South Taranaki Bight iron sand mining proposal
Assessment of potential impacts on commercial fishing

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In November 2015 I was provided with a summary of additional scientific work commissioned by TTR since 2014. The conclusions from my report dated 5 July 2013 remain valid in light of TTR's additional information.

Nici Gibbs, 18 November 2015

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Executive Summary

Trans-Tasman Resources Ltd (TTR) intends to carry out an iron sand mining operation in an area of the South Taranaki Bight off the west coast of the North Island of New Zealand. The area is located in the EEZ just beyond the 12 nm territorial sea boundary, between Hawera and Patea. During the mining operation, commercial fishing will be excluded from the active mining block – an area of approximately 3.7 km by 4 km – and may be further restricted by the location and movements of mining vessels.

This report describes the commercial fisheries in the vicinity of the proposed sand mining operation and evaluates potential impacts of the sand mining operation on the commercial fishing industry.

Commercial fisheries

The South Taranaki Bight is an exposed and weather-beaten area which nevertheless supports a productive and diverse range of valuable inshore fisheries. The main commercial fisheries in the immediate area of the mining operation are a mixed bottom trawl fishery for trevally, leatherjacket, gurnard and snapper, and a set net fishery targeting school shark, rig and blue warehou. Nearby fisheries include a coastal rock lobster fishery and, on the seaward side of the mining site, a mid-water trawl fishery for jack mackerel and a small bottom longline fishery.

The bottom trawl fishery occurs over a particularly productive area known as “the rolling grounds.” The area is fished by one trawler based in New Plymouth and around a dozen from the top of the South Island which visit on an occasional basis a part of their annual fishing plans. Although trawling effort occurs year round, the species taken show a distinct seasonality, with catches of many species peaking during the summer months.

The set net fishery has three main components: rig is targeted in shallow waters within 4 nm of the coast, school shark is targeted further out in waters around 50m deep, and blue warehou is targeted in shallow waters around Cape Egmont. Four set net vessels fish out of New Plymouth, often operating in all three target fisheries at different times of year, and several other vessels travel up from the South Island. The rig fishery in particular has been subject to significant spatial displacement over recent years as a result of regulations put in place to protect Maui’s dolphins.

Quota ownership in both the trawl and set net fisheries is dominated by the large seafood companies Talleys and Sanford. Te Ohu Kaimoana Trustee is also a major quota owner on behalf of Maori, and several other iwi-owned companies feature in the top 10 quota owners for stocks in this area.

Potential impacts on commercial fishing

The proposed mining operation overlaps with the bottom trawl fishery and the set net fishery. The extent of spatial displacement of the trawl fishery is likely to be minor as trawling effort is mainly concentrated beyond the 50m depth contour seaward of the mining site. The proportion of trawl catch taken within the mining site is therefore likely to be minimal. The wide distribution of the fishery means that any displaced catch can be caught elsewhere in the area with minimal, if any, increase in the overall cost of fishing. However, the increasing abundance of snapper off the west coast of the North Island, and the consequent

limited availability of SNA 8 Annual Catch Entitlement, may result in increased operating costs for one fisher if trawl effort is displaced in a northerly direction.

The mining operation will also displace set net catch and effort for school shark. The overall proportion of school shark taken from the mining area is likely to be small. However, even a minimal amount of displacement may be considered significant by the affected fishers due to the history of spatial exclusion in the near-shore parts of the set net fishery where rig and blue warehou are targeted. Regulatory closures to protect dolphins have pushed additional set net effort south into the Taranaki Bight and outwards into deeper waters beyond 7 nm. These cumulative effects may leave some set net fishers with limited flexibility to respond to even small additional exclusions.

As the amount of displaced catch in both the trawl and set net fisheries will be small, it is unlikely that there will be any wider negative impacts on the commercial fishing industry – in particular, no negative impacts on quota value, downstream businesses, or fish stock sustainability are anticipated as a consequence of spatial displacement.

Aside from spatial exclusion, commercial fisheries may be affected by changes in distribution or abundance of commercially fished species either in the mined area, or in adjacent waters or coastal reefs. In the mined area, key considerations are whether the seafloor will be restored to its current state and how quickly it will be recolonised by commercially fished species. In the adjacent waters, the dispersal of the sediment plume is a key consideration. Further out in the EEZ the mining operation is unlikely to have any negative effects on the mid-water trawl and bottom longline fisheries as the target fish species can migrate out of any areas affected by sediment dispersal. The degree of impact on fisheries along the Taranaki coast, including the valuable rock lobster fishery and the developing shellfish fisheries, will depend on the amount of sediment that is introduced into the reef environment. With appropriate management of sediment dispersal, no significant off-site impacts on commercial fisheries are anticipated.

Mitigation

Mitigation measures that could be adopted by TTR to minimise any impacts of the proposed mining activity on commercial fishing in the South Taranaki Bight include:

- developing a contact list of companies and vessels operating in the area;
- designing and implementing a communication system to alert vessel operators to the intended location and duration of mining activities on a regular basis;
- developing a more precise understanding of the location and seasonality of set net effort in the area of the mining operation, and designing the mining operational plan to minimise any impacts on the school shark fishery; and
- undertaking the mining operation in a manner that minimises the risk of sediment dispersal in the wider marine environment.

Introduction

Trans-Tasman Resources Ltd (TTR) intends to carry out an iron sand mining operation in an area of the South Taranaki Bight off the west coast of the North Island of New Zealand.

This report:

- Describes the commercial fisheries in the vicinity of the proposed sand mining operation; and
- Evaluates potential impacts of the sand mining operation on the commercial fishing industry.

The report is in three parts:

- **Part One** contains relevant background information including a summary of the proposed mining operation and a description of New Zealand's quota management system (QMS) under which commercial fisheries are managed;
- **Part Two** contains a description of the commercial fisheries in the vicinity of the proposed mining area, including the species caught, the fishing methods used, fishing vessels, quota ownership and value of the fisheries; and
- **Part Three** is an assessment of potential impacts on commercial fishing, including direct effects from spatial displacement of fishing activity, offsite effects and broader considerations.

An appendix contains a list of abbreviations used in this report and the contact details of the main fishing industry representatives for the South Taranaki Bight fisheries.

