can be taken from the fishery, that is, an estimate of "real world" biomass that sustains the maximum yield for the fishery.

57. The outcome of this approach provides stock-specific scientific advice about the management target for the fishery, as opposed to generic guidance. This target biomass is then used to determine the most appropriate rebuild strategy.

58. The work concluded that the biomass that can produce the maximum sustainable yield is around 35% SB_0. This target has the following characteristics:

- A low risk (<5%) of the stock declining below soft limit, defined as 20% SB_0
- Negligible risk of the stock declining below hard limit, defined as 10% SB_0
- Maximised average annual catch
- Is scientifically peer reviewed by a process that determines the range of management scenarios. These scenarios are provided in Appendix 8 and their relevance is assessed in Section F

Progress to date (Milestones & KPIs)

- 21st November 2018: Presented to the MPI science working group
- December – January 2019: Update on Management Strategy Evaluation as per the working group's recommendations
- 27th February 2019: Presented to Southern Inshore working group
  - All runs recommended and methods were accepted by the working Group
- February 2019: Management meeting to determine the management target (see Section F)

5. Improving Selectivity

Why it matters

59. In general terms, a fishery's biomass increases when recruitment is greater than mortalities. In addition to catch, there are natural fisheries mortality and incidental (unwanted) catch mortalities. The Minister has reduced mortalities from catch by reducing the maximum total commercial catch from 1 October 2018. Industry is also looking to reduce incidental catch mortalities through a range of selectivity measures. If successful, these collectively will help increase the rate of rebuild and shorten the time to rebuild to B_{MSY}. The range of measures include "when we fish", "where we fish" and "how we fish".

60. When and where we fish are avoidance approaches. It involves choosing not to fish at particular times of the year where history has shown we regularly find high concentrations of small TAR. This measure is included in the Strategy as a component of the Regional Management and Monitoring Plans where companies and regions are operating voluntary "keep clear!" areas. It makes more sense that these areas are identified by industry on a real-time basis as these vary within and between years—it makes no sense to fence where the cows aren't!

61. For this reason, most areas will be operating move-on rules where high concentrations of TAX are found. These are also included in the Regional Management and Monitoring Plans. The move-on rules apply where both of the following triggers are met:

    - TAR is greater than 10% of the catch in any haul; and
    - TAX is greater than 15% of the TAR catch by weight.

    In this circumstance the fisher is required to move to more than 1nm from all parts of the line where the small fish were encountered or move so that the net is at a depth of at least 10 metres more along all points of the line.

62. The third selectivity option, "how we fish" involves modifying fishing gear, particularly trawl nets, to reduce the amount of TAX caught.

63. Industry has committed to a three-phase process to improve selectivity of nets in the east coast TAR fishery:

    - Phase 1 – Modelling improved selectivity and how it can influence the rebuild plan
    - Phase 2 – Field testing what can be achieved in on-the-water through gear modification
    - Phase 3 – Broad adoption of improved gear to reduce TAX mortalities

64. This is part of an ongoing commitment to gear innovation. This work is not being completed in isolation and the Regional Management and Monitoring Plans identify that quota owners are committing to ring-fence a portion of their ACE and provide funding for collective TAR selectivity research.

65. The work on selectivity is applied research to understand what could be effective and then apply that so fishers improve their selectivity measures so that overall, we increase yield per recruit of eastern TAR. This is achieved by reducing mortalities of smaller eastern TAR (rather than additional cuts of larger economic TAR). This is achieved by:

    - Adjusting nets to not retain undersize tarakihi while retaining larger fish; and
    - Changing where and when we fish: avoiding areas where small tarakihi are more abundant year-round by designating voluntary "keep out!" areas and adopting move-on rules elsewhere

66. This work demonstrates that the recovery of the stock and ongoing management of the east coast fishery can be addressed through a range of measures. Making TACC reductions is not the only tool to rebuild the fishery.

Phase 1: Modelling improved selectivity and how it can influence the rebuild plan

67. Theoretical modelling of improvements to tarakihi selectivity has been completed and shows that if practical measures can be adopted that shift selectivity, there is strong potential to rebuild the east coast TAR fishery more quickly than just catch cutting measures on their own.

68. This work determined that the full trawl selectivity for TAR3 was 4 years and for TAR2 was 6 years.[2] Based on these results, projections were conducted to determine the impact of shifting selectivity:

    - TAR 3 – move the full selectivity from 4-year olds to 5-year olds
    - TAR 2 – move the full selectivity from 6-year olds to 7-year olds

69. It is expected that changing the selectivity will improve the yield per recruit for the fishery and thereby increase the rebuild rate.

70. Projections demonstrate that, for the same level of TACC cuts, the potential benefit of shifting selectivity by catching fish of a year older in both TAR2 and TAR3 is a 12 year faster rebuild of the eastern TAR fishery (**Error! Reference source not found.**3). This is substantial and warrants significant effort to realise these b enefits. Its importance increases as what is achieve for tarakihi will also have flow-on effects for other fisheries.

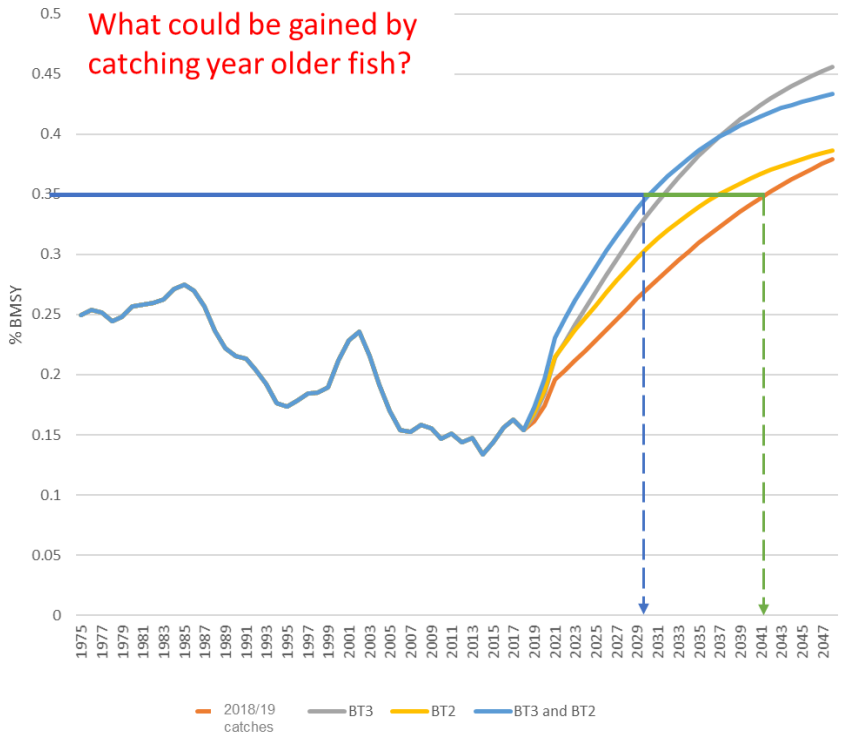


Figure 3: The theoretical modelling of improvements to the east coast TAR rebuild based on improvements to selectivity in different parts of the fishery. The orange line is current catches; the grey line is improved selectivity in the TAR3 trawl fishery; the yellow line is improved selectivity in the TAR2 trawl fishery; the light blue line is a combination of improved selectivity in TAR2 and TAR3). This shows the potential for significantly faster rebuilds.

[2] FAR 2018-05.

Phase 2: Field testing what can be achieved on-the-water through gear modification

71. The intention of field trials is to determine what a range of gear changes can achieve in relation to the theoretical improvements outlined in Phase 1.

72. The at-sea trials are quantifying changes in trawl selectivity associated with increased mesh size in the cod end and the orientation of the mesh – diamond, T45 and 90. The immediate trials are looking at differences in performance in moving from 4-inch to 5-inch diamond mesh configuration.

73. Phase 2 initially focussed on at-sea trials in TAR3 during April 2019 and will subsequently conduct trials in TAR2 that are planned for June 2019. These are interim trials and any additional work will be considered to enhance selectivity innovations within these fisheries.

74. Aligned with this work is the collection of "fall-through" data for NIWA. This will contribute to a wider collaboration between NIWA and SINTEF (one of Europe's largest independent research organisations).[3] This work will use SINTEF software tools and expertise to develop predictive models of trawl cod-end selectivity for New Zealand species to help inform commercial fishing practices and management decisions.

75. The development of this model means that in the future, fishers will be able to predict what changes in their gear configurations will mean for the selectivity of their target and bycatch species. Significant data is required to inform the predictive power of this model across a range of species. The integration of the fall through work with the field trials will allow data to be collected to develop the selectivity model.

Progress to date (Milestones & KPIs)

- 26th February: Selectivity trial design presented to the MPI Science Working Group
- 22nd – 26th April: TAR3 selectivity was trial undertaken
- 9th May: Selectivity trial presented to MPI Science Working Group
- June: Selectivity trial scheduled to be undertaken in TAR2

6. Regional Management and Monitoring Measures

Why it matters

76. Regional management and monitoring measures apply both operational measures and support research projects for the relevant regions. They bring the measures together and promote the implementation of workstreams to ensure regional management action is taken in a timely and effective manner (see Appendix 5 for the current measures).

77. In addition to these regional management and monitoring measures, individual companies have the opportunity to implement their own additional management and monitoring measures as they feel appropriate. The regional measures are deemed to be the minimum level industry commitment in each area that underpins Strategy.

[3] https://www.sintef.no/en/

Progress to date (Milestones & KPIs)

- October 2018 – April 2019: TAR1, 2, and 3 developed Regional Management and Monitoring Plans that complement the Strategy
- May – September 2019: Agreement to and progressive implementation of the key measures of the Regional Management and Monitoring Plans along with monitoring and reporting on that implementation
- October 2018 – October 2019: From the 2019/20 year the reporting will become the regional standards for eastern TAR management
- September 2020: Review the effectiveness of each Regional Management and Monitoring Plan. The Regional measures will be reviewed and updated annually, as appropriate considering updated information from both Workstreams

7. Utilising section 77 of the Fisheries Act

Why it matters

78. We are cognisant that the actions of individuals could impact on the effectiveness of actions taken by the rest of industry in implementing the Strategy. While we consider that this is unlikely, it would be useful to signal that the consequences of individual's maximising short-term gains could be the Minister using section 77 of the Fisheries Act to restrain such individuals.

79. This is a significant measure proposed by the industry and will need further exploration; to our knowledge this section has not been used to date and is a proposal not taken lightly. It reflects the degree of importance industry collectively place on ensuring that wider industry initiatives cannot negated by the actions of a few.

80. The key to ensure effective control of individual catchers is to set sensible overfishing thresholds that do not unduly penalise unintended bycatch of eastern TAR. Industry has undertaken preliminary analysis and suggests that the Minister should enact this measure only in the appropriate QMAs and that the thresholds should be set at a sensible level to prevent significant over-catch.

81. This measure is not intended to disadvantage fishers that have marginally exceeded their ACE holdings despite their best endeavours to avoid tarakihi and a demonstrated commitment to the Strategy. Rather, the measure is included in the legislation as an effective restraint on fishers that display a disregard for accepted fisheries management measures.

82. Our recommendation is that an appropriate overfishing threshold be applied based on a tonnage amount and a % ACE for the appropriate QMAs and be put in place so that it can be used from 1 October 2019. We are proposing to work with MPI to develop appropriate thresholds.

8. Development of Management Procedure Framework

Why it matters

83. A management procedure is designed to identify fishery rebuild strategies and ongoing harvest strategies that are robust to both uncertainty and natural variation, while balancing biological and socio-economic factors. Industry is committed to developing an east coast tarakihi management procedure informed by the 2020-21 stock assessment.

84. We consider that further changes to the total allowable commercial catch would be premature before this assessment; particularly given the catch reductions implemented by the Minister in 2018 have yet to be reflected in any stock assessment update. The benefit of other management measures implemented will also not have been realised.

85. In advance of the next stock assessment, it is proposed that industry work with MPI and contracted scientists to develop an appropriated management procedure framework and decision rule appropriate to the fishery.

86. Developing and implementing a management procedure will ensure that the rebuild and ongoing long-term management of the fishery is continually informed by science and our improved knowledge of the fishery. A management procedure will:

- Ensure the rebuild of the stock within defined management timeframes
- Be continually informed by science and our improved knowledge of the fishery
- Provide a feedback loop to ensure continued effective and informed management
- Establish a commitment to use ongoing, timely and effective decisions rules to manage the fishery

SECTION E: ENHANCING SCIENCE (Workstream 2)

87. The aim of enhancing science around east coast tarakihi is to check our understanding of the fishery, reduce key uncertainties, and assess the effectiveness of our current measures. We can then adjust our management to achieve the goals of our Strategy.

88. The sustainability of New Zeeland fisheries is supported by high quality science and the best management decisions are based on robust and comprehensive information. While acknowledging there is already programmed research that will provide information on east coast TAR, the 2018 MPI discussion paper identified no additional research services to improve knowledge of the stock structure or management initiatives to address complex TAR management issues. Industry considers that additional research and analysis is needed to better understand the fishery and select the optimal management approach.

89. The key objectives of Workstream 2 are:

    1. Implement an ongoing research plan to better inform the management of the east coast TAR fishery
    2. Provide data to better inform the next and subsequent stock assessments
    3. Develop and implement industry wide long-term research approaches to reflect changing environmental conditions

90. The key components to achieve these objectives are listed below, those with "#" are measures being managed by MPI. Those in italics are the additional measures industry proposed in 2018, the remainder are further measures that have been developed since 1 October 2018 to further enhance the management of the fishery.

    1. East Coast South Island trawl survey #
    2. Catch sampling #
    3. Development of a gear database
    4. Improved understanding of the commercial Catch Per Unit Effort
    5. *Development of a gear innovation pathway*
    6. *Genetic research*
    7. North Island independent survey design
    8. Development of a fish behaviour project utilising camera footage, initial focus on TAR but the project is transferable to other species
    9. Support for climate change research
    10. Integrating Amateur Charter Vessel records and recording

1. East Coast South Island trawl survey (ECSI)

Why it matters

91. The ECSI trawl survey is considered to provide the most accurate measure of abundance for many South Island inshore species. A long-term time series of fishery-independent relative abundance indices is a useful tool to monitor fish stocks, including tarakihi. This data also supports analyses of commercial CPUE as an input into stock assessments for these stocks.

92. Surveys provide early indications of year-class strength, changes in maturity-at-age, growth and mortality that can be difficult to determine from commercial fishery data due to the effects of gear selectivity and distribution of fishing activity. While these indicators may not feed directly into the stock status for management objectives, they do indicate potential changes to productivity that should be considered when making management decisions.

Progress to date (Milestones and KPIs)

- The latest ECSI trawl survey was conducted in 2018, with the next trawl survey scheduled for 2020. The timing of this survey will provide the most recent survey data to input into the stock assessment.
- The latest update of the stock assessment highlighted that the recruitment in the updated model was very similar to 2018 and that 2015 – 2017 recruitment was poorly determined (Figure 4)
- Figure 5 shows the analysis of the trawl survey time series indicating that TAR recruitment has been reasonable stable since 1992.

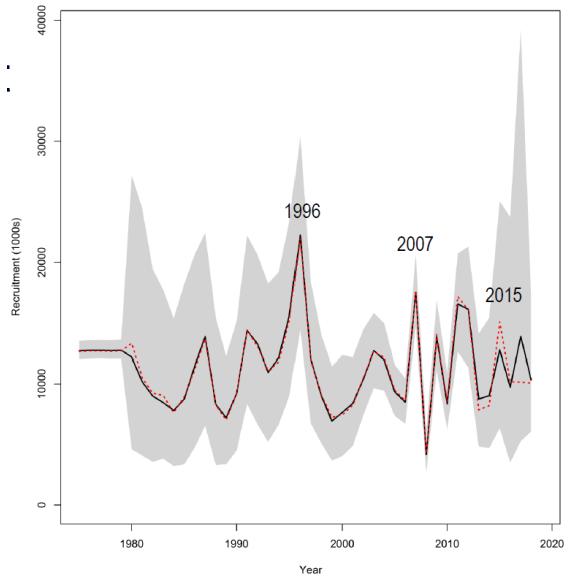


Figure 4: Updated stock recruitment as per the updated 2019 stock assessment model

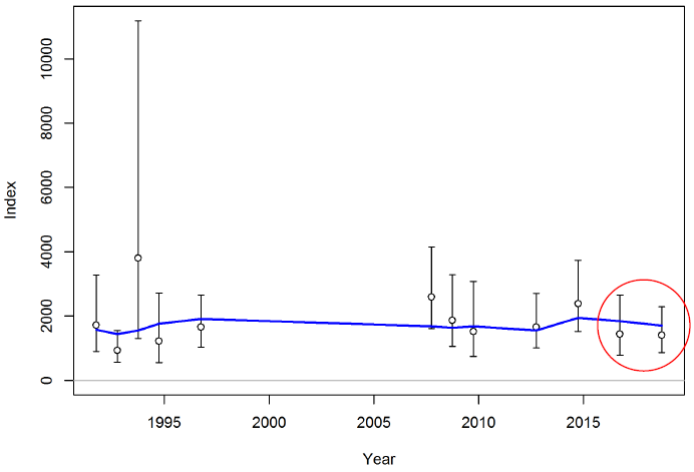


Figure 5: Updated trawl survey time series as per the updated 2019 stock assessment model

2. Catch sampling

Why it matters

93. The stock assessment is strongly informed by the age composition data from the commercial fishery catch sampling. The stock assessment assertion is that "The fisheries in Canterbury Bight/Pegasus Bay are dominated by younger fish and there is a progressive increase in the proportion of older fish in the catches from TAR2, the Bay of Plenty and east Northland."[4]

94. The catch-at- age sampling is vital as it informs stock structure and provides information on cohort and recruitment strength. NIWA, contracted by MPI, is conducting a two-year catch sampling project to obtain this information covering TAR1, 2, 3, 5, 7 and 8.

95. The success of the project is reliant on the sampling being representative across all TAR regions and requires the cooperation and engagement of industry to ensure access to fish in order to collect samples.

96. Nominated LFRs are working with NIWA staff to provide the required information for the 2018/19 and 2019/20 catch sampling programme to ensure the data collection and analysis is of the highest value.

[4] New Zealand Fisheries Assessment Report 2018/05 Langley, A.D (2018) Stock assessment of tarakihi off the east coast of mainland New Zealand. March 2018. ISBN 978-1-77665-797-1 at – Section 4.6 [27].

Progress to date (Milestones & KPIs)

- Current catch sampling has been conducted since 1st October 2018
- Feedback to date has indicated strong cooperation from industry
- NIWA has reported that the quota cuts are causing sampling issues in East Northland and Cook Strait, with the reduced catches in these areas making sampling difficult
- Industry are working with NIWA to ensure that despite reduced fishing effort in a particular area, as a result of changes in the fishery, that adequate data are collected

3. Development of a gear database

Why it matters

97. Engagement with industry has highlighted to both scientists and managers that there can be a disconnect between the CPUE analysis used in the stock assessment and what fishers consider to be the nature of the fishery. There have been some subtle changes in the fishery that need to be better understood. To achieve this, a research project is required for scientists to engage with fishers and identify the data fields that are currently not collected that would better inform CPUE analysis. For those fields already collected, it will provide assurances that the correct information is being collected and analysed.

98. Commercial fishers are required to report some trawl gear characteristics to MPI through reporting regulations. It is not clear that these are the critical gear characteristics that determine the selectivity of the gear. Because of this, there is still limited understanding of the specific configurations and components of trawl gear use and selectivity across New Zealand and more so, historical changes.

99. This has been identified as an information gap by scientists and fishery managers. A better understanding of gear configurations is expected to deliver the following benefits to MPI and the wider industry:

    - ensuring the sustainable utilisation of inshore trawl fisheries through more accurately quantifying the selective properties of trawl gear in scientific evaluations
    - fostering innovation to grow the value of our inshore fisheries and to help ensure sustainability

100. A number of fishers have trialled different configurations and changed the gear they are fishing with. While still compliant with regulatory requirements, this innovation is not well documented. The current documentation associated with catch effort reporting does not adequately record these improvements and there is no comprehensive database.

101. Various parties have also undertaken initiatives in the past to identify existing gear use in the inshore trawl fishery, including NIWA[5] and Clement & Associates Ltd.[6] These approaches have largely involved face-to-face interviews with fishers and have provided a snapshot of gear use at a point in time (not ongoing). There have been no processes to consistently update this and in the absence of better information scientists assume the gear is the same and there are no changes in selectivity occurring.

102. The current Government, MPI, and Fisheries Inshore New Zealand have an increased focus on fostering gear innovation in New Zealand's fisheries, specifically inshore.

[5] NIWA carried out interviews with 30 skippers in 2014/15 about bycatch issues and changes individuals were making to their nets.

[6] New Zealand Inshore Trawl Gear and Operations Survey. A report commissioned by Seafood Innovations Ltd and SeaFIC, and prepared by Clement & Associates Ltd. 2008 www.seafoodinnovations.co.nz/fileadmin/documents/Inshore_Trawl_Survey_Report_Final_Web.pdf

103. Having a better understanding of trawl gear use across New Zealand will assist with encouraging greater levels of innovation. This could be achieved through sharing knowledge (where not commercially sensitive) of gear innovations that are already occurring across the country and identifying issues with existing gear use and finding solutions.

104. With the roll out of commercial electronic catch and position reporting requirements there is an opportunity to build on the gear type information that can be collected via this new digital system. For gear selectivity information to be of most use for stock assessment and management purposes this will need to be recorded at the fishing event level.

105. Collecting gear type information via the electronic system provides the ability to match gear information to a fisher's catch effort.

106. MPI and Fisheries Inshore New Zealand are currently working on a "Phase 1" project, as part of a wider initiative that is proposed to collect ongoing information on trawl gear use in New Zealand (Figure 6).

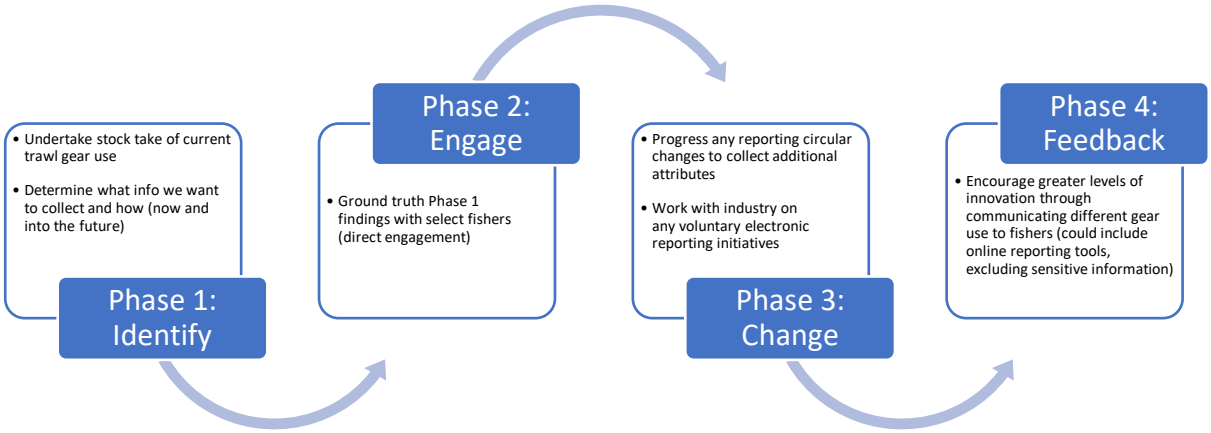


Figure 6: Development of gear database process, identifying the key aspects of each phase of the process

107. Furthermore, industry is developing a proposal to establish a research database to collate information/reports on historical gear trials and surveys of gear within New Zealand. This information would further contribute to our knowledge of trawl gear use for science and management purposes. This would align with the innovation measures identified as part of the Strategy.

4. Improved understanding of the commercial Catch Per Unit Effort for TAR

Why it matters

108. There is a risk that implementing the GPR & ER reporting requirements may compromise standardised CPUE indices that are based on the statutory data. Every time New Zealand has changed its system of catch and effort reporting in the past, there has been a disconnect between the data recorded under the old and new systems that has led to concerns about the performance of our fisheries. We have then required several years using the new data to adequately assess the status of our fisheries to show that nothing had really changed except the way we reported. Such a hiatus is highly undesirable, and industry consider that work should be done running reporting systems in parallel particularly for CPUE so this problem is mitigated. CPUE indices are critically important for the management of many inshore stocks including the east coast TAR fishery.

109. The purpose of this research programme is to assess and mitigate the impacts of changes in the statutory data regime on CPUE indices to ensure continuity of stock monitoring and management during the implementation of GPR & ER reporting requirements.

110. The information from this project is directly applicable to the ongoing management of the TAR fishery. The CPUE trends from the east coast fishery are an important component of the TAR stock assessment and it is imperative that we are aware of any impacts of transitioning to fine-scale data on our ability to interpret historical catch-effort data.

111. Fisheries Inshore New Zealand has developed a research programme to assess and mitigate the impacts of the upcoming changes in the statutory data regime on CPUE indices to ensure continuity of stock monitoring. The research is being co-funded by fishers, supported by funding from Seafood Innovations Limited (SIL) and conducted by Trident Systems.

112. The research project is taking the opportunity provided by the digital reporting implementation period to undertake parallel reporting using the current paper-based forms and ER. This will allow for testing the ER systems that are being developed whilst collecting and analysing data that will show how fisheries operate and how particular data fields are interpreted/completed by fishers. It will also address specific management information needs including future-proofing current assessment and management models.

113. The project approach is to supply fishers with ER/GPR systems that meet the statutory requirements to participating fishers who will then use the ER/GPR software to provide parallel ER data for a month when still reporting using the statutory paper forms. The parallel data will then be analysed to evaluate the old and new style data and work to provide continuous CPUE indices for key stocks for evaluation through the MPI Working Groups.

Progress to date (Milestones & KPIs)

- 7th February: Engagement meeting with MPI staff including fishery management, compliance, science and digital monitoring team representatives
- 20th March: Second engagement meeting with MPI staff
- 22nd March 2019: Training workshop in Whangarei for fishers
- 18th April 2019: Training workshop in Thames for fishers
- May 2019: Training workshop in Whangarei for fishers
- April 2020: Completion of data analysis and subsequent presentation of the results an MPI Science Working Group

5. Gear Innovation pathway

Why it matters

114. Selectivity measures (see Section C) demonstrate how the implementation of innovative practices can assist with the rebuild of the TAR stock, and are both transferable and beneficial to wider fisheries.

115. There are substantial barriers to the development and uptake of innovation in the fisheries sector, particularly for ACE fishers and small companies with limited in-house innovation capability or capacity. There is interest from both industry and Government to develop the fishing industry in a way that minimises its impact on the environment and maximises the value of the industry.

116. Fisheries Inshore New Zealand is looking to fund new ideas that could transform the New Zealand Seafood Industry. Fisheries Inshore New Zealand is looking to partner with others to create greater momentum to investigate and report success with (individually) small scale but (collectively) substantial innovations. Discussions are ongoing with Seafood Innovations Limited (SIL) to develop this process and ensure there is a framework to facilitate industry innovation.

117. MPI has provided a letter of support for this work and aligned with the MPI commitment to establish a gear database project (Research Project 3 above) that will complement this development as part of a general industry approach to continued innovation.

118. Gear innovation projects will provide the necessary support, guidance and financial support to enable grass-roots innovation around gear on board fishing boats that will reduce impacts, add value and increase productivity in New Zealand fisheries that have benefits at regional or national level.

119. Research outputs will be made available so the wider industry can access and benefit from them. Projects will also contribute information on the current use of gear in the industry to help better inform CPUE analyses.

Progress to date (Milestones & KPIs)

- May – June 2019: Finalise gear innovation pathway discussions between Fisheries Inshore New Zealand and SIL
- July 2019: First round of completed applications submitted to SIL
- October 2019: Second round of completed applications submitted to SIL

6. TAR genetic research

Why it matters

120. The overall objective of the work is to use genetic markers to determine the structure of the New Zealand tarakihi stock. This research will provide information that could prove or disprove the current stock assessment hypothesis regarding the connectivity of east coast TAR.

121. Industry continue to support the ongoing TAR genetic research being conducted by Victoria University with industry providing fish to the project for analyses.

122. Industry has engaged with recent MPI-hosted genetic study workshop and are awaiting the report of this workshop to identify future opportunities to maximise the benefits of genetic research methods to better understand the TAR fishery.

123. Additional funding for this work has been highlighted and discussed with Victoria University. The provision of additional research will be discussed and finalised to assist scientists in achieving a higher level of statistical rigour i.e. provide funding for more samples following the completion of the second phase of the population structure work.

124. The project is in two phases in line with the specific objectives:

    1. Determine the mitochondrial DNA (mtDNA) sequence using DNA from a broad range of tarakihi samples and conduct a "first look" test of stock structure; and subsequently

    2. Determine the whole genome sequences of a range of tarakihi samples and based on the results of the mtDNA study, conduct a high-resolution test of the stock structure.

125. Phase 2 of this project aims to provide demographic patterns like the amount of connectivity (migration rate) and the effective population size will be estimated.

126. Associated with this work, Victoria University are developing the TAR whole genome and are producing the first de novo draft reference genome of tarakihi.

Progress to date (Milestones & KPIs)

- Progress to date on the population structure has collected 1,400 specimens from 19 regions, including 60 fish from Australia (awaiting samples) and 40 King tarakihi (Figure 7). The samples were processed to collect length, weight and sex data
- The preliminary results of this work using mitochondrial DNA indicate no significant variation between the populations. The exception being King tarakihi which was identified as being significantly different. This difference may have management implications
- Phase 2 of the sampling to determine population structure is underway and results are pending
- Whole genome sequencing has been conducted using 27 samples
- Potential future work has highlighted that there is potential to align the genome work and stock structure work industry has identified the need to review the potential for a genetic tagging programme
- Further work as part of this PhD will also be looking at local adaptation traits to look for evidence of adaptive loci and investigate the relationship between genetic diversity and variation of environmental parameters

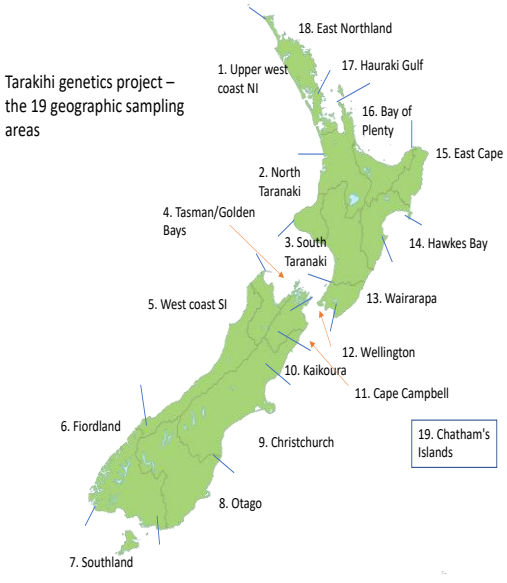


Figure 7: Sampling regions for TAR genetics research.

7. North Island fisheries independent survey

Why it matters

127. Between 1993 and 1996, four annual *RV Kaharoa* trawl surveys were undertaken on the east coast of the North Island between Cape Runaway and Turakirae Head. This survey was stopped by fisheries managers on advice from government scientists that the surveys were not providing robust data that could be relied on for management—there were very large levels of uncertainty apparent in surveys.

128. A North Island fisheries-independent survey that was sufficiently representative would provide valuable data to assess the relative change in abundance of important commercial species such as tarakihi between early 1990s and the present.

129. A fishery-independent survey would be designed to ensure it was optimised to ensure utility across a range of species. It would be designed to a provide reliable relative abundance information for a longer period. The resumption of a North Island survey would also provide better sub-regional spatial information on age and length structure; which are particularly important for tarakihi.

130. Industry is committed to the utilising fishery independent data that is collected in a cost-effective way. A research project is being contracted to design a North Island survey design that will review the different delivery models to ensure cost-effective implementation. It will also ensure scientific rigour and address the uncertainties of the resulted in the cessation of the last east coast North Island survey.

131. As part of the contracted work to design this survey, the contractor will reflect on the history of east coast North Island surveys and provide a scientific assessment regarding the potential to either attempt to continue the existing time series, start a new time series, or alternatively look to develop a methodology that both utilises the old survey whilst moving the new survey design forward in order to reflect current priorities and constraints on survey implementation.

132. Implementing this project, aligned with the ongoing management of FMA 1 and FMA 2 fisheries, will mean the project will be designed to provide maximum benefit for fisheries management across the suite of species in both regions.

Progress to date (Milestones and KPIs)

- May 2019: Contract an independent consultant to design North Island fisheries independent survey
- June – July: Design a North Island fisheries independent survey
- July – August 2019: Present the design to MPI Science Working Group
- August 2019: Stop/Go assessment and management discussion with MPI staff
- Depending on the results of the Stop/Go assessment this work would be progressed with the intention to commence this work for the 2019/20 fishing year

8. Developing a fish behaviour project utilising camera footage, initial focus on TAR but transferable to other species

Why it matters

133. The behavioural characteristics of fish in response to stimuli, coupled with their morphology, can provide researchers and net makers with important information on potential escapement behaviour to assist with improved design of trawl technology including mesh size, orientation and escapement windows.

134. Information gained about fish behaviour in the net from the use of underwater cameras in trawl nets will be investigated to assess the design needs and potential changes to existing fishing gear. Using the information from this work, and the resultant selectivity in the net with cameras included and excluded, will also give useful information on whether fish escapement behaviour is different in the presence of cameras.

135. In New Zealand, very little work has been done in this respect, whilst overseas there has been significant work in this field. Unfortunately, we cannot infer fish behaviour and reactions between different species, but we can source work that is done on the same species closer to New Zealand. This will give us a starting point for project development leading to innovation in fishing gear design technology.

136. This project is under development and is included in the Strategy to identify another avenue to speed up further innovation of fishing gear.

9. Support for climate change research

Why it matters

137. New Zealand faces similar challenges as other maritime countries in managing the multiple stressors associated with climate change, including sea-level rise, ocean acidification, and impacts from changing terrestrial fluxes. A sense of urgency exists to understand, predict and mitigate, at a national scale, the ocean and ecosystem responses to these global problems (Stevens and O'Callaghan, 2015).

138. Long-term coastal warming (Shears and Bowen, 2017), recent variability in fish stocks, and impacts on aquaculture (along with extremes in ocean temperature) have prompted an urgent rethink of how marine sectors will respond to changing environmental drivers (Salinger et al., 2019).

139. New Zealand is an island nation with stewardship of an ocean area twenty times its land size, yet it does not currently have an ocean observing system.

140. Industry is aware of a range of ongoing research projects that are being conducted to investigate the impact of climate change on our marine environment and associated species. Specifically, we are aware of a project that is investigating the ability to predict what climate change will mean for the distribution of key fish species.

141. Industry is supportive and engaged considering the importance of this work. We note that the work is based on sea surface temperature (SST) and consider that to provide more valuable data it is important to monitor and predict at-depth temperatures as well as SST.

142. Close connections between the NZ science community and stakeholders means that knowledge relevant to industry is paramount. Industry is engaging with research providers to determine the potential scope for using commercial fishing vessels to collect appropriate data.

143. Vessels of opportunity provide the perfect way to both minimise data collection costs and maximise data collection and provide at-depth temperature data collection. Currently some vessels within the industry use temperature sensors on their trawl doors but this is not a widely used technology within the inshore sector.

144. Industry is looking to work with scientists to develop a proposal to funders whereby the use of temperature sensors on gear such as on trawl doors is used more widely in order to provide opportunistic data to support ongoing scientific research.

Progress to date (Milestones and KPIs)

- April – July: Industry engagement with current research providers to determine the potential for research projects
- August: Proposal to funders to support the purchasing, implementation and ongoing data transmission of at-depth temperature data to support existing research approaches
- October: Anticipated start of the research programme, subject to funding arrangements

10. Integrating Amateur Charter Vessel records and recording

Why it matters

145. Whilst tarakihi is predominantly a commercial fishery, it is recognised that other stakeholders also hold views on fisheries management. Acknowledging this, industry has engaged with wider stakeholder engagement – see Section G.

146. Aligned with this, we are looking to collaborate with other stakeholders to better inform our joint understanding and associated management of the stock.

147. All amateur-fishing charter vessel operators must register with MPI before they can run any trips and are required to file reports in line with their charter vessel catch reporting requirements.[7] Tarakihi is currently not included in the list of species recorded by charter vessels.

148. A current research project "Summary and analysis of Amateur Charter Vessel reports – data grooming and outputs (MAF201803)" is looking into the data collected from charter vessels and is expected to provide recommendations on changes to reporting and data management of this data source.

149. This provides an opportunity to support the expansion of this current work to include TAR and review the potential, aligned with the new national panel survey results for TAR, to identify the most appropriate way to facilitate increased charter vessel reporting of TAR.

150. The Strategy is committed to becoming better informed to enable better management. Industry supports this work and has engaged with the lead scientist to discuss the potential for using this project to benefit tarakihi management.

151. The value of this reporting to the overall stock assessment which includes all sectors' information is at present unknown.

[7] https://www.mpi.govt.nz/dmsdocument/1376-charter-vessel-catch-reporting-requirements

SECTION F: ASSESSING APPROACHES

152. There are many approaches that can be taken to rebuild a stock. Careful consideration needs to be applied to decide on a rebuild rate that not only increases the stock biomass in a reasonable timeframe, but that also continues to provide sufficient catch to our fishing communities, and preserves the capacity of inshore fishers to provide the necessary data to inform ongoing management of the fishery.

153. The law requires measures to move the stock towards the biomass that can produce the maximum sustainable yield – that is happening now as per the projections of the latest stock assessment update which show the stock is projected to increase based on current catch levels (**Error! Reference source not found.**).

154. The Fisheries Act does not compel a particular rebuild rate and allows the Minister to have regard to relevant social, cultural, and economic factors.

155. We support a timeframe that reflects the history of the stock and provides a future for the fishery and fishers. A longer timeframe than the minimum default in the HSS will give time for the broader range of measures being implemented to have an impact. Those measures will achieve a more rapid recovery across this and other fisheries than just a reduction in the TACC for tarakihi.

156. To determine the most appropriate rebuild approach, there first needs to be consideration of what is the optimal rebuild target. No single default target or rebuild is applicable for all species and stocks.[8] Management targets for individual stocks have to be specific to the biological characteristics of the stock. In addition, the Act does not require that measures are only taken based on the biology and state of the fishery, it provides that in addition to this, the Minister should have regard to the relevant economic, social and cultural impacts when deciding upon the way and rate at which a stock is rebuilt to the target level.[9] (see Appendix 6 and 7).