1. Background information

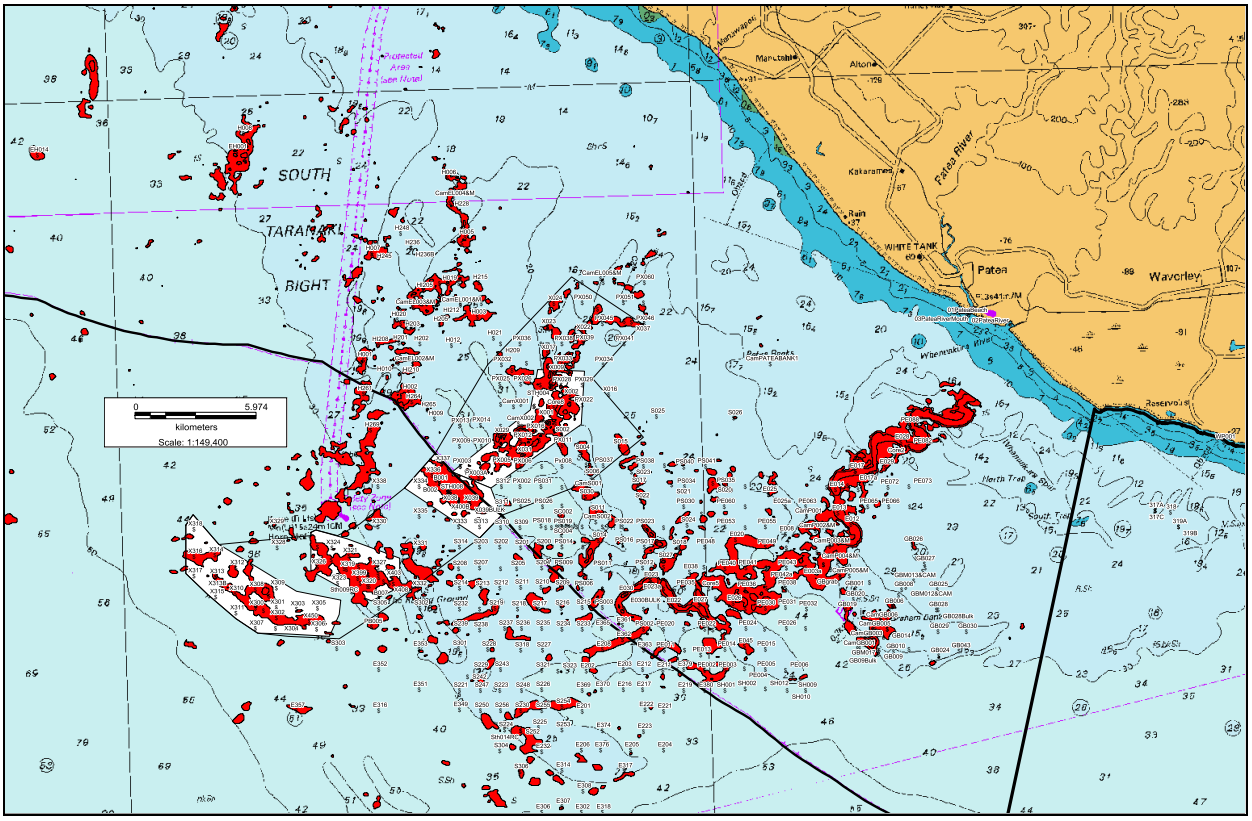
1.1 Summary of proposed mining operation

TTR holds or has applied for mineral exploration permits that together cover an area of 6,319 km^2 within the 12 nautical mile (nm) territorial sea off the west coast of the North Island of New Zealand. An adjacent area of 3,314 km^2 in the Exclusive Economic Zone (EEZ) is covered by a Continental Shelf Act prospecting licence.

The area of immediate interest for sand mining is located in the South Taranaki Bight, in the EEZ immediately outside the 12 nm limit of the territorial sea in waters 30m to 50m deep. The location of the area of interest is shown in **Figure 1**.

During the mining operation, sand is removed from the seafloor and pumped to a Floating Production, Storage and Offloading Vessel (FPSO). There, the heavier iron ore is removed from the lighter sand which is then returned to the seafloor. At least three large vessels are present throughout the mining operation – the FPSO, one or two Floating Storage Offloading Vessels (FSOs), and possibly one or two smaller anchor handling vessels. The iron ore is transferred from the FPSO to the FSO and shuttled directly to a nearby export vessel.

Figure 1: Proposed area for sand mining operations



Map supplied by TTR – note that the area of immediate interest for mining is in the EEZ only (i.e., seaward of the diagonal black line)

The FPSO is a large (275m) vessel on a mooring system which allows it to be winched on a pre-determined extraction and tailings deposition pattern. The configuration of the vessel and mooring system provides for mining blocks which are typically 300m long by 600m wide. The mooring spread for the FPSO is 2.7 km by 3 km. Allowing for a 0.5 km buffer zone around the mooring spread, the maximum area from which commercial fishing would be excluded at any one time is 3.7 km by 4 km (14.8 km^2).

A 300m by 600m block can be mined in around 10 days and then the mooring spread is relocated. TTR estimates that the mining operation as currently envisaged will have a life of 10 to 12 years.

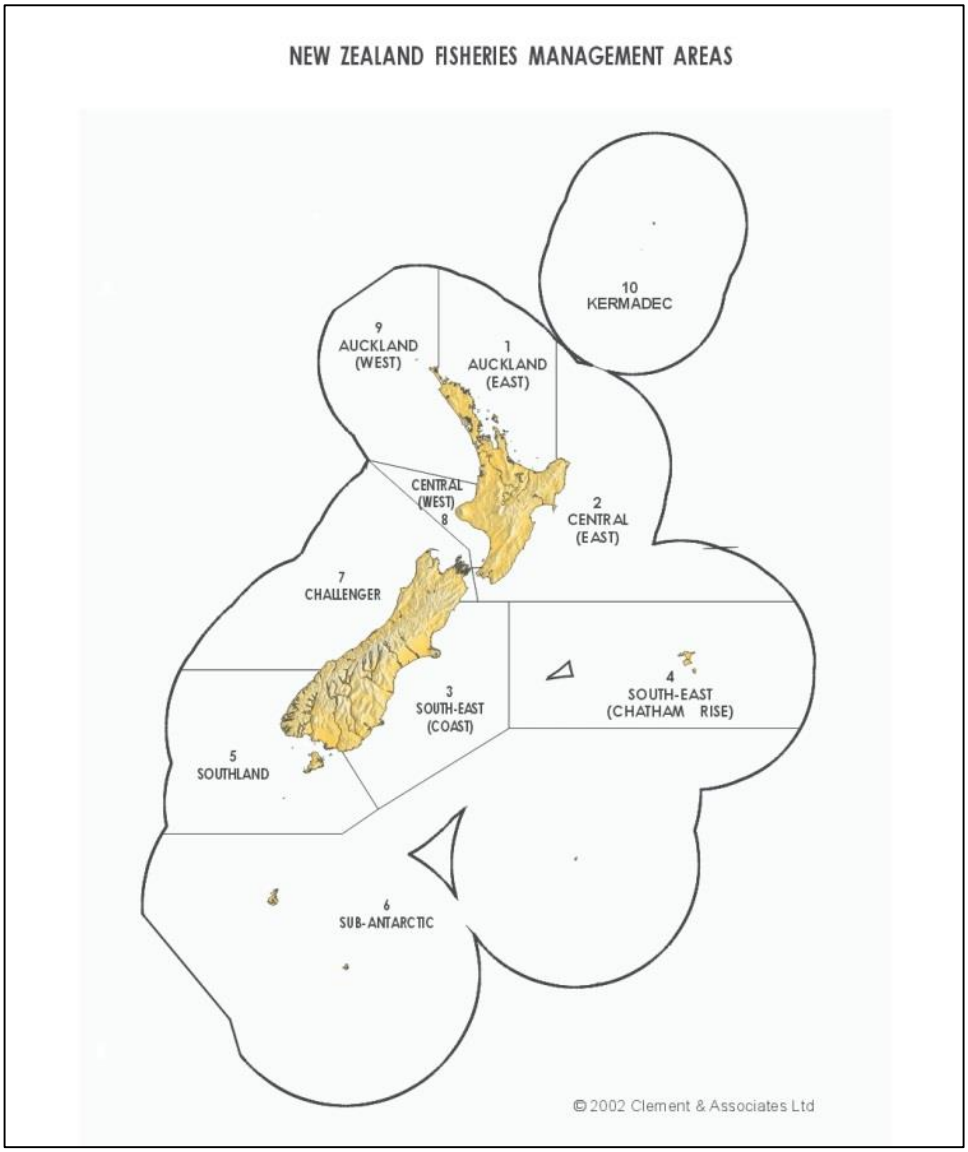
The mining method removes the full depth of sediment in one cut, leaving a fully mined area. After the iron ore is extracted, between 80% to 90% of the sand is returned from the FPSO to the seafloor through a long discharge pipe. At the start of each block, the tailings are discharged to an un-mined area alongside the extraction area, but in subsequent runs the tailings can be discharged directly onto previously mined areas.

1.2 The Quota Management System

New Zealand's Quota Management System (QMS) was established on 1 October 1986. Commercially fished species have gradually been introduced into the QMS over the last 26 years and the system itself has undergone several significant developments over the years. Today 97 species, comprising 633 separate fish stocks, are managed under the QMS.

For management purposes, New Zealand's EEZ is divided into ten fisheries management areas (FMAs) (**Figure 2**). Each species managed under the QMS is divided into a number of fish stocks in defined Quota Management Areas (QMAs). The QMAs are generally based on FMA boundaries, but vary between species. Each fish stock has a unique identifying code based on the species name and the QMA number. For example, trevally (species code TRE) is divided into five stocks – TRE 1 (covering FMA 1), TRE 2 (covering FMA 2), TRE 3 (covering FMAs 3, 4, 5 and 6), TRE 7 (covering FMAs 7, 8 and 9) and TRE 10 (covering FMA 10).

Figure 2: New Zealand Fisheries Management Areas[1]



Each stock managed under the QMS has a total allowable commercial catch (TACC) in tonnes set by the Minister of Fisheries and adjusted when necessary for either sustainability or utilisation reasons. Most stocks also have a total allowable catch (TAC) which comprises the TACC, together with allowances for recreational fishing, customary fishing and other sources of fishing related mortality. Adjustments to the TAC and TACC take place at the beginning of the fishing year, which is 1 October for most species.

[1] Map ©Clement and Associates Ltd. www.fishinfo.co.nz

Each of the 633 stocks in the QMS has 100 million quota shares (referred to formally as Individual Transferable Quota or ITQ). A quota share represents a fixed percentage of the total commercial rights for a fish stock in perpetuity. Each quota share generates Annual Catch Entitlement (ACE) which is the right to harvest that tonnage of the TACC for the stock during one fishing year. ITQ and ACE are fully and independently tradable, enabling ACE to change hands throughout a fishing season.

For example, if Person A owns 10 million quota shares in the trevally stock TRE 7, then that person has rights to 10% of the commercial harvest of TRE 7. The TRE 7 TACC is currently 2153 tonnes, providing Person A with 215.3 tonnes of ACE at the beginning of the fishing year. Person A can then use the ACE to harvest 215.3 tonnes of TRE 7 trevally or can sell the ACE to a commercial fisher. If the TRE 7 TACC is adjusted upwards, at the beginning of the next fishing year Person A will still own 10 million quota shares but these shares will generate a greater weight of ACE.

The perpetual and proportional nature of ITQ means that its value is related at least in part to the current abundance of the stock and its perceived future abundance. Quota owners therefore have the clearest incentive to operate their businesses not only for profit but also for sustainable fishing outcomes – as that will maximise the capital value of ITQ. This incentive lies at the core of the success of the QMS.

1.2.1 The spatial attributes of quota shares

The courts have consistently acknowledged that ITQ is a property right, albeit one that is the product of, and subject to, the constraints of the legislation that created it.[2] ITQ has strong property characteristics in that it is perpetual, tradable and divisible. While ITQ does not provide exclusivity in relation to space or the general opportunity to harvest the stock, it is exclusive in the sense that it is the only authority under which the commercial harvesting of the stock can take place, now or in the future.

For quota to have value, the stock must be able to be harvested – areas must be open to fishing. An understanding of the spatial attributes of ITQ is therefore vital to assessing the impact on commercial fishing of other activities that occupy space in the marine environment. The following points are relevant:

- ITQ is not a spatially exclusive right, but its value is determined by spatial considerations;
- At the highest level, the spatial scale of ITQ is defined by the QMA;
- However, the location of fishing activity within a QMA is not even. It depends on factors such as where the species lives, the economics of fishing, regulatory constraints, fishery management considerations, and environmental conditions (e.g., weather, water quality). None of these spatial constraints on fishing activity alter the basic spatial nature of ITQ but they are highly relevant to the ability of quota owners to maximise the value of their harvest rights;

[2] "While quota are undoubtedly a species of property and a valuable one at that, the rights inherent in that property are not absolute. They are subject to the provisions or the legislation establishing them. That legislation contains the capacity for quota to be reduced. If such reduction is otherwise lawfully made, the fact that quota are a "property right" to use the appellant's expression, cannot save them from reduction. That would be to deny an incident integral to the property concerned" *New Zealand Fishing Industry Association (Inc) v Ministry of Fisheries* (unreported, CA82/97, 22 July 1997, Wellington).