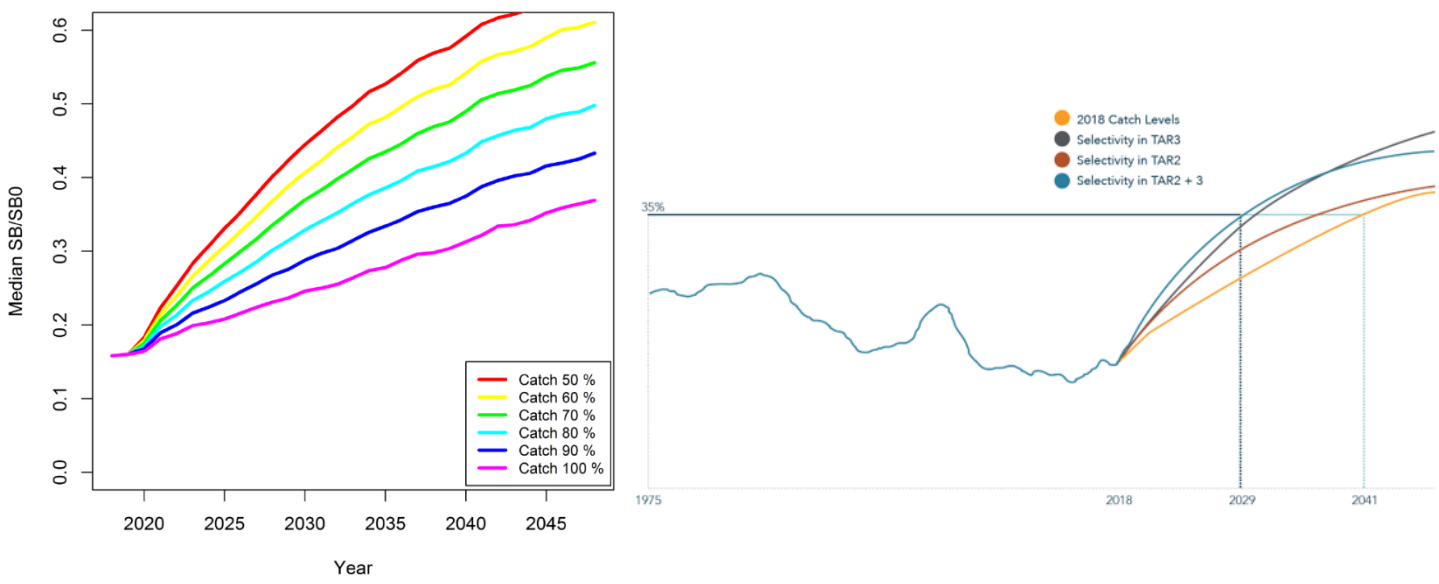


Figure 1: Graphs demonstrating the rebuild projections based on current catches and the potential increases in rebuild rate due to improved selectivity.

Left: Spawning biomass (SB) projections from the updated 2019 assessment model. The projected catches are based on different levels of the current 2018/19 catch, which reflects the current TACC based on the 25% TACC reductions in 2018/19. Catch 100% refers to the current 2018/19 catch levels)

Right: Spawning biomass (SB) projections from the 2018 assessment model that shows what catching one-year older fish in the bottom trawl fishery in TAR 3, TAR 2 or a combination of TAR 3 and TAR 2 would mean for the rebuild timeframe.

[8] Operational Guidelines for New Zealand's Harvest Strategy Standard (2011). Ministry of Fisheries June 2011 at page 2.

[9] Fisheries Act, section 13(3).

Management target

157. East coast tarakihi is a very important component of inshore fisheries and is predominantly caught as part of a mixed species fishery. TAR is the economic backbone of the many inshore vessels' annual catch plan. Reductions on the scale proposed by MPI, if adopted, will mean significant reductions in the fleet.

158. Noting that the fishery has never been above 27% SB_0 since 1975 (the entire time period used for the stock assessment), industry considered it appropriate to conduct the necessary work to determine the optimal management target.

159. A management strategy evaluation (MSE) was conducted to determine the optimal management target for east coast tarakihi. The policy guideline recognises that MSEs are fully compatible with the MPI's HSS policy guidelines.[10]

160. The range of scenarios presented in Appendix 8 show that a management target 35% SB_0 using the catch base for the fishery (2016/17 catch levels) meets the risk thresholds required by the HSS policy, whilst providing for the highest average annual catch.

161. Furthermore, a management target of 35% SB_0 meets the sustainable utilisation requirements of the Act, which is the principle upon which the HSS is founded. The yield per effort graph from the original stock assessment shows that 35% has a higher yield than a default 40% target (Figure 9) as supported by the MSE scenario runs in Appendix 8, as noted in the previous paragraph.

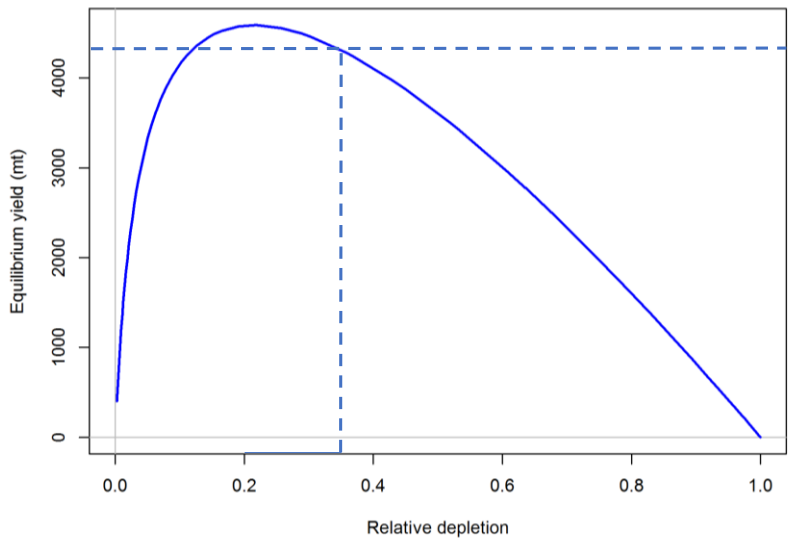


Figure 9: Yield per recruit curve for the east coast tarakihi fishery. The inserted lines demonstrate the yield for a 35% management target.

Rebuild strategy

162. This Strategy proposes a "U-shaped" rebuild to enable fisheries management to respond, research and reassess the management measures to a rebuild and effective management of the east coast TAR fishery. We refer to "U-shaped" to try to convey a strategy that starts more gradually but, through having complementary reinforcing measures, makes greater overall progress than a single measure strategy applied to a single fishery.

163. As part of our proposed commitments to rebuilding the stock to the 35% SB_0 target, the Strategy will monitor, report and build on the measures implemented as part of Workstreams 1 and 2, and the additional measures set out in the next section G – Ensuring Success. This approach supports a measured and thoughtful response to management with a timeframe that reflects the reality of the fishery.

164. Appendix 6 provides a detailed assessment of the 35% SB_0 target and the rationale for its use as most appropriate management target for eastern TAR.

[10] Harvest Strategy Standard for New Zealand Fisheries (2008). Ministry of Fisheries – October 2008 at [25].

165. In contrast a default management target using a "V shaped" single measure rebuild requires severe cuts to rebuild a fishery within the default timeframe but that doesn't appropriately consider and respond to the history of the fishery, and the social, cultural and economic realities.

SECTION G: ENSURING SUCCESS

166. We recognise that it is actions that demonstrate our commitment to the long-term management of the east coast TAR stock and the Strategy.

167. To ensure success, we are focussed on providing a framework to collect and analyse relevant data to better inform management, to undertake agile decision-making on any needed adjustments, and to be transparent about our performance. In addition to all the work we have set out under Management Measures and Enhancing Science, we intend to implement the following additional measures as part of our proposed Strategy.

168. The following measures are focussed on tarakihi in the first instance but are transferable to other fisheries and are applicable to other circumstances. As such, the use of these measures in tarakihi sets the basis for using them more widely in inshore fisheries management.

169. The additional measures to those set out earlier under the two workstreams are:

- Integration of information collection and reporting measures with ER & GPR
- Fisheries New Zealand engagement
- Wider stakeholder engagement

1. Integration of measures with ER & GPR to support reporting and assessment framework

Why it matters

170. The progressive implementation of ER & GPR across our fishing fleet assists with the development of automated reporting. The reporting will be developed further to reflect the range of proposed measures as part of the option to better inform fisheries management (e.g. the development of a gear database).

171. This will require extensive work within industry to ensure we have timely access to information and can arrange for the necessary analysis to be provided. Feedback will then be given to fishers at a collective and individual level and consideration can be given to improving our management approach.

2. Fisheries New Zealand engagement

Why it matters

172. Industry has sought to develop an open and transparent collaboration with MPI on industry's work programme on TAR. Industry wanted MPI to be aware of progress and developments through the first year of implementing the Strategy. This has been done to ensure that any issues with the implementation of the Strategy can be identified and addressed in a timely manner between parties.

173. The Minister's 2018 decision letter identified his wish that MPI officials work closely with industry to develop and implement an effective management strategy.

174. Engagement has been through Science Working Groups (with a TAR focussed Science Working Group held on the 9th May 2019), direct and regular discussion with the MPI fisheries managers responsible for tarakihi,

arranged meetings between industry and MPI managers to discuss the progress of the Strategy, and meetings arranged to directly engage with other stakeholders.

175. As part of the continued engagement with MPI managers, an automated process for reporting on the progress of the Strategy to allow for a transparent assessment of its efficacy is being discussed and developed (see Integration of measures with ER & GPR).

4. Wider stakeholder engagement

Why it matters

176. Industry want to be open about what it is doing and how effective that is throughout implementation of the Strategy. We have already been open and available to discuss tarakihi management with other stakeholders and look to collaborate with others where that is of mutual benefit.

177. Three wider stakeholder meetings were arranged by industry, hosted by MPI, where representatives from different stakeholder groups including customary, recreational and eNGOS were invited to provide feedback on the Strategy as it was being developed.

The following meetings have been held to date:

- TAR 1 – Meeting held 25th March 2019
- TAR 2 – Meeting held 2nd April 2019
- TAR 3 – Invitation for 29th April 2019 (cancelled as a result of limited responses to attend).

SECTION H: IMPLEMENTATION PLAN

178. The high-level implementation timeframe being developed for the Strategy is shown in the table below; this has been constrained to eight years for the purposes of this paper. The Strategy timeframe will be aligned with the defined management objectives / targets and the timeframes determined through the management procedure.

Section	Measure	Year 1 (18/19)	Year 2 (19/20)	Year 3 (20/21)	Year 4 (21/22)	Year 5 (22/23)	Year 6 (23/24)	Year 7 (24/25)	Year 8 (25/26)	Year 9 (26/27)	Year 10 (27/28)
Stock Assessment		Stock assessment update (FINZ)		MPI scheduled stock assessment update (Anticipated stock assessment will continue into second year)					MPI scheduled stock assessment update	(Anticipated stock assessment will continue into second year)	
Management Measures to reduce mortality	Catch reduction	Adhering and monitoring to new catch restrictions									
	Catch splitting	Review of arrangements to facilitate continuation of the approach	Integrated as part of electronic reporting Automated validation implemented			Continuation as required					
	Reporting TAX	Implementing TAX reporting Transition to ER reporting of TAX Industry validation of TAX reporting	Integrated as part of electronic reporting Automated validation implemented	Ongoing statutory requirement							
	Management Strategy/Procedure Evaluation	Completed									
	Improving selectivity	Conducted assessment of potential benefits to rebuild plan Carried out field trials	Continuation of gear innovation commitment								
	Regional management and monitoring measures	Developed regional management and monitoring plans	Implement regional management & monitoring plans		Review plans based on the stock assessment and management procedure review	Implement regional management & monitoring plans				Review plans based on the stock assessment and management procedure review	Implement regional management & monitoring plans
	Enacting Section 77 of the Fisheries Act	Raised potential to enact S77	Use of S77 where appropriate								
	Development of a management Procedure		Develop Management Procedure framework		1. Implement MP 2. Review MP with the results of the new stock assessment	Implement MP				Implement MP Review MP with the results of the new stock assessment	Implement MP
Enhancing science	East Coast survey	Results of last survey completed and provided for update stock assessment									
	Catch sampling	Catch sampling					Catch sampling				
	Development of a gear database	Initiated and currently arranging contractors	Integration of process with ER								
	Improved understanding of the commercial Catch Per Unit Effort	Project underway and completed this year									
	Genetic research	PhD ongoing									
	North Island independent survey design	Design being developed	Implementation of a survey as appropriate								
	Development of a fish behaviour project utilising camera footage, initial focus on TAR but the project is transferable to other species	Project being scoped out									
	Support for climate change research	Project being scoped out									
	Integrating Amateur Charter Vessel records and recording	Discussions to be held with recreational representatives.	Implementation of the project as appropriate		Integration of reporting with amateur vessel reporting requirements						

SECTION I: APPENDICES

The appendices provided in this section are:

FROM SECTION D: IMPROVING OPERATIONS

- Appendix 1 – Catch reduction progress and monitoring
- Appendix 2 – TAR 1 E/W catch spreading
- Appendix 3 – TAR 7 E/W catch spreading
- Appendix 4 – TAX reporting
- Appendix 5 – Regional Management and Monitoring Plans for TAR 1, 2 and 3

FROM SECTION F: ASSESSING APPROACHES

- Appendix 6 – Rationale for appropriate management target for TAR Industry information pack - April 2019
- Appendix 7 – Summary of MSE scenarios
- Appendix 8 – Stock status projections based on the updated 2019 stock assessment. The blue circle indicates the proposed rebuild timeframe of the management strategy, whilst the blue dashed line demonstrates the years that can be saved through selectivity improvements.

Appendix 1 – Catch reduction progress and monitoring

(Preliminary data provided. This data is continually being monitored and analysed to investigate and address any discrepancies)

TAR1 CUMULATIVE % TACC CAUGHT

For the period: Oct - Dec 2018
Date As At: 31/01/2019

Fishing Year		October	November	December	January	February	March	April	May	June	July	August	September	Total ACE
2018/19	Catch/Month (kg)	69,011	66,970	44,099	53,203	60,350	154,392							1,097,000
	Cumulative catch (Kg)	69,011	135,981	180,080	233,283	293,633	448,025							
	% TACC Caught	6%	12%	16%	21%	27%	41%							
TAR 1 E	TAR 1E Catch/Month (kg) (Based on current reports)	62,198	61,689	16,758	17,600	25,925	116,972							518,000
	Cumulative catch (Kg)	62,198	123,887	140,645	158,245	184,170	301,142							
	% TACC Caught	12%	24%	27%	31%	36%	58%							
TAR 1 W	TAR 1W Catch/Month (kg) (Based on current reporting)	19,935	20,533	29,515	14,347	3,566	1,865							579,000
	Cumulative catch (Kg)	19,935	40,468	69,983	84,330	87,896	89,761							
	% TACC Caught	3%	7%	12%	15%	15%	16%							
2017/18	Catch/Month (kg)	69,878	64,664	67,354	49,721	65,703	178,317	205,740	176,329	81,255	108,197	99,492	91,533	1,583,534
	Cumulative catch (Kg)	69,878	134,542	201,896	251,617	317,320	495,637	701,377	877,706	958,961	1,067,158	1,166,650	1,258,183	
	% TACC Caught	4%	8%	13%	16%	20%	31%	44%	55%	61%	67%	74%	79%	
2016/17	Catch/Month (kg)	104,135	75,495	88,036	102,254	81,157	144,385	218,606	177,565	125,387	86,331	109,034	77,825	1,600,289
	Cumulative catch (Kg)	104,135	179,630	267,666	369,920	451,077	595,462	814,068	991,633	1,117,020	1,203,351	1,312,385	1,390,210	
	% TACC Caught	7%	11%	17%	23%	28%	37%	51%	62%	70%	75%	82%	87%	
2015/16	Catch/Month (kg)	94,370	78,650	48,553	61,481	91,933	160,254	205,623	197,879	71,247	46,511	69,768	102,806	1,561,393
	Cumulative catch (Kg)	94,370	173,020	221,573	283,054	374,987	535,241	740,864	938,743	1,009,990	1,056,501	1,126,269	1,229,075	
	% TACC Caught	6%	11%	14%	18%	24%	34%	47%	60%	65%	68%	72%	79%	
2014/15	Catch/Month (kg)	123,092	118,209	92,109	72,943	113,185	159,770	237,020	167,943	127,746	73,108	96,014	81,586	1,578,907
	Cumulative catch (Kg)	123,092	241,301	333,410	406,353	519,538	679,308	916,328	1,084,271	1,212,017	1,285,125	1,381,139	1,462,725	
	% TACC Caught	8%	15%	21%	26%	33%	43%	58%	69%	77%	81%	87%	93%	

TAR 1 2018/19 progress compared to 2014 - 2018 average

	October	November	December	January	February	March	April	May	June	July	August	September	Year to date
2018 Catch/Month (Kg)	69,011	66,970	44,099	53,203	60,350								180,080
Average Catch/Month (2014-2017) (Kg)	97,869	84,255	74,013	71,600	87,995								256,136
Difference	- 28,858	- 17,285	- 29,914	- 18,397	- 27,645								- 76,056

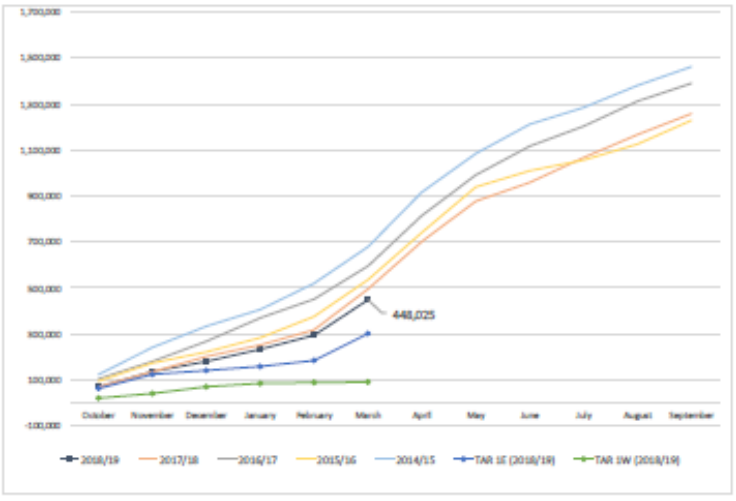
TAR 1E 2018/19 progress compared to 2014 - 2018 average
Based on attributing 47% of TAR 1 as TAR 1E for all earlier years.