- The current value of ITQ incorporates all future potential value from the commercial harvest of the stock. As a result of the proportional and perpetual nature of ITQ, that value is a function of:
    - stock abundance (current and future); and
    - spatial access (current and future distribution of the stock and access to the stock within the QMA).

Small scale and/or temporary spatial exclusion from fishing grounds commonly has impacts at the level of individual fishers. For example, an affected fisher may need to purchase a new vessel to fish in grounds that are further away, or purchase additional ACE to cover a different mix of bycatch species. The cost of fishing may increase (additional fuel costs, less efficient fishing grounds) and the fisher may not be able to fully catch his or her ACE, leading to reduced revenue. For that individual, fishing may become uneconomic, forcing the fisher out of business.

These types of impacts on individuals can be contrasted with impacts of spatial displacement that are felt at a fishery-wide level (i.e., across all quota owners in a stock). There are several ways in which fishery-scale impacts can arise from spatial displacement. First, displaced fishing effort will shift into other areas in the QMA, which may increase the risk of localised depletion, potentially increasing risks to stock sustainability. As a result the TACC may need to be cut, reducing revenue to quota owners. Second, if the majority of fishers find it difficult to catch their ACE as a result of spatial displacement from fishing grounds, then the TACC may not be caught, leading to reduced ACE prices. Both of these scenarios may result in a decrease in quota value. If spatial access constraints in a fishery become significant, the confidence of the quota owners in the future earnings potential of their quota shares may be eroded, resulting not only in a dramatic drop in quota value, but also undermining the long term incentives for fisheries sustainability provided by the QMS.

The payment of compensation or adjustment assistance may be justified where impacts are felt across all quota owners in a stock and where the impacts interfere with the effective operation of the QMS. Although the payment of compensation is not a requirement of the Exclusive Economic Zone and Continental Shelf (Environmental Effects) Act 2012, nor is it specifically prohibited. It is a well-established principle of statutory construction that a statute should not be interpreted to remove property rights without compensation unless the intention to do so is expressed in clear and unambiguous terms.[3] Therefore, if the granting of an EEZ consent for a new activity led to an impact on quota value that was so significant as to constitute an effective taking of property, quota owners would have an arguable common law case for compensation to be payable.

There is no simple, formulaic approach to identifying the threshold level beyond which the impacts of spatial displacement become significant across a fishery. The circumstances of the fishery and the nature of the displacement need to be examined on a case by case basis.

[3] The leading Canadian case on compensation for the deprivation of property, *Manitoba Fisheries Ltd v Canada [1978] 1 SCR 101*, suggests that this principle amounts to a common law right to, or presumption for, compensation for expropriation of property which may be ousted only by express statutory provision. Other cases, such as *R v Tener [1985] 1 SCR 533* and *Authorson v Canada [2003] 2 SCR 40*, have reaffirmed the approach adopted in Manitoba Fisheries. It is generally acknowledged that the approach of the Supreme Court of Canada in Manitoba Fisheries recognising a common law right to compensation unless ousted by express statutory provision is an approach that is capable of being followed in the New Zealand Courts.

2. Description of commercial fisheries

2.1 Overview of commercial fishing in the South Taranaki Bight

The South Taranaki Bight is part of the Central (West) Fisheries Management Area known as FMA 8, which runs from Tirua Point in north Taranaki to a point north of Titahi Bay near Wellington (see **Figure 2**). The region's west coast beaches and coastal waters are buffeted by the predominant westerly winds and the seas are often rough. Despite its weather limitations, the area supports a productive and diverse range of valuable inshore commercial fisheries.

The main commercial fisheries in the South Taranaki Bight are:

- a mixed trawl fishery for trevally, leatherjacket, gurnard and snapper;
- set netting for rig, school shark and blue warehou;
- a mid-water jack mackerel trawl fishery; and
- potting for rock lobster.

The main commercial species, stocks and fishing methods for FMA 8 are summarised in **Table 1**.[4] In addition to the main species identified in Table 1, other species are caught in relatively small numbers either as bycatch of the main inshore fisheries, or as small target fisheries. The TACCs for the main stocks of commercial interest in Table 1 are shown in **Table 2**, together with an analysis of the proportion of the TACC of each stock that has been caught in recent years.[5]

2.2 Fishing methods

Analysis of commercial fishing catch and effort data from six fishing seasons (2004-05 to 2009-10) was carried out by NIWA for TTR.[6] NIWA's findings on fishing methods in the area of mining interest were that:

- trawling was the most common commercial fishing method, with effort split evenly between bottom and mid-water trawling;
- set netting was the next most common fishing method;
- other fishing methods reported in the area included bottom longlining and low levels of trolling, rock lobster potting, drop lining and fish trapping.

2.2.1 Bottom trawl fisheries

Species

The bottom trawl fishery in the South Taranaki Bight is a mixed species fishery. As is typical in inshore trawl fisheries, trawl vessel operators will target a range of different species at different times and in different places, meaning that the overall pattern of commercial fishing is complex. For instance, a trawl targeting snapper may catch only a small proportion of snapper, with the bulk of the remainder of the catch consisting of associated species such as gurnard, trevally, leatherjacket and kahawai. Some of the main trawl target species in the South Taranaki Bight are shown in **Figure 3**.

[4] Table modified from Ministry of Fisheries (2009)

[5] Percentage catch of TACC from Clement and Associates (2012)

[6] NIWA (2012)