	October	November	December	January	February	March	April	May	June	July	August	September	Year to date
2018 Catch/Month (Kg)	62,198	61,689	16,758	17,600	25,925								184,170
Average Catch/Month (2014-2017) (Kg)	45,998	39,600	34,786	33,652	41,357								195,393
Difference	16,200	22,089	- 18,028	- 16,052	- 15,432								- 11,223

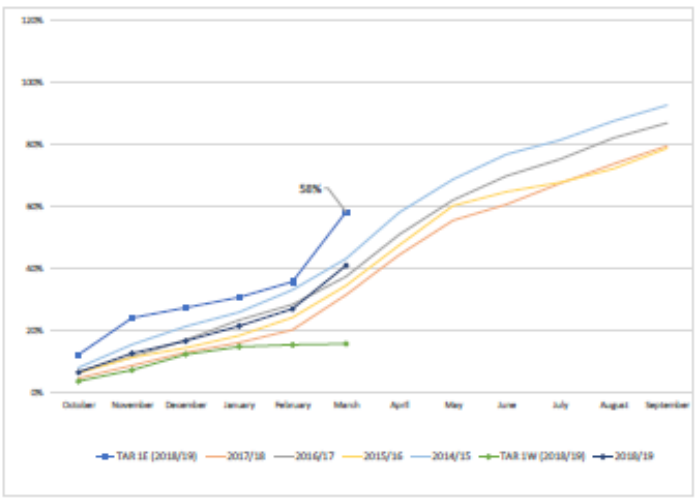
Difference between KUPE & TAR 1 E/W split

	October	November	December	January	February	March	April	May	June	July	August	September	TOTAL
KG	- 13,122	- 15,252	- 2,174	21,256	30,859	35,555	-	-	-	-	-	-	57,122
TONNE	- 13.12	- 15.25	- 2.17	21.26	30.86	35.56	-	-	-	-	-	-	57

TAR1 CUMULATIVE KG CAUGHT



TAR1 CUMULATIVE ACE % CAUGHT



TAR2 CUMULATIVE % TACC CAUGHT

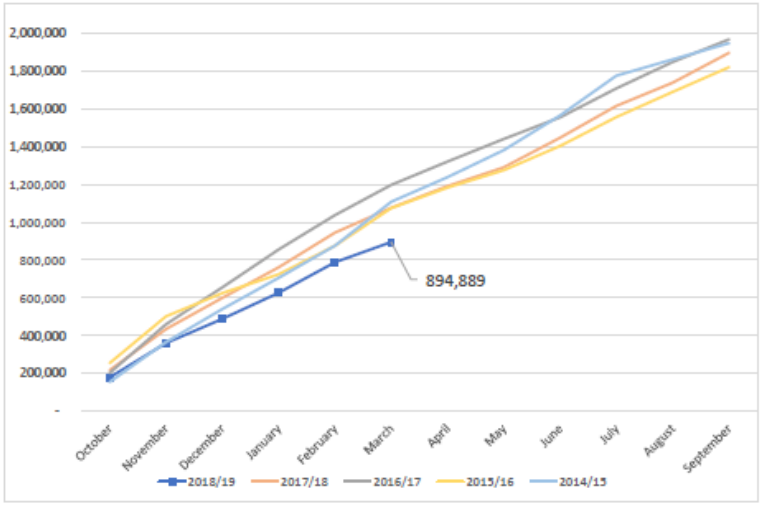
For the period: Oct 2018 - March 2019
Date As At: 15/05/2019

Fishing Year		October	November	December	January	February	March	April	May	June	July	August	September	Total ACE
2018/19	Catch/Month (kg)	178,778	181,388	128,476	138,205	160,695	107,347							1,500,000
	Cumulative catch (Kg)	178,778	360,166	488,642	626,847	787,542	894,889							-
	% TACC Caught	12%	24%	33%	42%	53%	60%							
2017/18	Catch/Month (kg)	216,670	217,854	165,361	161,134	183,680	131,995	114,335	99,751	155,246	168,436	124,269	157,544	1,797,511
	Cumulative catch (Kg)	216,670	434,524	599,885	761,019	944,699	1,076,694	1,191,029	1,290,780	1,446,026	1,614,462	1,738,731	1,896,275	
	% TACC Caught	12%	24%	33%	42%	53%	60%	66%	72%	80%	90%	97%	105%	
2016/17	Catch/Month (kg)	202,260	258,040	195,084	200,324	181,296	160,114	122,534	119,710	115,600	152,817	140,864	118,697	1,833,320
	Cumulative catch (Kg)	202,260	460,300	655,384	855,708	1,037,004	1,197,118	1,319,652	1,439,362	1,554,962	1,707,779	1,848,643	1,967,340	
	% TACC Caught	11%	25%	36%	47%	57%	65%	72%	79%	85%	93%	101%	107%	
2015/16	Catch/Month (kg)	254,361	246,955	123,000	100,443	150,108	200,368	107,427	91,695	129,493	153,053	131,724	131,581	1,801,045
	Cumulative catch (Kg)	254,361	501,316	624,316	724,759	874,867	1,075,235	1,182,662	1,274,357	1,403,850	1,556,903	1,688,627	1,820,208	
	% TACC Caught	14%	28%	35%	40%	49%	60%	66%	71%	78%	86%	94%	101%	
2014/15	Catch/Month (kg)	154,274	210,600	175,454	164,770	171,290	231,963	130,022	142,417	184,395	209,384	86,776	86,109	1,854,873
	Cumulative catch (Kg)	154,274	364,874	540,328	705,098	876,388	1,108,351	1,238,373	1,380,790	1,565,185	1,774,569	1,861,345	1,947,454	
	% TACC Caught	8%	20%	29%	38%	47%	60%	67%	74%	84%	96%	100%	105%	

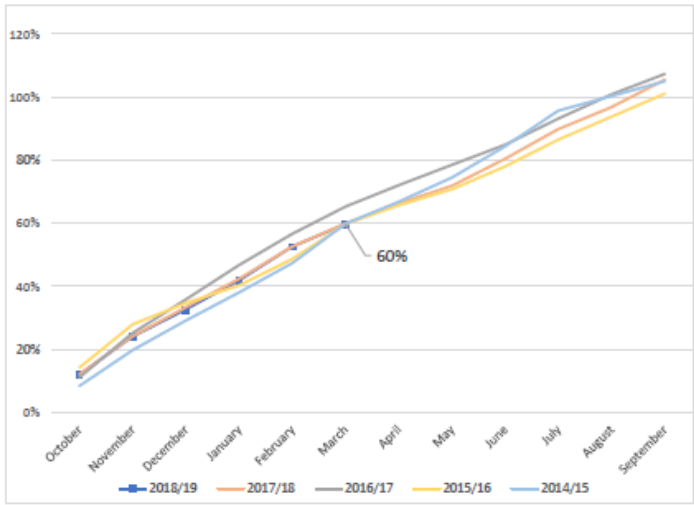
2018/19 progress compared to 2014 - 2018 average

	October	November	December	January	February	March	April	May	June	July	August	September	Year to date
2018 Catch/Month (Kg)	178,778	181,388	128,476	138,205	160,695	107,347							894,889
Average Catch/Month (2014-2017) (Kg)	206,891	233,362	164,725	156,668	171,594	181,110							1,114,350
Difference	- 28,113	- 51,974	- 36,249	- 18,463	- 10,899	- 73,763							- 219,461

TAR2 CUMULATIVE KG CAUGHT



TAR2 CUMULATIVE % ACE CAUGHT



TAR3 CUMULATIVE % TACC CAUGHT

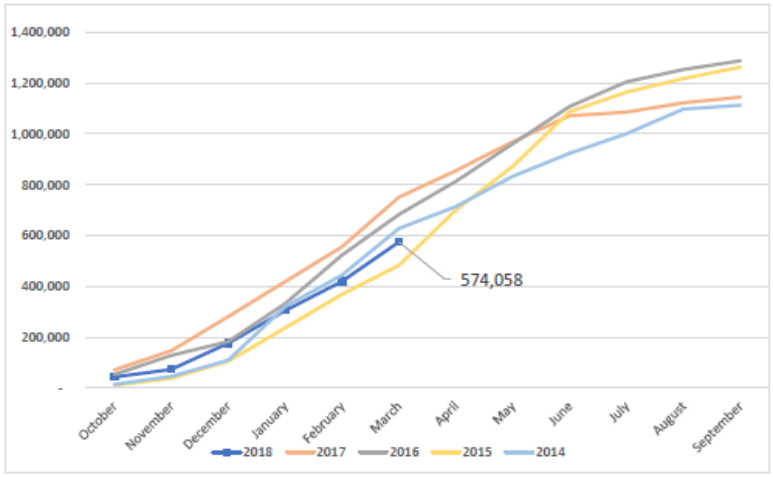
For the period: Oct 2018 - March 2019
Date As At: 15/05/2019

Fishing Year		October	November	December	January	February	March	April	May	June	July	August	September	Total ACE
2018	Catch/Month (kg)	42,688	30,314	102,739	128,934	114,126	155,257							1,040,000
	Cumulative catch (kg)	42,688	73,002	175,741	304,675	418,801	574,058							
	% TACC Caught	4%	7%	17%	29%	40%	55%							
2017	Catch/Month (kg)	70,824	74,986	134,520	138,032	137,143	194,613	104,535	113,981	101,895	14,019	37,317	22,366	1,528,091
	Cumulative catch (kg)	70,824	145,810	280,330	418,362	555,505	750,118	854,653	968,634	1,070,529	1,084,548	1,121,865	1,144,231	
	% TACC Caught	5%	10%	18%	27%	36%	49%	56%	63%	70%	71%	73%	75%	
2016	Catch/Month (kg)	52,623	74,411	55,424	149,523	190,079	159,645	131,299	148,330	146,226	97,117	47,478	34,921	1,524,508
	Cumulative catch (kg)	52,623	127,034	182,458	331,981	522,060	681,705	813,004	961,334	1,107,560	1,204,677	1,252,155	1,287,076	
	% TACC Caught	3%	8%	12%	22%	34%	45%	53%	63%	73%	79%	82%	84%	
2015	Catch/Month (kg)	9,936	26,840	67,850	131,443	131,512	114,515	218,545	171,170	214,758	77,578	52,922	45,176	1,545,909
	Cumulative catch (kg)	9,936	36,776	104,626	236,069	367,581	482,096	700,641	871,811	1,086,569	1,164,147	1,217,069	1,262,245	
	% TACC Caught	1%	2%	7%	15%	24%	31%	45%	56%	70%	75%	79%	82%	
2014	Catch/Month (kg)	13,945	31,614	64,138	210,274	123,545	183,929	85,568	119,024	90,570	77,979	96,047	15,497	1,534,596
	Cumulative catch (kg)	13,945	45,559	109,697	319,971	443,516	627,445	713,013	832,037	922,607	1,000,586	1,096,633	1,112,130	
	% TACC Caught	1%	3%	7%	21%	29%	41%	46%	54%	60%	65%	71%	72%	

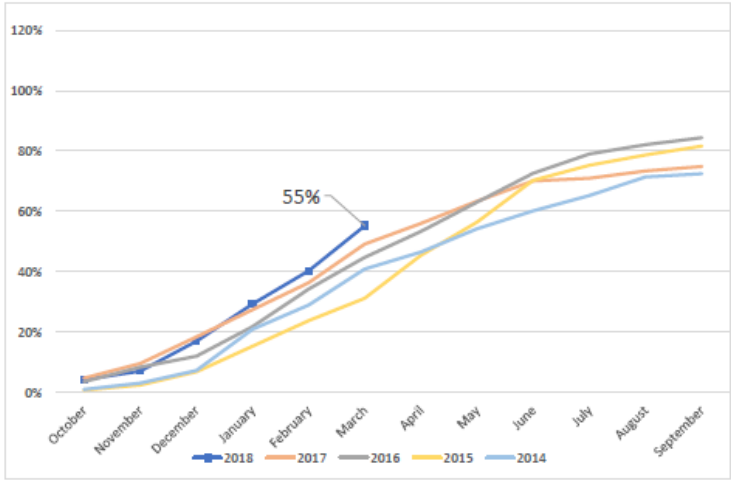
2018/19 progress compared to 2014 - 2018 average

	October	November	December	January	February	March	April	May	June	July	August	September	Year to date
2018 Catch/Month (Kg)	42,688	30,314	102,739	128,934	114,126	155,257							574,058
Average Catch/Month (2014-2017) (Kg)	36,832	51,963	80,483	157,318	145,570	163,176							635,341
Difference	5,856	- 21,649	22,256	- 28,384	- 31,444	- 7,919							- 61,283

TAR3 CUMULATIVE KG CAUGHT



TAR3 CUMULATIVE % ACE CAUGHT



TAR7 CUMULATIVE % TACC CAUGHT

For the period: Oct 2018 - March 2019
Date As At: 15/05/2019

	Year	October	November	December	January	February	March	April	May	June	July	August	September	Total ACE
2018	Catch/Month	128,674	123,732	125,029	129,661	89,661	108,452		-					1,042,000
	Cumulative catch	128,674	252,406	377,435	507,096	596,757	705,209							
	% TACC Caught	12%	24%	36%	49%	57%	68%							
TAR 7 E	TAR 7E Catch/Month (kg) (Based on current reports)	10,915	16,234	61,377	39,275	13,967	25,314							179,000
	Cumulative catch (Kg)	10,915	27,149	88,526	127,801	141,768	167,082							
	% TACC Caught	6%	15%	49%	71%	79%	93%							
TAR 7 W	TAR 7W Catch/Month (kg) (Based on current reporting)	130,396	112,407	130,986	98,405	75,695	105,416							863,000
	Cumulative catch (Kg)	130,396	242,803	373,789	472,194	547,889	653,305							
	% TACC Caught	15%	28%	43%	55%	63%	76%							
2017	Catch/Month	70,824	74,986	134,520	138,032	137,143	194,613	104,535	113,981	101,895	14,019	37,317	22,366	1,528,091
	Cumulative catch	70,824	145,810	280,330	418,362	555,505	750,118	854,653	968,634	1,070,529	1,084,548	1,121,865	1,144,231	
	% TACC Caught	5%	10%	18%	27%	36%	49%	56%	63%	70%	71%	73%	75%	
2016	Catch/Month	52,623	74,411	55,424	149,523	190,079	159,645	131,299	148,330	146,226	97,117	47,478	34,921	1,524,508
	Cumulative catch	52,623	127,034	182,458	331,981	522,060	681,705	813,004	961,334	1,107,560	1,204,677	1,252,155	1,287,076	
	% TACC Caught	3%	8%	12%	22%	34%	45%	53%	63%	73%	79%	82%	84%	
2015	Catch/Month	9,936	26,840	67,850	131,443	131,512	114,515	218,545	171,170	214,758	77,578	52,922	45,176	1,545,909
	Cumulative catch	9,936	36,776	104,626	236,069	367,581	482,096	700,641	871,811	1,086,569	1,164,147	1,217,069	1,262,245	
	% TACC Caught	1%	2%	7%	15%	24%	31%	45%	56%	70%	75%	79%	82%	
2014	Catch/Month	13,945	31,614	64,138	210,274	123,545	183,929	85,568	119,024	90,570	77,979	96,047	15,497	1,534,596
	Cumulative catch	13,945	45,559	109,697	319,971	443,516	627,445	713,013	832,037	922,607	1,000,586	1,096,633	1,112,130	
	% TACC Caught	1%	3%	7%	21%	29%	41%	46%	54%	60%	65%	71%	72%	

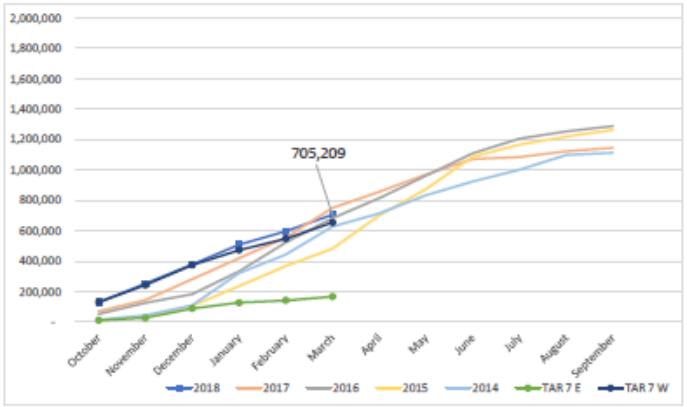
2018/19 progress compared to 2014 - 2018 average

	October	November	December	January	February	March	April	May	June	July	August	September	Year to date
2018 Catch/Month	128,674	123,732	125,029	129,661	89,661	108,452							705,209
Average Catch/Month (2014-2017)	36,832	51,963	80,483	157,318	145,570	163,176							635,341
Difference	91,842	71,769	44,546	-27,657	-55,909	-54,724							69,868

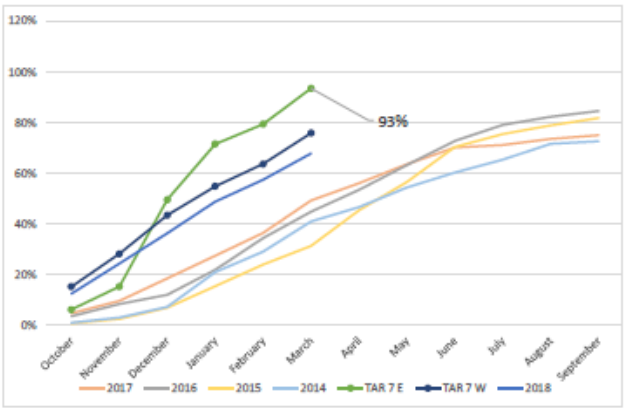
Difference between KUPE & TAR 7 E/W split

	October	November	December	January	February	March	April	May	June	July	August	September	TOTAL
KG	-12,637	-4,909	-67,334	-8,019	-1	-22,278	-	-	-	-	-	-	-115,178
TONNE	-12.64	-4.91	-67.33	-8.02	-0.00	-22.28	-	-	-	-	-	-	-115

TAR7 CUMULATIVE KG CAUGHT



TAR7 CUMULATIVE % CAUGHT



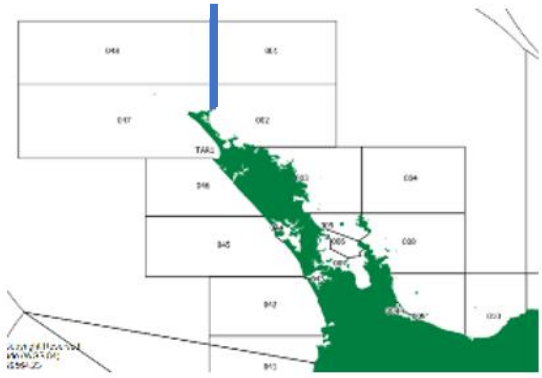
Appendix 2 – TAR 1 E/W catch spreading

1. Objective: Implement a formal agreement to abide by catch spreading measures for TAR1E and TAR1W, and as part of this, formal agreement to make information available for monitoring and verification of the catch splits.
2. Stock assessment represents only the eastern part of TAR1.
3. Agreement is considered to be an essential part of the TAR Management Strategy, which seeks to avoid significantly greater TACC cuts by MPI, and uncertainty about future management of the East / West components of the TAR1 stock.
4. For catch spreading in TAR1, the working boundary between TAR1E and TAR1W is to be the boundary between FMA1 and FMA9.
5. FishServe has designed a database and application, separate to the statutory reporting of Kupe, which will record and process all TAR1E and TAR1W reporting. After this first year of the management strategy FishServe will utilise Kupe platform from year two onwards.
6. Every TAR1 quota owner has had their TAR1 apportioned to be 52.78% TAR1W ACE and 47.22% TAR1E ACE. Industry will then either use, trade or sell their ACE in each eastern or western side of the QMA as suits their operation. The TACCs following the Minister's decision for these areas are:

	New TACC as per Minister's decision	Total Eastern ACE available	Total Western ACE available
TAR1	1,097	518	579

Implementation rules

7. Abide by the TAR1 East / West Agreement.
8. Implement a catch plan for the 2018/19 fishing year that ensures that your catches remain within the available ACE.
9. Ensure that when trading ACE that the parties you trade with are also signed up for and adhering to the TAR1 East / West Agreement.
10. The TAR1 East / West Agreement will be monitored by FishServe and the Northern Regional Committee on an ongoing basis.
11. Quarterly reports on the TAR1 East / West Agreement will be produced and circulated, including to MPI.
12. The TAR1 E allocation is a ceiling that should not be exceeded. This will impact the TAR management Strategy.



What do TAR 1 quota holders fishers / quota holders need to do?