Table 1: Main species, stocks and fishing methods in FMA 8

Species common name	Species scientific name	Stock	FMA	Main commercial fishing methods
Snapper	*Pagrus auratus*	SNA 8	8 & 9	Bottom trawl
Tarakihi	*Nemadactylus macropterus*	TAR 8	8	Bottom trawl
Red gurnard	*Chelidonichthys kumu*	GUR 8	8	Bottom trawl
Trevally	*Pseudocaranx dentex*	TRE 7	7, 8 & 9	Bottom trawl
Leatherjacket	*Parika scaber*	LEA 2	2, 7 & 8	Bottom trawl
Spiny dogfish	*Squalus acanthias*	SPD 8	8 & 9	Bottom trawl, set net
Barracouta	*Thyrsites atun*	BAR 7	7, 8 & 9	Mid-water trawl
School shark	*Galeorhinus galeus*	SCH 8	8	Set net, bottom trawl
Rig	*Mustelus lenticulatus*	SPO 8	8	Set net, bottom trawl
Blue warehou	*Serioella brama*	WAR 8	8	Bottom trawl, set net
Kahawai	*Arripis trutta* *Arripis xylabion*	KAH 8	8 & 9	Trawl, set net
John dory	*Zeus faber*	JDO 2	2 & 8	Bottom trawl
Red cod	*Pseudophycis bachus*	RCO 2	2 & 8	Bottom trawl
Blue cod	*Parapercis colias*	BCO 8	8	Pot
Flatfish	*Colistium nudipinnis* *Peltorhampus novaeseelandiae* *Colistium guntheri* *Rhombosolea retiaria* *Rhomobsolea plebeian* *Rhombosolea leporine* *Rhomobsolea tapirina* *Pelotretis flavilatus*	FLA 2	2 & 8	Bottom trawl
Bluenose	*Hypergylphe antarctica*	BNS 8	8	Bottom longline
Jack mackerel	*Trachurus declivis* *Trachurus novaselandiae* *Trachurus murphyi*	JMA 7	7, 8 & 9	Mid-water trawl
Kingfish	*Seriola lalandi*	KIN 8	8 & 9	Mid-water trawl
Pilchard	*Sardinops sagax*	PIL 8	8 & 9	Mid-water trawl
Rock lobster	*Jasus edwardsii*	CRA 9	*[7]	Pot

Key[8]

Species with predicted distributions that particularly coincide with areas potentially affected by iron sand mining operations and which are also predicted to be particularly abundant in areas of mining interest

Other species with predicted distributions that particularly coincide with areas potentially affected by iron sand mining operations

[7] CRA QMAs do not follow FMA boundaries. CRA 9 runs down the west coast of New Zealand from the Kaipara Harbour near the top of the North Island, down to Bruce Bay in the South Island

[8] Species identified in NIWA (2012)

Table 2: TACCs and commercial catches for main inshore finfish stocks in FMA 8

Stock	TACC (tonnes)	% TACC caught			Average annual catch 2009/10 – 2011/12 (tonnes)
		2009/10	2010/11	2011/12	
BAR 7	11,173	86	55	77	8,119
TRE 7	2,153	92	89	88	1,931
SNA 8	1,300	98	101	105	1,317
SCH 8	529	87	111	96	518
KAH 8	520	87	88	99	475
RCO 2	500	73	100	110	472
LEA 2	1,136	40	24	24	333
FLA 2	726	29	41	36	256
SPO 8	310	79	71	64	221
SPD 8	307	63	71	81	220
TAR 8	225	99	86	104	217
GUR 8	543	44	34	39	212
JDO 2	269	56	51	49	140
WAR 8	233	68	39	42	116
BCO 8*	34	22	21	29	14

*in 2009/10 and 2010/11 the BCO 8 TACC was 74 tonnes

In a characterisation of FMA 8 fisheries prepared for the Challenger Finfish Management Company,[9] five distinct inshore trawl fisheries were identified within FMA 8, of which the following three occur at least in part within the South Taranaki Bight:[10]

- a trawl fishery targeting snapper, red gurnard and trevally. This fishery is primarily located north of New Plymouth with only a small proportion of effort in the South Taranaki Bight. The associated non-target catch is comprised of a large number of species, most notably barracouta, leatherjacket, kahawai and John dory;
- an inshore barracouta trawl fishery in the South Taranaki Bight, operating in depths of 40m to 80m, with a significant catch of leatherjackets; and
- a trawl fishery in the south of FMA 8, operating in the 30m to 80m depth range, principally targeting red gurnard and, to a lesser extent, flatfish. Most of the fishing effort occurs off the Kapiti/ Horowhenua coast although some fishing trips do extend into the South Taranaki Bight. Non-target species caught in this fishery include leatherjacket, barracouta, trevally, snapper and red cod.

[9] Langley (2011)

[10] The other two FMA 8 trawl fisheries identified by Langley (2011) were two fisheries targeting tarakihi, one in the North Taranaki Bight, and one further south near Kapiti

According to NIWA, species commonly targeted in the South Taranaki Bight trawl fishery are red gurnard, tarakihi, trevally, barracouta, warehou (two species), flatfish (several species), leatherjacket, John dory and snapper.[11]

Fishing industry sources suggest that the main species targeted in the direct area of interest for mining are trevally and leatherjacket, with some gurnard, John dory and flatfish.[12]

In addition to the main trawl target species identified above, a range of other species is taken as bycatch, including species such as rig and school shark that are also targeted by set netters.[13]

Figure 3: Commonly caught inshore trawl species in the South Taranaki Bight[14]

Trevally (*Pseudocaranx dentex*) is common around many parts of the North Island and the top half of the South Island. It is most abundant at depths of around 80m.

Leatherjacket (*Parika scaber*) occurs in rocky or weedy areas near the shore throughout coastal New Zealand, but is also found over the open seabed, commonly at depths of 40-60m.

Red Gurnard (*Chelidonichthys kumu*) is widespread around New Zealand and is found on sandy shell seabeds, usually at depths of less than 100m.

John dory (*Zeus faber*) is most common in warmer waters around the North Island in depths of up to 50m.

[11] NIWA (2012)

[12] Keith Mawson, Egmont Seafoods, pers comm (8 May 2013); Carol Scott, Southern Inshore Fisheries Management Company Ltd, pers comm (10 May 2013); Doug Saunders-Loder, Talleys Fisheries, pers comm (14 May 2013)

[13] Ministry for Primary Industries (2012)

[14] Species information from Seafood Industry Council (2007). Photo credits: Trevally & John dory photographs by Clive Ralph, courtesy of Seafood New Zealand; Leatherjacket photograph from www.fooduniversity.com; Gurnard photograph by Sean Shadbolt from The New Zealand Seafood Cookbook, reproduced on www.seafoodnewzealand.org.nz courtesy of Auckland Seafood School and Penguin Group New Zealand

Spatial distribution

Bottom trawling effort is spread throughout much of the South Taranaki Bight. There is a particular concentration of both effort and catch immediately outside the 50m contour from Opunake south to Patea and at similar depths along the Manawatu coast.[15]

The area around the proposed mining site is known to commercial fishers as "the rolling ground" because of its undulating seafloor. Trawl operators consider the rolling ground to be an important and productive fishery and suggest that the seafloor formation may make it particularly suitable as a fish habitat.[16]

Seasonality

Trawling occurs year round with no obvious seasonality when viewed as a whole.[17] However, the catch rates of the individual key species are highly seasonal; snapper and John dory catch rates peak during October-March, while catch rates of trevally are highest in January-February and very low during May-September. Catch rates of barracouta also tend to be highest during the summer months, while the catch rate of red gurnard tends to remain relatively constant throughout the year.[18]

The South Taranaki Bight is exposed to the elements, and this has an impact on the amount of trawling effort in the area by limiting the number of fishable days.[19]

Utilisation trends

Catch information from recent years shows that the main target species of snapper, trevally and tarakihi have been fully caught or nearly fully caught, whereas gurnard and leatherjacket are highly variable and have been under-caught for many years (**Table 2**).