13. Ensure you have returned all catch spreading documentation **– this is the responsibility of all quota and ACE holders.**
14. Ensure you have read and signed the Tarakihi East / West Catch Limit Agreement for 2018/19 Fishing Year.
15. Ensure you have read and signed the Tarakihi East / West data release.
16. Provide Monthly Catch reports specifying the TAR 1 E/W splits **– this is the reasonability of the fisher.**
17. Provide ACE transfer reports specifying the TAR 1 E/W splits **– this is the reasonability of the ACE seller.**

Appendix 3 – TAR 7 E/W catch spreading

18. Objective: Implement a formal agreement to abide by catch spreading measures for TAR7E and TAR7W, and as part of this, formal agreement to make information available for monitoring and verification of the catch splits.
19. Stock assessment represents only the eastern part of TAR7.
20. This agreement is considered to be an essential part of the TAR Management Strategy, which seeks to avoid significantly greater TACC cuts by MPI, and uncertainty about future management of the East / West components of the TAR7 stock.
21. For catch spreading in TAR7, the working boundary between TAR7E and TAR7W is to be the boundary is the existing TAR2/8 line west to landfall.
22. FishServe has designed a database and application, separate to the statutory reporting of Kupe, which will record and process all TAR7E and TAR7W reporting. After this first year of the management strategy FishServe will utilise Kupe platform from year two onwards.
23. Every TAR7 quota owners have had their TAR7 apportioned to be 82.84% TAR7W ACE and 17.16% TAR7E ACE. Industry will then either use, trade or sell their ACE in each eastern or western side of the QMA as suits their operation. The TACCs following the Minister's decision for these areas are:

	New TACC as per Minister's decision	Total Eastern ACE available	Total Western ACE available
TAR7	1,042	179	863

Implementation rules

24. Abide by the TAR7 East / West Agreement.
25. Implement a catch plan for the 2018/19 fishing year that ensures that your catches remain within the available ACE.
26. Ensure that when trading ACE that the parties you trade with are also signed up for and adhering to the TAR7 East / West Agreement.
27. The TAR7 East / West Agreement will be monitored by FishServe and the Northern Regional Committee on an ongoing basis.
28. Quarterly reports on the TAR7 East / West Agreement will be produced and circulated, including to MPI.

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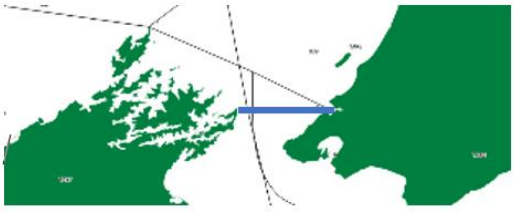
29. The TAR7E allocation is a ceiling that should not be exceeded. This will impact the TAR Management Strategy.
30. Fishers can catch all of their catch in TAR7 ACE in TAR7W if they wish.

TAR7E ACE can be used to cover TAR7W catch. As long as it reduces TAR7E catch



What do TAR7 quota holders fishers / quota holders need to do?

1. Ensure you have returned all catch spreading documentation **– this is the responsibility of all quota and ACE holders.**
2. Ensure you have read and signed the Tarakihi East / West Catch Limit Agreement for 2018/19 Fishing Year.
3. Ensure you have read and signed the Tarakihi East / West data release.
4. Provide Monthly Catch reports specifying the TAR 7 E/W splits **– this is the responsibility of the fisher.**
5. Provide ACE transfer reports specifying the TAR7 E/W split **– this is the responsibility of the ACE seller.**

Reporting of sub-MLS tarakihi (TAX) by QMA and method

Quarterly report to Fisheries Inshore NZ
Subject to the confidentiality agreement between FINZ and MPI

Authors:
David Middleton

To be cited as:

Middleton, D. (May 2019). Reporting of sub-MLS tarakihi (TAX) by QMA and method, 11 pages.
Quarterly report to Fisheries Inshore NZ
Subject to the confidentiality agreement between FINZ and MPI.

1. REPORTING OF TAX

With effect from 10 November 2018[1], the Ministry for Primary Industries (MPI) has required commercial fishers:

- taking tarakihi within the TAR 1, 2, 3 and 7 quota management areas, and
- fishing by trawling, set net, Danish seine or bottom long lining,

to report the estimated greenweight of tarakihi below the minimum legal size using the reporting code 'TAX'.

Reporting of TAX is required for every fishing event, including events where no sub- MLS tarakihi is caught, but is restricted to vessels reporting on the paper catch-effort returns[2].

The most recent effort data used in this report were from 06 Apr 2019. MPI have confirmed that validation of TAX data, including procedures for identifying missing TAX data, has not yet been implemented[3].

2. METHODS

This report provides summaries of the proportion of TAX by QMA, quarter and method. Because the reporting requirement is triggered by the taking of tarakihi, data are considered for trips that have reported landings of TAR 1, 2, 3 or 7 since 10 November 2018 ('qualifying trips')[4].

For all qualifying trips, the associated effort by trawling, set net, Danish seine or bottom long lining was extracted. If a fishing event does not have an associated estimate of TAX, it is reported as a missing TAX estimate in the tables below and treated as a zero for the reporting of TAX totals and TAX proportions. In light of the large number of such events, this assumption will be revisited in subsequent reports.

One fishing event with an obviously erroneous catch of TAR has been removed prior to generating the summaries in this report.

Data from area-method strata with less than three vessels or clients have been omitted from tables to meet MPI reporting guidelines.

[1]Although some notifications gave a start date of 18 November 2018

[2]There is a disposal code for sub-MLS fish under the new electronic reporting (ER) regime which obviates the need for the TAX code for vessels using ER.

[3]Correspondence with MPI's Research Data Management team established that the implementation of TAX reporting was split into two parts in order to be able to start collecting the data as soon as possible. The first stage put in place the ability for fishers to report TAX and then have it split off from other catch to avoid accidental inclusion in commercial catch totals. Any later validation specific to TAX is part of a second stage, which has not yet progressed due to work on introduction of Electronic Reporting.

[4]It is unclear whether MPI intended that the reporting requirement for TAX is assessed on a trip by trip basis, or some other basis.

3. QUARTERLY FLEET-SCALE SUMMARY

3.1 Q1: Oct - Dec 2018

QMA	Method	Vessels	Fishing events	Missing TAX est.	TAR (kg)	TAX (kg)	%TAX
TAR1	BLL	32	279	143	7390	4	0.1
TAR1	BT	13	457	158	13592	6	0.0
TAR1	DS	4	167	155	2569	0	0.0
TAR1	PRB	6	409	86	17782	32	0.2
TAR1	SN	4	39	17	177	0	0.0
TAR2	BLL	8	217	211	897	0	0.0
TAR2	BT PRB	18	906	122	241230	675	0.3
TAR2	SN						
TAR2							
TAR3	BT	24	598	184	60388	1073	1.7
TAR3	DS						
TAR3	SN	7	201	82	52742	3	0.0
TAR7	BLL	10	62	30	938	0	0.0
TAR7	BT	34	1477	460	184707	1105	0.6
TAR7	DS						
TAR7	SN	7	29	20	53	0	0.0

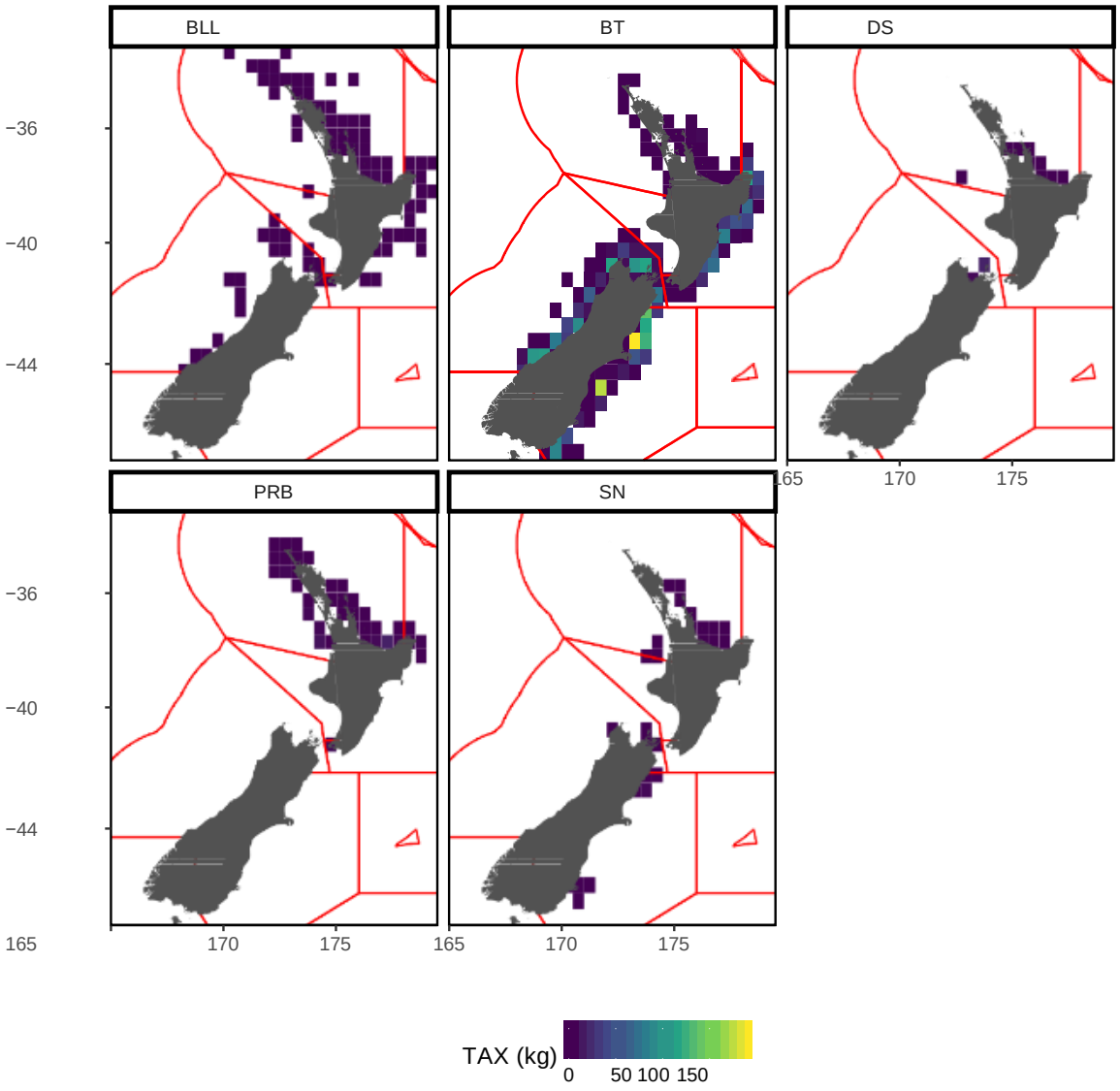


Figure 1: The distribution of TAX catch in Oct - Dec 2018, for all fishing events reported with a start latitude and longitude. Tarakihi QMA boundaries are shown in red.

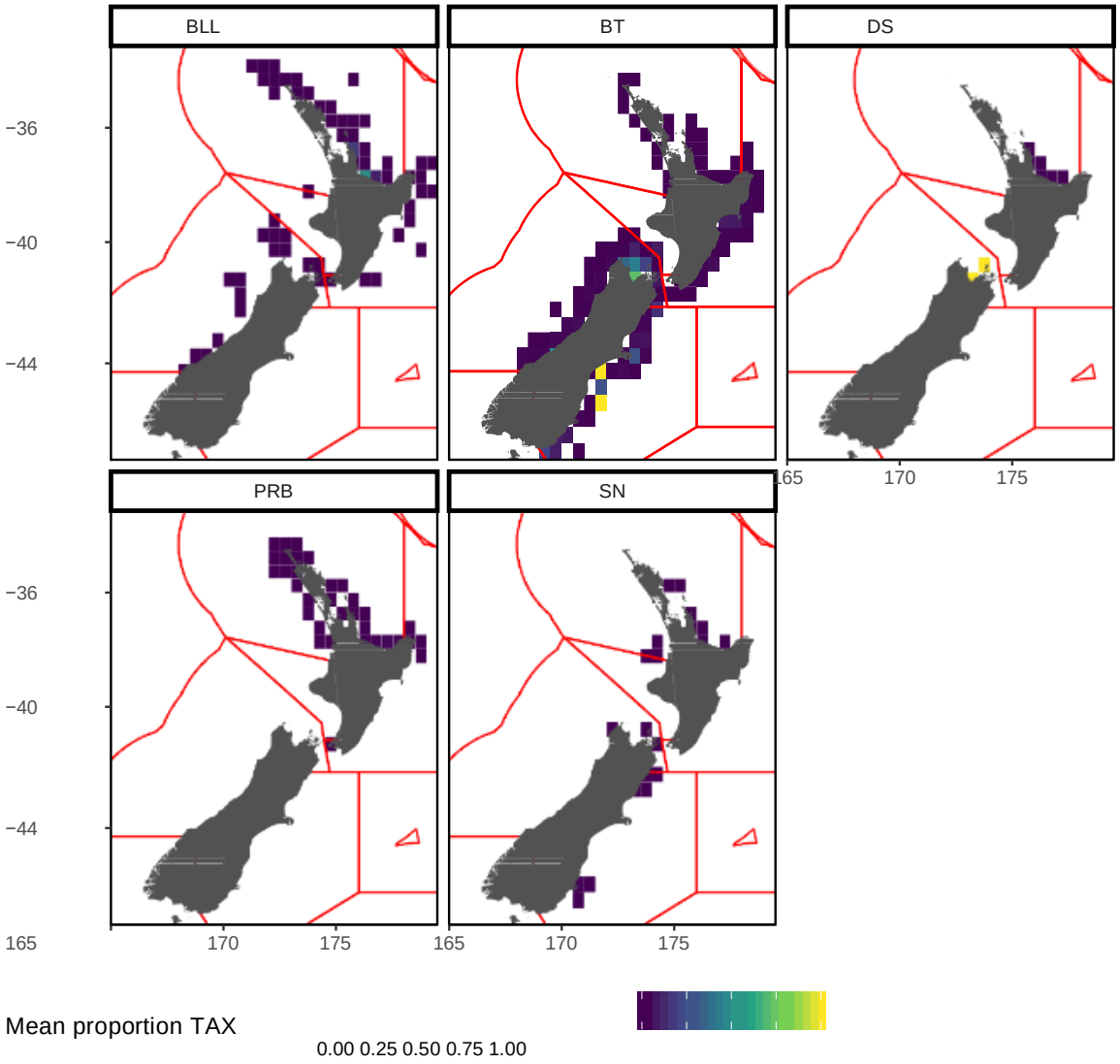


Figure 2: The mean proportion of TAX in Oct - Dec 2018, for all fishing events reported with a start latitude and longitude. Tarakihi QMA boundaries are shown in red.

QMA	Method	Vessels	Fishing events	Missing TAX est.	TAR (kg)	TAX (kg)	%TAX
TAR1	BLL	32	279	143	7390	4	0.1
TAR1	BT	13	457	158	13592	6	0.0
TAR1	DS	4	167	155	2569	0	0.0
TAR1	PRB	6	409	86	17782	32	0.2
TAR1	SN	4	39	17	177	0	0.0
TAR2	BLL	8	217	211	897	0	0.0
TAR2	BT PRB	18	906	122	241230	675	0.3
TAR2	SN						
TAR2							
TAR3	BT	24	598	184	60388	1073	1.7
TAR3	DS						
TAR3	SN	7	201	82	52742	3	0.0
TAR7	BLL	10	62	30	938	0	0.0
TAR7	BT	34	1477	460	184707	1105	0.6
TAR7	DS						
TAR7	SN	7	29	20	53	0	0.0

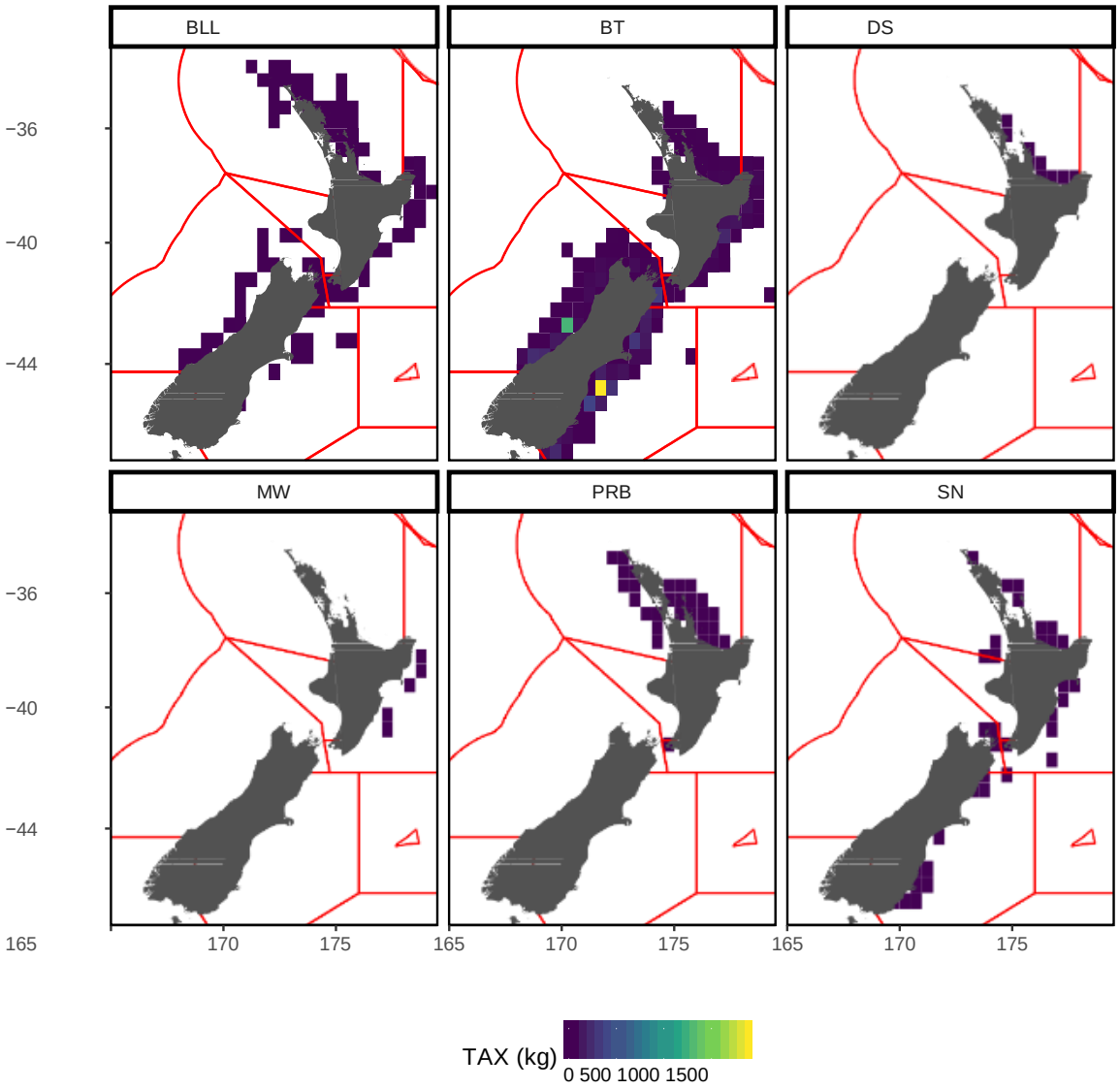


Figure 3: The distribution of TAX catch in Jan - Mar 2019, for all fishing events reported with a start latitude and longitude. Tarakihi QMA boundaries are shown in red.

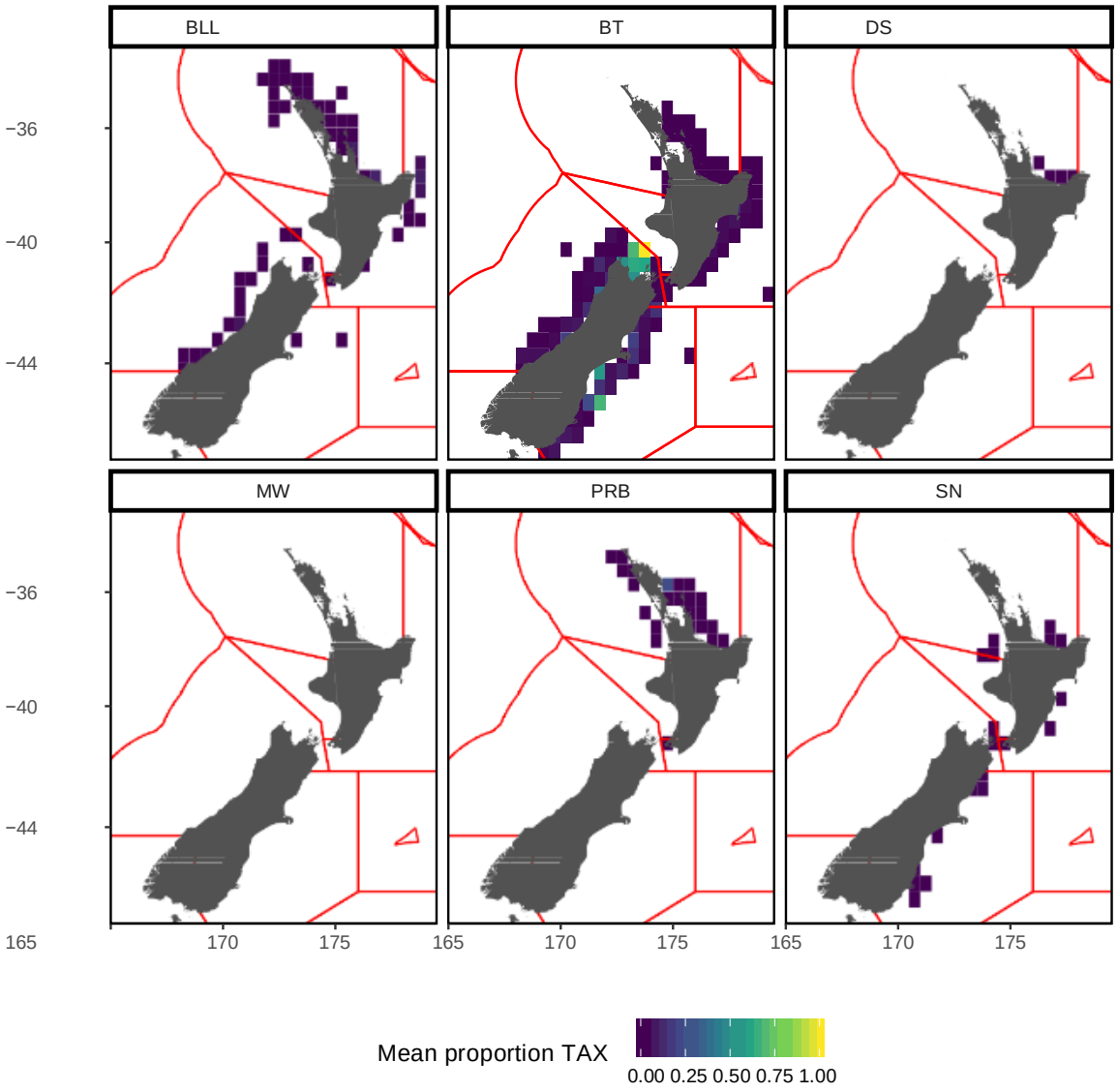


Figure 4: The mean proportion of TAX in Jan - Mar 2019, for all fishing events reported with a start latitude and longitude. Tarakihi QMA boundaries are shown in red.

4. ANNUAL SUMMARY FOR 2018-19

rea	Method	Vessels	Fishing events	Missing TAX est.	TAR (kg)	TAX (kg)	% TAX
TAR1	BLL	37	776	353	21905	13	0.1
TAR1	BT	15	1268	335	57335	50	0.1
TAR1	DS	6	322	266	3544	0	0.0
TAR1	PRB	7	857	120	31269	44	0.1
TAR1	SN	6	73	35	273	0	0.0
TAR2	BLL	11	440	391	2153	24	1.1
TAR2	BT	22	1828	257	502255	1286	0.3
TAR2	MW						
TAR2	PRB						
TAR2	SN	5	59	59	117	0	0.0
TAR3	BLL	3	31	31	77	0	0.0
TAR3	BT	32	1860	632	200125	5018	2.4
TAR3	DS						
TAR3	SN	11	541	187	124922	17	0.0
TAR7	BLL	11	206	76	2428	7	0.3
TAR7	BT	38	2959	700	405306	3618	0.9
TAR7	DS						
TAR7	SN	8	49	26	83	0	0.0

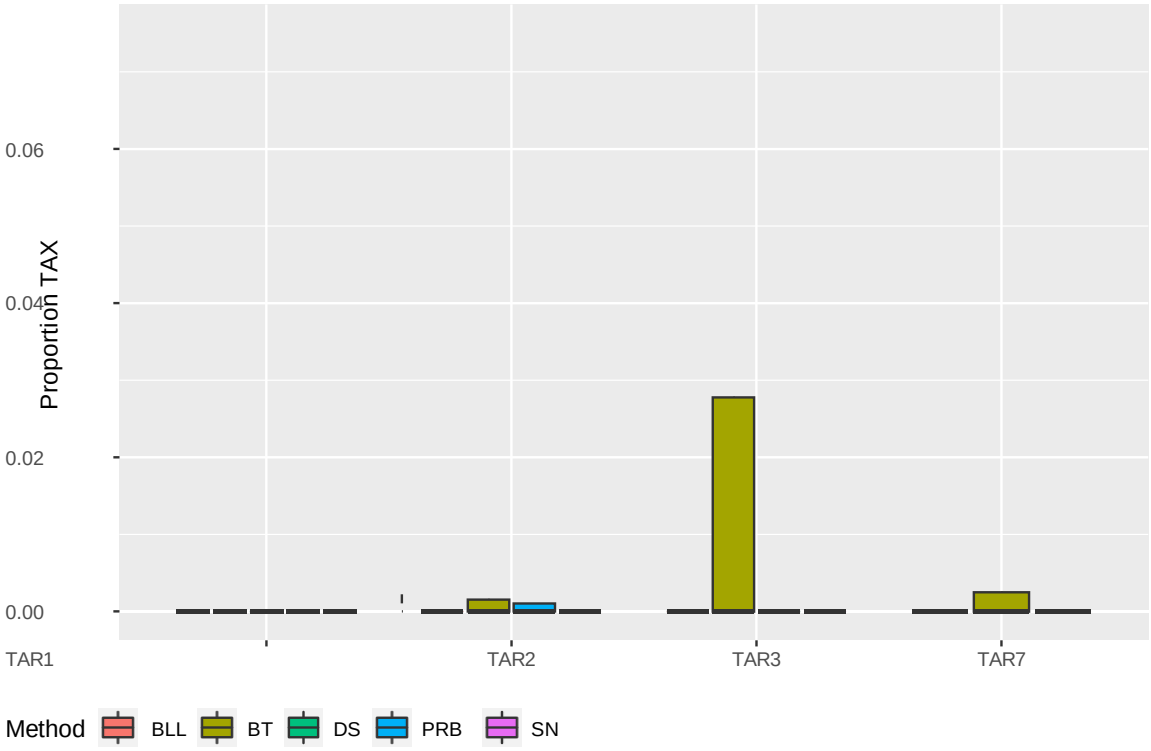


Figure 5: The distribution of per event proportions of TAX catch in 2018/19, by method and area. Limited to method-area combinations with at least 10 events. Outliers have been omitted for clarity.

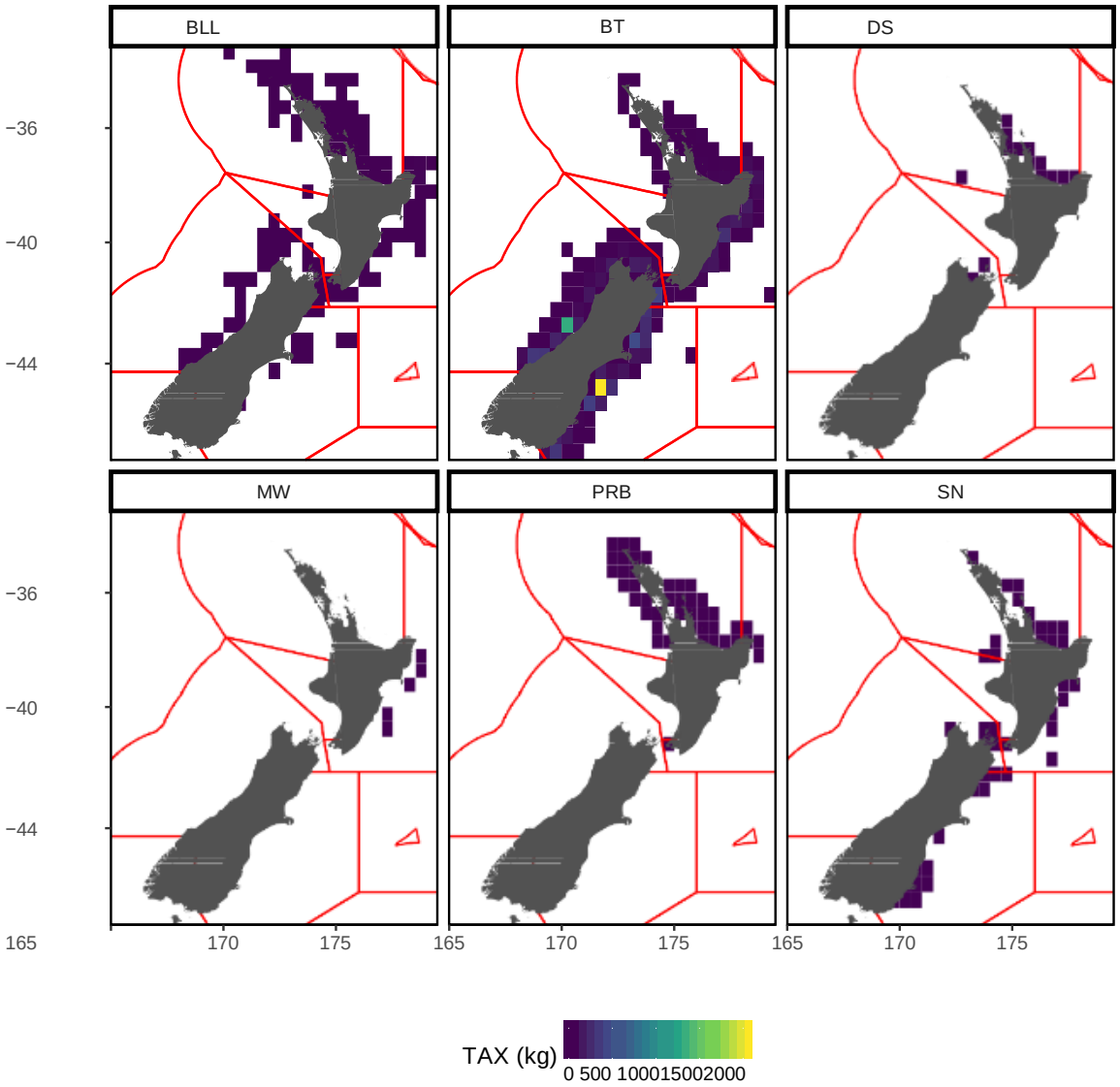


Figure 6: The distribution of TAX catch in 2018/19, for all fishing events reported with a start latitude and longitude. Tarakihi QMA boundaries are shown in red.

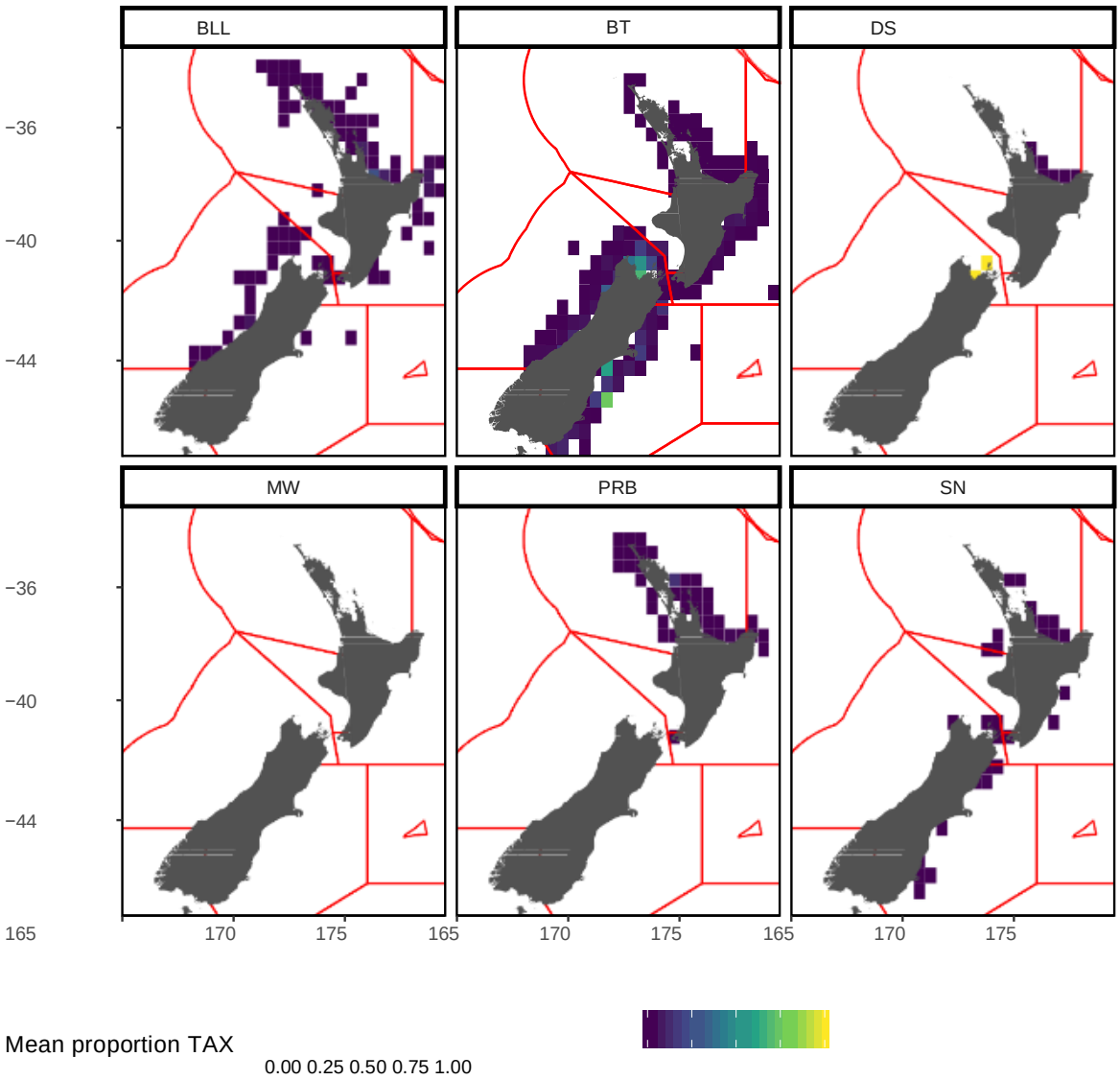


Figure 7: The mean proportion of TAX in 2018/19, for all fishing events reported with a start latitude and longitude. Tarakihi QMA boundaries are shown in red.

Appendix 5 Regional Management and Monitoring plans

NORTHERN REGIONAL COMMITTEE
TAR1 MANAGEMENT AND MONITORING PLAN

COMMITMENT

Signatories of the TAR1 Management and Monitoring Plan (Plan) are committed to the overarching goal of the industry TAR Management Strategy. That being to rebuild and maintain the biomass of the eastern Tarakihi fishery at or above maximum sustainable yield.

STRATEGY OBJECTIVES

1. A **short-term objective** to increase the east coast TAR biomass to circa 20% B_0 by the next stock assessment in2020/21.

2. A **short to medium term objective** to improve the knowledge about the stock to inform the next stock assessment in 2020/21, to reduce uncertainties, fine tune management measures to ensure their effectiveness and allow more informed management decisions in future.

3. A **medium to long term objective** to develop a Management Procedure framework for use in 2019/20 and 2020/21 prior to the finalisation of the next stock assessment. The Management Procedure will be updated to reflect the results of the next stock assessment and management settings. The Management Procedure will be implemented for each of the following 5 years before the stock assessment in 2025/26.

SCOPE

- This Plan only relates to TAR1
- Parties to this Plan are TAR1 quota holders, LFRs and fishers
- The Plan is aligned with the management strategy short term objective
- The Plan will be reviewed and updated in accordance with the next stock assessment (2020/21) to ensure it remains effective and relevant in the broader context of the TAR Management Strategy

This Plan does not preclude individual companies or fishers implementing measures that exceed the measures included in this agreement.

This agreement is intended to provide a minimum expectation of conduct in the TAR1 fishery. This minimum conduct will support the rebuild of the east coast TAR fishery.

CONDUCT

Parties to this Plan agree to the following management and monitoring initiatives for the TAR1 fishery, and shall:

- Support and implement the TAR1 E/W split through the provision of all voluntary agreements, TAR1 E/W transfer documentation and TAR1 E/W monthly harvest returns
- Remain within the overarching TAR1 east TACC, acknowledging that parties may trade ACE to ensure that as individual entities they can cover their TAR catch with available TAR1 east ACE
- Agree as a party to not target TAR when available ACE (as per catch plans) is less than 10% of original holding. The remaining ACE will be used to cover TAR as a bycatch. Overarching arrangements for catch plans will be the responsibility of individual parties to allow vessels to better plan for landing other viable and available ACE, account for seasonal variations, and continue to maintain a profitable vessel
- Support the inclusion in the TAR Strategy of the use of section 77 over-fishing thresholds subject to development of appropriate criteria to invoke that mechanism
- Honour existing regional commitments with wider stakeholders to ensure that fishers are cognisant of these agreements and adhere to them
- Commit support for the TAR selectivity trials completed as part of the TAR Management Strategy and in addition to the industry funding to support this selectivity work, agree to commit 1% of ACE holdings for 2019/20 year to Fisheries Inshore NZ to be used for experimental research if required
- Parties agree to review and implement recommendations from the selectivity trials, in accordance with the means at their disposal and their capabilities
- Identify areas of importance for KTA and make this information available
- Identify important nursery / juvenile TAR areas and make this information available. Management measures will be implemented accordingly following identification of such areas

- Skippers shall avoid fishing areas that are likely to hold predominantly small, sub-MLS tarakihi. That is, tarakihi < 25cm in fork length. In every haul, shot or set if:
  - Tarakihi is less than 10% of your total catch NO ACTION is required
  - Tarakihi is more than 10% of your total catch and 15% is under MLS MOVE-ON
- Any vessel that Moves-on for all subsequent lines for that trip:
  - Shall be more than 1nm from all parts of the line where the small fish were encountered, or
  - Action a depth change of at least 10 metres along all points of the line
- Skippers are encouraged to convey information about areas where there are high numbers of small fish to other vessels

ONGOING ASSESSMENT AND MANAGEMENT PLAN REVIEW

This Plan may be reviewed after the next stock assessment in 2020/21 or by agreement prior to this assessment on the basis of selectivity gear trial results and management procedure updates.