There are many reasons why stocks in mixed species fisheries may be under or over caught. One of the dynamics at work in the west coast trawl fisheries is the reduction of the TACC for the snapper stock SNA 8 in 2005-06. The reduced TACC not only constrains snapper catches – it also means that associated trawl species may not be fully utilised due to unavailability of SNA 8 ACE.[20] The lack of availability of SNA 8 ACE also has an impact on the distribution of fishing effort, as trawlers will move to areas where their catch composition best matches their ACE portfolio.

Total fishing effort and catch in the FMA 8 trevally/gurnard/snapper trawl fishery declined considerably during the early 2000s, but since the mid-2000s the fishing effort has remained relatively stable.[21] The barracouta/leatherjacket trawl fishery has also changed significantly over time. In the early 2000s it was directed principally at arrow squid but in subsequent years leatherjacket and barracouta became the main target species. Since 2005/06, there has been minimal fishing effort in this part of the trawl fishery, partly due to the lack of any effort directed at squid in the area.[22]

[15] NIWA (2012) Figure 5-2.
[16] Doug Saunders-Loder, Talleys Fisheries, pers comm (14 May 2013)
[17] NIWA (2012)
[18] Kendrick and Bentley (2010) and Langley (2011)
[19] Doug Saunders-Loder, Talleys Fisheries, pers comm (14 May 2013)
[20] Kendrick and Bentley (2010)
[21] Langley (2011)
[22] Langley (2011)

Vessels

Historically the trawl fishery has consisted of pair trawlers and single trawl vessels. However, the single trawl has become far more dominant in recent years in response to market demands for higher quality fish.[23]

The number of vessels operating in the wider FMA 8 trawl fishery has declined over the last decade. Information from local industry sources suggests that the trawl fleet currently operating in the area of interest for sand mining consists of:[24]

- 1 New Plymouth based trawler (the Receiver skippered by Ian (Curly) Brown); and
- 10 to 12 South Island based trawlers.

The South Island vessels are occasional visitors to South Taranaki. Most are fishing with ACE from Talleys Fisheries, a major FMA 8 inshore finfish quota owner. Talleys view the South Taranaki Bight as an important area within their overall fishing operations – it provides a bit of variety for vessels that usually operate in the Challenger area (FMA 7), and is known as a productive fishery with good quality fish, particularly flatfish, leatherjacket, snapper, trevally and gurnard. Talleys therefore encourages Nelson-based trawlers to fish in the area when it suits the vessel's catch-plan. The trawlers, which range from small 15m vessels through to larger 30m vessels, will fish the area for a week or less, landing their catch fresh in Nelson.[25]

It is also understood that a Picton-based trawler/longliner operates in the area occasionally.[26]

Industry sources were not aware of any Wellington, Paremata or Whanganui based vessels currently operating in the fishery.[27] Historically vessels from these ports have fished in the South Taranaki Bight[28] and it is possible that Wellington-based trawlers may still occasionally fish there.

2.2.2 Set net fisheries

Species

The FMA 8 set net fishery targets primarily rig, school shark, and blue warehou, with some bycatch of spiny dogfish.[29] The South Taranaki Bight is particularly important for rig and school shark (**Figure 4)**.

Spatial distribution

The South Taranaki Bight set net fishery is widely distributed, but focused particularly:

- between Hawera and Whanganui around the 50m depth contour; and
- closer to the shore in shallow waters around most of the coastline.[30]

[23] Davies et al (2013)
[24] Keith Mawson, Egmont Seafoods, pers comm (8 May 2013); Doug Saunders-Loder, Talleys Fisheries, pers comm (14 May 2013)
[25] Doug Saunders-Loder, Talleys Fisheries, pers comm (14 May 2013)
[26] The Connor family from Picton. Doug Saunders-Loder, Talleys Fisheries, pers comm (14 May 2013)
[27] Keith Mawson, Egmont Seafoods, pers comm (8 May 2013)
[28] Ministry of Fisheries (2009)
[29] NIWA (2012) and Ministry for Primary Industries (2012)
[30] NIWA (2012) Figure 5.4

Figure 4: Common set net target species in the South Taranaki Bight [31]

Rig (*Mustelus lenticulatus*) are found around New Zealand, congregating in spring and summer in large numbers in broad shallow bays. Sometimes known as spotted dogfish (hence the species code SPO), rig is also marketed as lemonfish and is popular in fish and chip shops.

School shark (*Galeorhinus galeus*) is common in New Zealand coastal waters, particularly to the north, at depths to at least 200m. It is most abundant inshore, especially in spring and summer when the mature females come in to give birth. It is sometimes marketed as flake.

Fisheries for each of the main target species have different spatial distributions:

- Rig is taken primarily within 4 nm of the coast in waters less than 30m deep;
- School shark is commonly targeted further from the shore in waters around 50m deep; and
- Blue warehou is targeted in shallow coastal areas principally around Cape Egmont.

Regulatory closures intended to protect Maui's dolphin have had a significant effect on the distribution of set net effort and catch on the west coast of the North Island and in Taranaki in particular. This is discussed further in section 3.1.2 below.

Seasonality

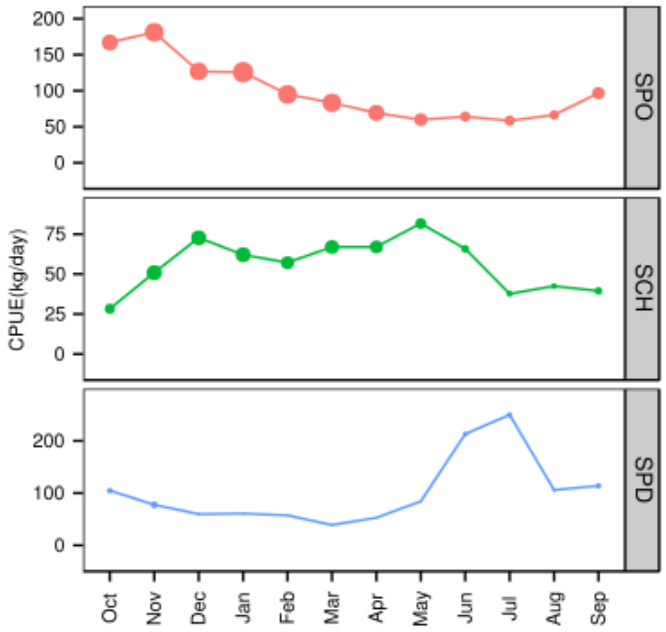
Rig is mostly caught during spring and summer, when the fish aggregate close to the shore.[32] In the Taranaki area, the main rig catches occur from September through to March with a peak in January.[33] School shark is caught year round, but the highest catch rates occur in April-May with a secondary peak from September to November. Catch rates for both shark species are very low around July, whereas the warehou set net fishery is busiest from May to December.[34] Seasonal catch rates for rig and school shark, together with bycatch species spiny dogfish are shown in **Figure 5**.[35]