AREA 2 COMMITTEE
TAR2 MANAGEMENT AND MONITORING PLAN

COMMITMENT

Signatories of the TAR2 Management and Monitoring Plan (Plan) are committed to the overarching goal of the industry TAR Management Strategy. That being to rebuild and maintain the biomass of the eastern Tarakihi fishery at or above maximum sustainable yield.

STRATEGY OBJECTIVES

1. A **short-term** objective to increase the east coast TAR biomass to circa 20 % B_0 by the next stock assessment in 2020/21.
2. A **short to medium term objective** to improve the knowledge about the stock to inform the next stock assessment in 2020/21, to reduce uncertainties, fine tune management measures to ensure their effectiveness and allow more informed management decisions in future.
3. A **medium to long term objective** to develop a Management Procedure framework for use in 2019/20 and 2020/21 prior to the finalisation of the next stock assessment. The Management Procedure will be updated to reflect the results of the next stock assessment and management settings. The Management Procedure will be implemented for each of the following 5 years before the stock assessment in 2025/26.

SCOPE

- This Plan only relates to TAR2
- Parties to this Plan are TAR2 quota holders, LFRs and fishers (signed by fisher representatives of the Napier Port Fishers Association)
- The Plan is aligned with the management strategy short term objective
- The Plan will be reviewed and updated in accordance with the next stock assessment (2020/21) to ensure that the Plan remains effective and relevant in the broader context of the TAR Management Strategy

This plan does not preclude individual companies or fishers implementing measures that exceed the measures included in this agreement.

This agreement is intended to provide a minimum expectation of conduct in the TAR2 fishery. This minimum conduct will support the rebuild of the east coast TAR fishery.

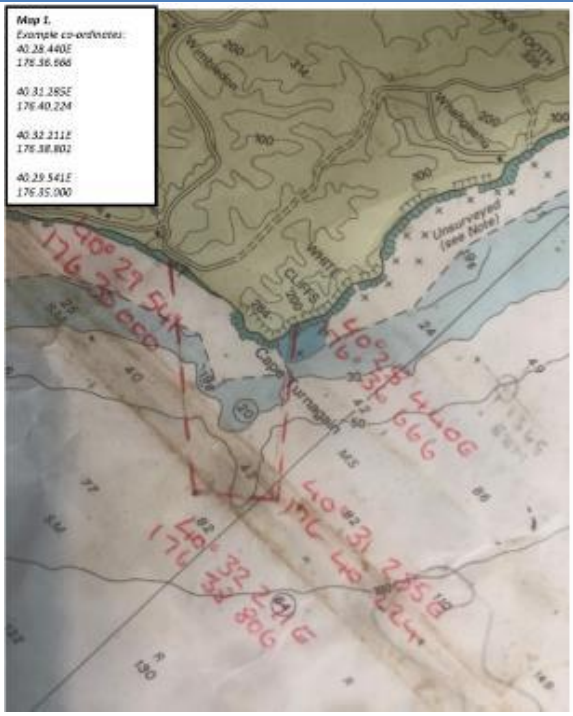
CONDUCT

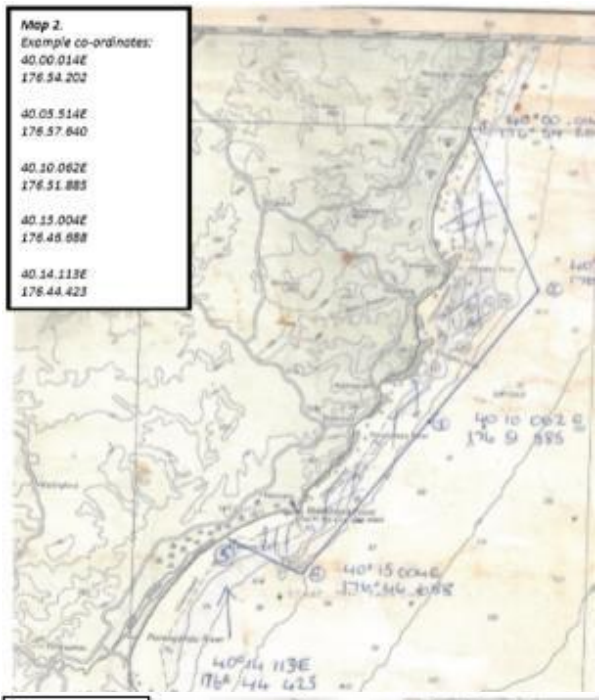
Parties to this Plan agree to the following management and monitoring initiatives for the TAR2 fishery, and shall:

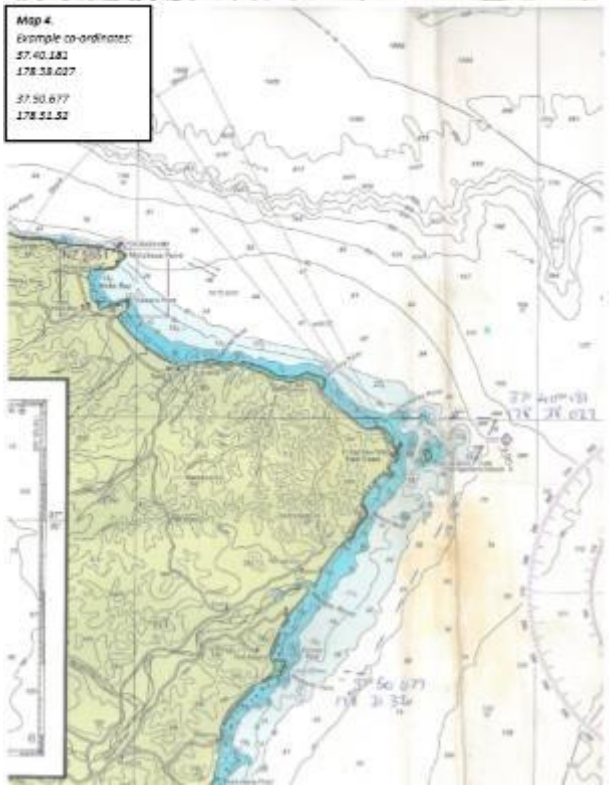
- Remain within the overarching TAR2 TACC, acknowledging that parties may trade ACE to ensure that as individual entities they can cover their TAR catch with available ACE
- Not lease TAR2 ACE to LFRs, operators or fishers that are not signatories to this agreement
- Agree as a party to not target TAR when available ACE is less than 10% of original holding. The remaining ACE will be used to cover TAR as a bycatch. Overarching arrangements for catch plans will be the responsibility of individual parties to allow vessels to better plan for landing other viable and available ACE, account for seasonal variations, and continue to maintain a profitable vessel
- Support the inclusion in the TAR Strategy of the use of section 77 over-fishing thresholds subject to development of appropriate criteria to invoke that mechanism
- Honour existing regional commitments with wider stakeholders such as the Springs Box closure and ensure that fishers are cognisant of these agreements and adhere to them
- Commit support for the TAR2 selectivity trials completed as part of the TAR Management Strategy and in addition to the industry funding to support this selectivity work, agree to transfer 1% of ACE holdings for 2019/2020 year to Fisheries Inshore NZ to be used for experimental research
- Parties agree to review and implement recommendations from the selectivity trials, in accordance with the means at their disposal and their capabilities
- Comply with voluntary spatial closures that contain small juvenile fish (including TAR) for to all trawlers. Areas identified as per the identified voluntary spatial closure maps section of this agreement
- Skippers shall avoid fishing areas that are likely to hold predominantly small, sub-MLS tarakihi. That is, tarakihi < 25cm in fork length. In every haul, shot or set if:
  - Tarakihi is less than 10% of your total catch NO ACTION is required
  - Tarakihi is more than 10% of your total catch and 15% is under MLS MOVE-ON

- Any vessel that Moves-on for all subsequent lines for that trip:
  - Shall be more than 1nm from all parts of the line where the small fish were encountered, or
  - Action a depth change of at least 10 metres along all points of the line
- Skippers are encouraged to convey information about areas where there are high numbers of small fish to other vessels

IDENTIFIED VOLUNTARY SPATIAL CLOSURES







ONGOING ASSESSMENT AND MANAGEMENT PLAN REVIEW

This plan and management measure may be reviewed after the next stock assessment in 2020/21 or by agreement prior to this assessment on the basis of selectivity gear trial results and management procedure updates.

SOUTHERN INSHORE
TAR3 MANAGEMENT AND MONITORING PLAN

COMMITMENT

Signatories of the TAR3 Management and Monitoring Plan (Plan) are committed to the overarching goal of the industry TAR Management Strategy. That being to rebuild and maintain the biomass of the eastern Tarakihi fishery at or above maximum sustainable yield.

STRATEGY OBJECTIVES

1. **Short-term** objective to increase the east coast TAR biomass by at least 12% (from current status) by the next stock assessment (2020/21) and in doing so increase the stock status to circa 20% B_0 within three years;

2. **Short to Medium-term** objective to improve the knowledge about the stock to inform the next and future stock assessments, to reduce uncertainties, to fine tune management measures to ensure their effectiveness and to allow more informed management decisions in future;

3. **Medium to Long-term** objective to develop a Management and Monitoring Plan including an associated Management Procedure for use starting in 2019/20. The Management Procedure will be implemented annually and updated to align with stock assessments and in the intervening years the industry initiated rapid stock assessment updates will be presented to the MPI Working Group for peer review. The Management Procedure will be updated to reflect the results of the next stock assessment and management settings (2020/21).

SCOPE

- This Plan relates directly to the TAR 3 fishery
- It recognises that this fishery is directly interconnected to the TAR1 and TAR2 Plans within the overarching East Coast TAR fishery, but with variances that relate directly to the southern (TAR3) fishery.
- Parties to this Plan are TAR3 quota holders who are shareholders of Southern Inshore as per the required provision of the Company Constitution. Quota owners agree with the express understanding that provisions of this plan will be implemented and adopted by fishers related to those quota owners/LFRs, where possible. All attempts will be made by Southern Inshore to secure the adherence to the plan from fishers not directly related to Southern Inshore shareholders, but who are operating in the TAR3 fishery
- The Plan will be reviewed and updated in accordance with the next stock assessment (2020/21) to ensure that it remains effective and relevant in the broader context of the East Coast TAR management strategy. This Plan does not preclude individual companies or fishers implementing measures that exceed those included in this agreement. This agreement is intended to provide a minimum expectation of conduct in the TAR3 fishery. However, if there are measures that may benefit other fishers and the TAR3 fishery in general, it is encouraged that fishers provide that information to Southern Inshore to be included where possible in the overarching objectives of the East Coast TAR rebuild plan

TAR 3 MANAGEMENT MEASURES

Parties to this TAR3 regional plan agree to the following management and monitoring initiatives for the TAR 3 fishery.

1. Remain within the overarching TAR3 TACC, acknowledging that parties may trade ACE to ensure that as individual entities they can cover their TAR catch with available ACE.
2. Not lease TAR3 ACE to other quota owners who are not signatories to the East Coast TAR strategy agreement.
3. To ensure that TAR3 is not a primary target species if provisional quota holdings or available ACE are not at a level that can be spread across a fishing year without incurring overcatch or deemed value.
4. Agree to review and implement fishing gear changes recommended from gear trials (where operationally possible) in TAR3 and from any trials that may be relevant from TAR2.
5. To comply with recommended management measures specific to the TAR3 fishery.

IDENTIFYING JUVENILE AREAS

Certain areas within the TAR3 fisheries management area have over time been identified as areas that may potentially have small sub-MLS/juvenile TAR being recruited to the TAR fishery. Reporting of sub-MLS tarakihi under the reporting code TAX will help to inform the areas most prevalent with juveniles from which more informed management measures can be implemented. Indicative sizes may also be utilised from the east coast South Island trawl survey.

In order to minimise the impact on these areas the following management measures are recommended.

i. Areas that have a degree of small/juvenile TAR will be subject to a 'Move on Rule'. This includes a measure of the overall catch at that specific location that includes at least 10% of TAR below the sub-MLS (TAR X) fish size.

ii. Should the catch of sub-MLS (TAR X) exceed 10% of the catch of TAR then the vessel should move to an area not less than 5Nm from this initial site before fishing again. The vessel is to move if the catch proportion again exceeds the threshold.

iii. Where areas may have known seasonal variation, both spatial and depth, of fish sizes within the range of sub-MLS TAR, these areas should be avoided.

iv. Fishers are to adopt, at a minimum, 125mm diamond mesh codends when operating in the TAR3 fishery. Further provisions on codend mesh sizes may be implemented after selectivity gear trials.

v. To investigate areas, and efficacy, of annual and seasonal voluntary restricted areas for TAR.

ONGOING ASSESSMENT AND MANAGEMENT PLAN REVIEW

This Plan and management measure may be reviewed after the next stock assessment in 2020/21 or by agreement prior to this assessment on the basis of selectivity gear trial results and management procedure updates.

Appendix 6 - Rationale for appropriate management target for east coast TAR

Basis for setting a management target

1. The primary statutory requirement for setting a management target for New Zealand fisheries is to set it in line with the purpose of the Fisheries Act 1996 to provide for the utilisation of fisheries resources while ensuring sustainability (S8 (1)).

2. Section 13 of the Fisheries Act sets out the Minister's responsibilities regarding the target biomass for a stock, that being at or above B_{MSY}. In considering the way in which and rate at which a stock is moved towards or above a level that can produce maximum sustainable yield the Minister shall have regard to **such social, cultural, and economic factors as he or she considers relevant**.

3. Fishery managers are required to provide targets as modified by relevant factors in line with the statutory requirements set out in the Act.[11] The primary policy documentation to guide managers to make management decisions is the Harvest Strategy Standard (HSS) guidelines and associated operational guidelines. The HSS guidelines itself has no legal basis but is a guiding policy document. Managers can depart from the HSS guidelines if they consider they can justify this in terms of the circumstances that warrant such departure.

4. In order to encompass all viable approaches covered by sub-sections 13(2) and 13(2A) of the Act, the HSS guidelines uses the short-hand phrase "MSY-compatible reference points or better". MSY-compatible reference points include those related to stock biomass (i.e. BMSY), fishing mortality (i.e. FMSY) and catch (i.e. MSY itself), as well as analytical and conceptual proxies (i.e. approximations) for each of these three quantities. Guidance on methods for calculating the reference points (including their proxies) is contained in the Operational Guidelines. "Or better" means being above BMSY or its proxies, and/or below FMSY or its proxies, and/or below MSY or its proxies.

5. The respective roles and responsibilities of managers, scientists and stakeholders are outlined in the HSS implementation guidelines which states that *'Targets will be set by fisheries managers based on estimates on MSY-compatible reference points but modified by relevant factors'.* Relevant factors identified as things that are likely to result in targets that are "better" than MSY-compatible reference points. Relevant inputs termed to be cultural, social, economic and ecosystem considerations as required by the Act.

Concerns regarding the relevance of HSS defaults to reflect changing fisheries management approaches

6. The HSS implementing guideline is from 2011, whilst the strategy itself hasn't been reviewed since 2007. This document should have been reviewed at least every five years to ensure that the guidelines reflect the evolution of fisheries plans and fisheries management strategies in New Zealand, and the evolution of international best practice.

7. It is arguable whether the HSS guidelines still accurately reflect the context of fisheries management in New Zealand and international best practice for setting management targets. This raises questions regarding the relevance of an outdated policy guidance document that is not reflecting changing approaches to fisheries management and utilisation of scientific information by managers.

8. Recent developments in the scientific literature show a shift towards the use of Management Strategy Evaluations (MSEs) for setting fisheries management targets as demonstrated by its prominence in the international scientific literature.[12] The use of a default management target ignores this international prominence of MSE as a fisheries management tool in recent years. The HSS itself acknowledges the utility of an MSE.

9. MSEs are fully compatible with the Harvest Strategy Standard. The three core components of the Harvest Strategy Standard (a specified target based on MSY-compatible reference points or better, a soft limit, and a hard limit, all with associated acceptable probabilities and management actions), simply provide minimum performance standards, or minimum performance measures, for MSEs and do not restrict

[11] Ministry of Fisheries (2011) Operation Guidelines for New Zealand's Harvest Strategy Standard – Revision 1 at page 27
[12] Punt, A. E., Butterworth, D. S., de Moor, C. L., De Oliveira, J. A., & Haddon, M. (2016). Management strategy evaluation: best practices. *Fish and Fisheries*, *17*(2), 303-334.

alternative management objectives, or innovative management strategies, or additional performance measures beyond this.

Application of policy guidance for setting an east coast tarakihi managment target

10. FNZ's default position based on a simplified interpretation of the HSS is a generalist approach to a tarakihi species specific management issue. That approach doesn't reflect that the HSS guidelines identifies that management targets and rebuild plans are species-specific and require an assessment by species on a case-by-case basis: "there is no single target level applicable for all species and stocks"[13].

11. During the 2018 consultation on TAR at a consultation meeting in Auckland (16th July) the Fisheries New Zealand scientist present stated that '40% SB_0 was more appropriate than a species-specific real-world percentage.' This was based on the following rationale that the problems with doing stock specific real-world SB_{MSY} calculations are:

    - the difficulty of including all real-world factors in an appropriate way,
    - the fact that the real-world SB_{MSY} will change depending on a number of factors such as the apportionment of TACCs between areas and/or the mix of sizes of fish caught (selectivity), natural mortality, and recent average recruitment, and
    - density-dependent effects will become more pronounced so that the values of population parameters that apply now may not be applicable in the future.

12. The concerns raised at this meeting and subsequent engagement about the more appropriate use of a species-specific target are addressed by the fact that the MSE approach provides assurance to uncertainty (Punt et al, 2016). The reference point approach to being precautionary is to include a buffer to the reference point, however it is argued that the precautionary approach should be extracted from reference points and instead is more effective when applied to process (Hilborn, 2002).

13. Hilborn (2002) who explored some of the problems that have arisen in the practice of applying standard reference points, including

    1) uncertainties in current stock biomass and virgin stock biomass as applied in reference point formula,
    2) the inappropriateness of reference points applied to species for which they were not derived,
    3) the tendency of reference-point use to produce an environment in which stock-assessment scientists rarely evaluate alternative management policies, and
    4) the role of concern about reference points as a displacement activity for scientists that keeps them from working on more significant problems in fisheries management.

14. Butterworth (2007) noted the greatest advantages to the MSE approach are (i) a sound basis to limit the extent of future TAC variations without compromising resource status and (ii) the proper way of addressing concerns about scientific uncertainty through simulation testing. This position was supported by FNZ scientists who attended the Napier cross-sector consultation meeting on the 18th July, where they agreed that a species-specific target is more appropriate.

Way & Rate

15. Following the determination of a B_{MSY} is the determination of an appropriate management rebuild framework referred to as the way and rate of a rebuild. These are management decisions. They are not determined by science.

16. FNZ's reliance on managing to a 2 times 'Tmin' rebuild timeframe appears to be a misguided view that this is dictated to them by the HSS.

17. Industry advocates instead to manage the rebuild over an appropriate timeframe that reflects all the relevant factors under the Fisheries Act.

[13] Ministry of Fisheries (2011) Operation Guidelines for New Zealand's Harvest Strategy Standard – Revision 1 at page 2

18. The use of Tmin (the theoretical number of years required to rebuild a stock to the target with zero fishing mortality) and 2 times Tmin as the rebuild time under fishing is specified in the HSS guidelines but has no legal basis. The requirement to rebuild a stock is set out in the Act and requires the consideration of relevant factors (as outlined previously).