Set net fishers have indicated that seasons and weather play a big part in how often the proposed mining site is fished.[36] In particular, the school shark fishery is in deeper water so it tends to be more weather dependent.

[31] Species information from Seafood Industry Council (2007). Photograph credits: Rig photograph by The Photo, courtesy of Seafood New Zealand; school shark photograph from dpi.nsw.gov.au
[32] Ministry for Primary Industries (2012)
[33] Kendrick and Bentley (2012)
[34] Langley (2011)
[35] Summary of seasonal catch rates prepared by Trident Systems. http://www.fonz.tridentsystems.co.nz/
[36] Comments from Lyle Jenkins and Ian McDougall, New Plymouth set net fishermen, to Keith Mawson, Egmont Seafoods. Pers comm. (13 May 2013)

Because of the seasonality of the target fisheries, Taranaki-based set netters typically target different species at different times of year – beginning with rig in spring, then moving further out to target school shark in the summer months, before coming inshore again to target warehou in the autumn and winter.[37]

Figure 5: Seasonal set net catch rates for rig (SPO), school shark (SCH) and spiny dog fish (SPD) in the Tasman Bay / Taranaki Bight fisheries



Utilisation trends

Effort has been maintained at around 800 vessel days per year in the SPO 8 rig set net fishery since the early 1990s, with landings of about 200 tonnes of rig annually.[38] The percentage of SPO 8 TACC caught has shown a declining trend over recent years, from 79% caught in 2009/10, down to 71% and 64% in the following two years. Warehou shows a similar downward trend (68%, 39% 42% for the last three years). The declining catches in these fisheries which are both taken primarily within 4 nm of the coast possibly reflects the cumulative effect of regulatory closures to protect Maui's dolphins.

In contrast, school shark (SCH 8) has been fully utilised (average 98% caught over last three seasons) with a consequence that SCH 8 ACE is tightly held. The full utilisation of SCH 8 means that set netters displaced from the rig fishery by regulatory closures cannot easily compensate for that displacement by switching additional effort to school shark.

Vessels

Information from industry sources is that the South Taranaki Bight set net fishery is currently fished by:[39]

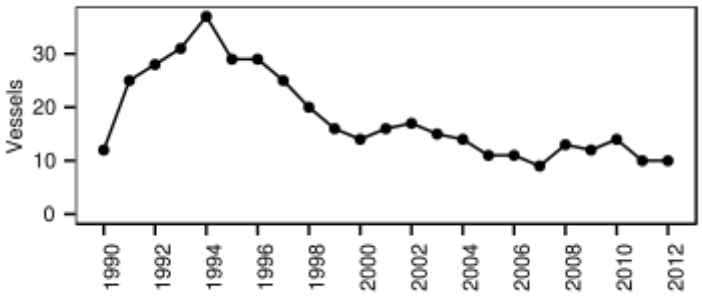
- 4 New Plymouth based set net vessels; and
- 2 or 3 South Island based set netters.

[37] Carol Scott, Southern Inshore Fisheries Management Company Ltd, pers com (10 May 2013)
[38] Kendrick and Bentley (2012)
[39] Keith Mawson, Egmont Seafoods, pers comm (8 May 2013)

New Plymouth-based set netters adjust their fishing location to catch different target species through the fishing year, but tend to stick to a single fishing method (set netting). In contrast, it is more common for Nelson-based set net vessels to change their gear type during the year, for example to dredge for scallops or trawl. This reflects the different environment and availability of fisheries near the two ports.[40]

The number of set net vessels operating in FMA 8 has declined over the years, as shown in **Figure 6**. In particular, set net vessels fishing out of New Plymouth have reduced significantly in recent years following extensive closures further north intended to protect Maui's dolphins.

Figure 6: Central West set net vessel numbers by year[41]



2.2.3 Line fisheries

It is difficult to obtain a clear picture of longlining activity in the South Taranaki Bight. The 2011 characterisation of FMA 8 fisheries identifies three distinct line fisheries (bottom longline and dropline) in FMA 8, none of which appear to have any significant spatial overlap with the area of mining interest. The three identified line fisheries are:[42]

- A school shark line fishery, operating primarily in the southern part of FMA 8 in the 80-200 m depth range;
- a hapuku line fishery operating exclusively in the southern (Kapiti) area of FMA 8; and
- the bluenose bottom longline fishery, also associated with hapuku, operating along the edge of the continental shelf in the 150-600m depth range.

NIWA reports that bottom longlining effort is strongly concentrated north of New Plymouth, but that relatively small amounts of school shark, hapuku and bass, red gurnard and snapper are targeted in the South Taranaki Bight. Some longlining has taken place along the coastline between Hawera and Whanganui but both effort and catch were at comparatively low levels (70-90 sets per year since 2007).[43]

Industry sources indicate that two long-line vessels targeting school shark and hapuku are currently operating out of New Plymouth,[44] and at least one from the South Island.[45]

[40] Carol Scott, Southern Inshore Fisheries Management Company Ltd, pers com (10 May 2013)
[41] Summary of vessel numbers prepared by Trident Systems http://www.fonz.tridentsystems.co.nz/ The graph shows numbers of "other" set net vessels (i.e., set net vessels other than those targeting flatfish)
[42] Langley (2011)
[43] NIWA (2012), Figure 5-5
[44] Information from a submission prepared by the Seafood Industry Council on Interim Set net measures to manage the risk of Maui's dolphin mortality (April 2012) http://www.seafoodnewzealand.org.nz

2.2.4 Mid-water trawling

Mid-water trawling targets jack mackerel, with barracouta taken mainly as bycatch. The fishery occurs year-round, but there is a concentration of effort in December and January. A secondary peak in July to August in recent years is characterised by a greater proportion of tows targeting barracouta.[46] The total catch from this fishing method in the Taranaki Bight is around ten times that from bottom trawling. This difference is due to the different species targeted and caught by the two methods. Most mid-water trawling is in deeper waters well beyond the 50m depth contour.[47]

There is unlikely to be significant spatial overlap between the midwater trawl fishery and the area of interest for sand mining.