19. Fishery and stock targets and limits are set based on an assessment of risk in order to manage them on a long-term basis to provide for utilisation while ensuring sustainability. With this in mind industry has completed MSE work that provides scenarios that meet the requirements of the Act and meet the policy guidance on risk.

20. The MSE scenarios provided in Appendix 8 that demonstrate that 35% at 2016/17 catch levels (4442 tonnes) achieves the risk requirements of the policy document for all the requested scenarios whilst achieving sustainable utilisation as provided for in the Act.

21. Rather than a 'set and forget' way and rate approach as proposed by the HSS defaults, industry is proposing agile decision making that manages risk and accounts for all relevant factors. This process begins with the MSE approach which Punt et al (2016) identified MSE as being 'at the interface between science and policy' noting that *'A well-structured MSE utilises links between policy and science however ensures a wall of science remains so that decision makers do not decide scientific issues and scientists do not make policy decisions.'*

22. An agile decision-making approach is consistent with the recent ***Your Fisheries Your Say*** consultation which identifies FNZ's policy direction towards using harvest control rules to more quickly response to changes in our fisheries. It is therefore contradictory to the proposed future policy approach for fisheries managers to be promoting the use of a generic management target of 40% SB_0 as the reference point and the default 2 times Tmin rebuild timeframe.

23. The industry proposed approach identifies a species-specific management target that meets the risk thresholds for sustainably fishing whilst maximising utilisation. A management procedure is then used to rebuild to this level in a manner that reflects the health of the stock. This approach is recognised as having two key advantages over the current 'set and forget' response to changes in abundance: responsiveness, and greater certainty and transparency.

24. Given these benefits and the transparent species-specific approach proposed by industry it is concerning the FNZ managers could be considering blunt management tools that do not reflect the increased prominence of agile decision-making internationally or indeed reflect the policy direction sought within FNZ.

Appendix 7 – Summary of Management Strategy scenarios. The yellow column identifies the proposed option as per this Strategy

Summary statistics

Risk20 = proportion of years below 20% SB0 (all iterations combined)
Risk10 = proportion of years below 10% SB0 (all iterations combined)

Scenario: *Recent Recruitment Devs, Basic MP Exp3*

Notional target SB/SB0 %	30	30	30	30	30	30	30	35	35	35	35	35	35	35	40	40	40	40	40	40	40
Catch scalar %	70	80	90	100	110	120	130	70	80	90	100	110	120	130	70	80	90	100	110	120	130
SB/SB0 median %	38.1%	34.4%	31.4%	28.8%	26.6%	24.9%	23.0%	41.5%	38.1%	35.2%	32.8%	31.1%	29.8%	28.5%	44.7%	41.4%	38.7%	36.7%	35.0%	33.8%	32.7%
Risk20	0.7%	2.3%	5.7%	12.4%	21.2%	29.5%	38.4%	0.3%	0.6%	1.7%	4.3%	8.0%	13.0%	18.1%	0.0%	0.2%	0.4%	1.3%	3.0%	5.3%	8.1%
Risk10	0.0%	0.4%	0.7%	1.6%	4.6%	8.2%	14.9%	0.1%	0.0%	0.1%	0.4%	0.8%	1.9%	4.2%	0.0%	0.0%	0.0%	0.2%	0.3%	0.5%	1.2%
Catch average	3,699	3,840	3,932	3,976	3,921	3,820	3,614	3,533	3,699	3,814	3,889	3,934	3,933	3,882	3,368	3,537	3,666	3,751	3,813	3,853	3,857
Catch Std dev	695	759	837	1,021	1,337	1,654	2,020	677	694	758	870	987	1,172	1,389	647	680	734	821	902	991	1,112

Scenario: *Recent Recruitment Devs, Basic MP Exp3_CPUEbias parameter 0.90 Lower biomass levels and higher risk.*

Notional target SB/SB0 %	30	30	30	30	30	30	30	35	35	35	35	35	35	35	40	40	40	40	40	40	40
Catch scalar %	70	80	90	100	110	120	130	70	80	90	100	110	120	130	70	80	90	100	110	120	130
SB/SB0 median %	35.3%	31.6%	28.2%	25.6%	23.1%	20.7%	17.0%	38.9%	35.3%	32.2%	29.6%	27.6%	25.9%	24.1%	42.2%	38.7%	35.8%	33.6%	31.7%	30.1%	29.1%
Risk20	1.7%	5.4%	12.3%	23.4%	35.8%	47.2%	59.8%	0.5%	1.7%	4.2%	9.5%	17.0%	25.1%	33.7%	0.1%	0.4%	0.0%	3.3%	6.4%	11.3%	16.0%
Risk10	0.1%	0.6%	1.0%	2.8%	8.3%	17.0%	32.2%	0.0%	0.1%	0.2%	0.6%	2.2%	5.4%	11.0%	0.0%	0.0%	0.2%	0.2%	0.3%	1.5%	3.0%
Catch average	3,809	3,941	4,023	4,026	3,882	3,628	3,064	3,659	3,813	3,929	3,994	3,991	3,926	3,764	3,498	3,669	3,790	3,874	3,936	3,946	3,931
Catch Std dev	717	766	848	1,057	1,448	1,876	2,310	675	703	745	849	1,053	1,315	1,643	654	671	737	809	886	1,032	1,186

Scenario: *Recent Recruitment Devs, Basic MP Exp3_AssessError Slightly higher risk but relatively trivial effect*

Notional target SB/SB0 %	30	30	30	30	30	30	30	35	35	35	35	35	35	35	40	40	40	40	40	40	40
Catch scalar %	70	80	90	100	110	120	130	70	80	90	100	110	120	130	70	80	90	100	110	120	130
SB/SB0 median %	38.1%	34.6%	31.6%	29.0%	26.9%	24.6%	22.4%	41.6%	38.2%	35.4%	33.2%	31.3%	29.9%	28.6%	44.9%	41.8%	39.1%	37.1%	35.4%	33.9%	33.0%
Risk20	1.1%	3.1%	7.7%	14.2%	22.6%	33.5%	41.9%	0.5%	1.2%	2.8%	5.6%	10.1%	15.2%	21.1%	0.2%	0.5%	0.0%	2.1%	4.3%	7.0%	10.4%
Risk10	0.3%	0.4%	1.7%	2.8%	5.9%	13.8%	20.2%	0.1%	0.2%	0.5%	0.8%	1.8%	3.8%	7.2%	0.0%	0.1%	0.2%	0.2%	0.7%	1.4%	2.8%
Catch average	3,682	3,825	3,887	3,905	3,845	3,590	3,380	3,522	3,683	3,780	3,851	3,872	3,840	3,738	3,361	3,514	3,636	3,727	3,770	3,794	3,758
Catch Std dev	766	802	977	1,190	1,470	1,913	2,203	723	761	851	961	1,134	1,338	1,600	698	738	807	870	992	1,122	1,281

Scenario: *Recent Recruitment Devs, Basic MP Exp3_Assess3yr Lower risk at an equivalent biomass level*

Notional target SB/SB0 %	30	30	30	30	30	30	30	35	35	35	35	35	35	35	40	40	40	40	40	40	40
Catch scalar %	70	80	90	100	110	120	130	70	80	90	100	110	120	130	70	80	90	100	110	120	130
SB/SB0 median %	37.8%	34.4%	31.2%	28.8%	27.0%	25.8%	24.9%	41.2%	37.8%	35.0%	32.7%	31.1%	29.8%	28.7%	44.4%	41.3%	38.5%	36.5%	34.8%	33.6%	32.5%
Risk20	0.2%	0.9%	3.2%	7.7%	14.0%	20.0%	25.5%	0.1%	0.2%	0.7%	2.0%	4.4%	7.7%	11.1%	0.0%	0.0%	0.0%	0.4%	1.1%	2.3%	3.9%
Risk10	0.0%	0.0%	0.0%	0.1%	0.3%	0.5%	1.4%	0.0%	0.0%	0.1%	0.0%	0.0%	0.2%	0.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Catch average	3,711	3,861	3,970	4,038	4,067	4,074	4,038	3,553	3,713	3,831	3,916	3,967	3,994	4,012	3,389	3,552	3,681	3,772	3,834	3,881	3,916
Catch Std dev	746	746	806	901	1,053	1,205	1,403	713	731	798	871	981	1,080	1,189	696	724	783	863	940	1,013	1,081

Appendix 8 – Stock status projections based on the updated 2019 stock assessment. The blue circle indicates the proposed rebuild timeframe of the management strategy, whilst the blue dashed line demonstrates the years that can be saved through selectivity improvements

Model Year	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048
Fishing Year	2017/18	2018/19																													
Projection year		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
						Tmin					2Tmin					3Tmin					4Tmin										
Total catch (model)																															
catch50	4,549	3,727	1,949	1,949	1,949	1,949	1,949	1,949	1,949	1,949	1,949	1,949	1,949	1,949	1,949	1,949	1,949	1,949	1,949	1,949	1,949	1,949	1,949	1,949	1,949	1,949	1,949	1,949	1,949	1,949	1,949
catch60	4,549	3,727	2,304	2,304	2,304	2,304	2,304	2,304	2,304	2,304	2,304	2,304	2,304	2,304	2,304	2,304	2,304	2,304	2,304	2,304	2,304	2,304	2,304	2,304	2,304	2,304	2,304	2,304	2,304	2,304	2,304
catch70	4,549	3,727	2,659	2,659	2,659	2,659	2,659	2,659	2,659	2,659	2,659	2,659	2,659	2,659	2,659	2,659	2,659	2,659	2,659	2,659	2,659	2,659	2,659	2,659	2,659	2,659	2,659	2,659	2,659	2,659	2,659
catch80	4,549	3,727	3,017	3,017	3,017	3,017	3,017	3,017	3,017	3,017	3,017	3,017	3,017	3,017	3,017	3,017	3,017	3,017	3,017	3,017	3,017	3,017	3,017	3,017	3,017	3,017	3,017	3,017	3,017	3,017	3,017
catch90	4,549	3,727	3,373	3,373	3,373	3,373	3,373	3,373	3,373	3,373	3,373	3,373	3,373	3,373	3,373	3,373	3,373	3,373	3,373	3,373	3,373	3,373	3,373	3,373	3,373	3,373	3,373	3,373	3,373	3,373	3,373
catch100	4,549	3,727	3,727	3,727	3,727	3,727	3,727	3,727	3,727	3,727	3,727	3,727	3,727	3,727	3,727	3,727	3,727	3,727	3,727	3,727	3,727	3,727	3,727	3,727	3,727	3,727	3,727	3,727	3,727	3,727	3,727
Pr(SBproj > 40% SB0)																															
catch50	0.000	0.000	0.000	0.000	0.006	0.051	0.095	0.215	0.309	0.417	0.507	0.594	0.653	0.718	0.766	0.824	0.860	0.886	0.908	0.926	0.948	0.961	0.973	0.973	0.976	0.979	0.984	0.990	0.990	0.990	0.993
catch60	0.000	0.000	0.000	0.000	0.004	0.038	0.063	0.139	0.218	0.308	0.378	0.452	0.529	0.588	0.635	0.675	0.723	0.766	0.816	0.839	0.864	0.881	0.907	0.927	0.939	0.947	0.950	0.961	0.964	0.970	0.975
catch70	0.000	0.000	0.000	0.000	0.004	0.024	0.035	0.088	0.151	0.201	0.268	0.322	0.379	0.433	0.489	0.534	0.582	0.614	0.668	0.688	0.743	0.771	0.794	0.816	0.823	0.848	0.864	0.873	0.890	0.896	0.903
catch80	0.000	0.000	0.000	0.000	0.002	0.015	0.027	0.053	0.097	0.142	0.190	0.229	0.256	0.296	0.339	0.380	0.431	0.460	0.490	0.528	0.552	0.580	0.623	0.641	0.667	0.685	0.701	0.712	0.729	0.753	0.770
catch90	0.000	0.000	0.000	0.000	0.002	0.011	0.017	0.036	0.064	0.093	0.125	0.156	0.177	0.201	0.224	0.258	0.277	0.306	0.328	0.343	0.374	0.388	0.420	0.465	0.488	0.506	0.515	0.537	0.560	0.565	0.587
catch100	0.000	0.000	0.000	0.000	0.000	0.009	0.009	0.019	0.037	0.065	0.081	0.101	0.119	0.129	0.138	0.154	0.169	0.195	0.218	0.245	0.255	0.273	0.280	0.299	0.329	0.346	0.354	0.375	0.401	0.413	0.422
Pr(SBproj > 35% SB0)																															
catch50	0.000	0.000	0.000	0.006	0.037	0.163	0.265	0.396	0.529	0.617	0.700	0.758	0.817	0.860	0.895	0.920	0.948	0.961	0.973	0.980	0.988	0.990	0.995	0.993	0.995	0.993	0.994	0.994	0.995	0.997	0.999
catch60	0.000	0.000	0.000	0.003	0.027	0.106	0.184	0.296	0.405	0.487	0.580	0.654	0.695	0.750	0.797	0.832	0.872	0.889	0.908	0.930	0.949	0.960	0.970	0.975	0.975	0.979	0.983	0.989	0.989	0.989	0.992
catch70	0.000	0.000	0.000	0.001	0.015	0.072	0.114	0.219	0.288	0.377	0.438	0.515	0.570	0.615	0.656	0.694	0.737	0.776	0.814	0.842	0.859	0.880	0.897	0.915	0.934	0.940	0.945	0.953	0.957	0.961	0.969
catch80	0.000	0.000	0.000	0.000	0.012	0.048	0.081	0.139	0.201	0.271	0.323	0.362	0.412	0.462	0.508	0.544	0.586	0.612	0.657	0.677	0.719	0.754	0.776	0.792	0.809	0.818	0.838	0.851	0.864	0.876	0.879
catch90	0.000	0.000	0.000	0.000	0.007	0.033	0.042	0.092	0.136	0.174	0.230	0.259	0.288	0.313	0.348	0.394	0.428	0.454	0.483	0.510	0.531	0.549	0.590	0.609	0.627	0.637	0.664	0.679	0.693	0.709	0.723
catch100	0.000	0.000	0.000	0.000	0.005	0.021	0.031	0.054	0.090	0.123	0.153	0.174	0.193	0.219	0.235	0.261	0.272	0.288	0.311	0.330	0.356	0.366	0.388	0.430	0.456	0.462	0.475	0.511	0.524	0.528	0.545
Pr(SBproj > 20% SB0)																															
catch50	0.049	0.074	0.307	0.728	0.876	0.949	0.976	0.982	0.984	0.990	0.991	0.995	0.998	0.998	0.998	0.999	0.999	0.999	0.999	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
catch60	0.049	0.074	0.275	0.666	0.812	0.902	0.940	0.953	0.963	0.976	0.985	0.987	0.991	0.992	0.996	0.997	0.998	0.998	0.997	0.999	0.999	0.999	0.999	0.999	0.999	1.000	1.000	0.999	1.000	1.000	1.000
catch70	0.049	0.074	0.243	0.567	0.723	0.833	0.887	0.910	0.919	0.930	0.940	0.953	0.968	0.970	0.977	0.983	0.989	0.991	0.993	0.994	0.996	0.996	0.996	0.996	0.997	0.997	0.997	0.996	0.997	0.997	0.999
catch80	0.049	0.074	0.213	0.476	0.623	0.725	0.788	0.809	0.836	0.858	0.876	0.885	0.903	0.919	0.939	0.944	0.953	0.957	0.962	0.973	0.976	0.980	0.986	0.989	0.987	0.987	0.990	0.990	0.990	0.993	0.996
catch90	0.049	0.074	0.177	0.395	0.500	0.616	0.665	0.691	0.717	0.731	0.760	0.779	0.791	0.815	0.840	0.852	0.871	0.874	0.886	0.896	0.906	0.918	0.930	0.938	0.949	0.949	0.951	0.946	0.958	0.959	0.962
catch100	0.049	0.074	0.133	0.318	0.411	0.493	0.520	0.553	0.581	0.601	0.624	0.639	0.658	0.677	0.684	0.697	0.717	0.721	0.749	0.761	0.784	0.799	0.806	0.815	0.824	0.829	0.843	0.855	0.857	0.864	0.874
Pr(SBproj > 10% SB0)																															
catch50	0.991	0.983	0.997	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
catch60	0.991	0.983	0.994	0.999	0.999	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
catch70	0.991	0.983	0.990	0.998	0.999	0.999	0.999	0.999	0.998	0.999	0.999	0.998	0.998	0.998	0.998	0.998	0.998	0.998	0.999	0.999	0.999	0.999	0.999	0.999	0.999	0.999	1.000	1.000	1.000	1.000	1.000
catch80	0.991	0.983	0.988	0.998	0.997	0.997	0.997	0.994	0.995	0.993	0.991	0.992	0.992	0.995	0.996	0.996	0.997	0.998	0.997	0.997	0.997	0.997	0.995	0.997	0.998	0.997	0.998	0.997	0.998	0.999	1.000
catch90	0.991	0.983	0.983	0.996	0.996	0.995	0.990	0.982	0.976	0.977	0.978	0.979	0.982	0.978	0.979	0.977	0.979	0.981	0.983	0.984	0.987	0.990	0.987	0.986	0.988	0.989	0.989	0.988	0.988	0.990	0.990
catch100	0.991	0.983	0.978	0.991	0.987	0.980	0.969	0.952	0.948	0.937	0.931	0.933	0.928	0.927	0.929	0.925	0.924	0.923	0.924	0.925	0.935	0.943	0.945	0.947	0.948	0.949	0.953	0.956	0.961	0.958	0.957
Median SBproj/SB0																															
catch50	0.158	0.160	0.183	0.223	0.252	0.283	0.307	0.331	0.353	0.378	0.402	0.424	0.445	0.463	0.482	0.498	0.517	0.527	0.542	0.559	0.569	0.576	0.592	0.608	0.617	0.622	0.629	0.642	0.650	0.656	0.664
catch60	0.158	0.160	0.179	0.214	0.239	0.266	0.287	0.307	0.327	0.348	0.369	0.389	0.407	0.423	0.441	0.456	0.473	0.482	0.496	0.510	0.520	0.526	0.542	0.558	0.567	0.571	0.578	0.590	0.601	0.604	0.611
catch70	0.158	0.160	0.175	0.206	0.226	0.250	0.266	0.283	0.300	0.317	0.336	0.353	0.370	0.383	0.398	0.412	0.426	0.435	0.446	0.460	0.469	0.476	0.490	0.506	0.514	0.519	0.525	0.537	0.546	0.549	0.556
catch80	0.158	0.160	0.171	0.198	0.213	0.233	0.245	0.259	0.272	0.286	0.302	0.315	0.329	0.341	0.352	0.365	0.377	0.386	0.396	0.409	0.415	0.422	0.433	0.449	0.457	0.464	0.468	0.480	0.486	0.489	0.498
catch90	0.158	0.160	0.168	0.189	0.200	0.216	0.224	0.233	0.245	0.256	0.268	0.276	0.288	0.297	0.304	0.315	0.326	0.334	0.343	0.354	0.360	0.365	0.375	0.388	0.396	0.402	0.406	0.416	0.420	0.425	0.433
catch100	0.158	0.160	0.164	0.181	0.188	0.199	0.203	0.208	0.216	0.224	0.231	0.237	0.246	0.250	0.255	0.264	0.274	0.278	0.288	0.296	0.298	0.304	0.313	0.322	0.334	0.336	0.342	0.352	0.359	0.364	0.369

This circle highlights the potential to rebuild the stock 12 years faster as a result of improved selectivity. It demonstrates that the ability to rebuild the stock is greatly improved using a suite of measures as proposed by this Strategy.

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