2.2.5 Rock lobster potting

Rock lobster – also known as spiny rock lobster, red rock lobster or crayfish – is one of New Zealand's most valuable commercial fisheries. The South Taranaki coast is part of the CRA 9 rock lobster fishery which extends from Kaipara Harbour in the north to Bruce Bay on the West Coast of the South Island. Although the QMA is geographically large, it has the smallest TACC (47 tonnes) of any of the commercially-fished rock lobster regions. Habitat constraints restrict the CRA 9 commercial lobster fishery to the north-west coast of the South Island and the area between Patea and Kawhia, in particular the Taranaki coastline.[48] The average annual commercial catch of rock lobsters in the Taranaki area (statistical reporting area 935) is 23.6 tonnes,[49] which is about 50% of the CRA 9 TACC. The TACC has been fully caught every year since 1992.

There are currently 23 CRA 9 quota owners. In the 2011 season six vessels reported CRA 9 landings.[50] Only one of these vessels (based in Picton) is understood to be currently operating in the South Taranaki area.[51]

The estimated value of the CRA 9 landed catch is $3.1 million (based on average port price paid to fishermen). The total export value of rock lobster (all stocks) was $221 million in 2011.[52]

Rock lobster potting takes place in coastal waters with no direct spatial overlap with the proposed mining operation. Potential off-site impacts on the rock lobster fishery are discussed in section 3.3 of this report.

2.3 Quota ownership

Quota ownership was analysed for six representative stocks – four trawl-caught stocks LEA 2, TRE 7, SNA 8 and GUR 8, and set net target stocks SPO 8 and SCH 8 (**Table 3**).[53]

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[45] Doug Saunders-Loder, Talleys Fisheries, pers comm (14 May 2013)
[46] Hurst et al (2012)
[47] NIWA (2012)
[48] Unpublished report prepared by Daryl Sykes, NZ Rock Lobster Industry Council, for members of the National Rock Lobster Management Group and using data sourced from the FishServe registry, Rock Lobster Fishery Assessment Working Group reports and Fisheries Research Reports
[49] Statistical reporting area 935 runs from just south of New Plymouth to near Bulls. NIWA (2012)
[50] Unpublished report prepared by Daryl Sykes, as above.
[51] Daryl Sykes, NZ Rock Lobster Industry Council, pers comm (8 May 2013)
[52] Seafood New Zealand. http://www.seafoodnewzealand.org.nz/our-industry/key-facts/
[53] Quota register reports provided by FishServe.

Table 3: FMA 8 Quota ownership in representative stocks at May 2013

	SPO 8	SCH 8	GUR 8	LEA 2	TRE 7	SNA 8
No. of quota owners	45	45	48	63	95	68
% owned by top 3 quota owners	55%	44%	57%	62%	72%	81%
No. of quota owners owning 75% of stock	8	11	8	5	4	3
Top 3 quota owners & quota shares owned	Talleys Group Mgt Ltd	Talleys Group Mgt Ltd	Talleys Group Mgt Ltd	Talleys Group Mgt Ltd	Sanford Ltd	Sanford Ltd
	36,925,484	26,675,631	37,260,677	28,196,567	50,716,255	60,815,466
	Shirley Shields, Catherine Boaler-Walls	Sanford Ltd	Sanford Ltd	Sanford Ltd	Aotearoa Fisheries Ltd	Aotearoa Fisheries Ltd
	11,186,129	10,672,943	13,181,148	20,525,615	15,382,336	12,973,120
	Ngati Porou Seafoods Ltd	Pupuri Taonga Ltd	Ngai Tahu Seafood Resources Ltd	Alpine South Fishing Ltd	Raukura Moana Seafoods Ltd	Raukura Moana Seafoods Ltd
	7,538,710	7,089,890	6,636,598	12,865,079	5,925,642	7,333,800

Companies or organisations with large quota ownership across inshore finfish stocks in FMA 8 are Talleys, Sanford, and Te Ohu Kai Moana Trustee (TOKM). For the stocks in Table 3, Talleys is the most significant quota owner in SPO 8 (with 37% of the quota shares), SCH 8 (26%), GUR 8 (37%) and LEA 2 (28%), whereas Sanford is very dominant in SNA 8 (with 62% of quota shares) and TRE 7 (51%).

TOKM, which owns quota awaiting allocation to iwi as part of the commercial fisheries settlement, is the fifth or sixth biggest quota owner across all stocks (typically holding around 4-5% of FMA 8 inshore finfish quota shares). Iwi owned companies are also common in the top 10 quota owners of the FMA 8 stocks, including Aotearoa Fisheries Limited (the largest iwi-owned seafood company, owned by all iwi), Pupuri Taonga (the quota owning entity of Sealord), Raukura Moana Seafoods (Tainui), Ngai Tahu Seafoods, and Ngati Porou Seafoods. Taranaki iwi also own relatively small packages of quota in all the fisheries. The balance of top 10 quota owners in each stock is made up of a mixture of smaller quota owners, several of which are locally based in New Plymouth (e.g., Egmont Seafoods), Whanganui or Wellington.

Quota ownership in the trawl target stocks (especially the valuable SNA 8 and TRE 7 stocks) is relatively concentrated, whereas in the shark set net fisheries it is more diffuse. For example, the top three SNA 8 quota owners between them own 81% of the quota shares. This compares with SCH 8, where the top three quota owners own 44% of the quota shares.

The dominant quota owning entities, the level of quota aggregation and the general pattern of quota ownership in these representative FMA 8 stocks are typical of quota ownership in inshore finfish stocks.

2.4 Value of commercial fisheries

There are several recognised ways of valuing commercial fisheries – the most common are landed value, quota trade prices and total asset value.

2.4.1 Landed value

The annual landed value of a commercial fishery can be estimated by multiplying the average price paid to fishermen (known as the "port price"[54]) by either the TACC of the stock or, for a more realistic estimate, the average commercial catch in recent years. The landed values of the main stocks of interest are shown in **Table 4**. Of the stocks shown in this table, those with the highest port prices are – in descending order – John dory, snapper and blue cod, whereas the stocks with the highest landed value are snapper, barracouta, trevally and school shark.

Table 4: Estimated annual landed value of stocks of interest

Stock	Average annual catch 2009/10 – 2011/12 (tonnes)	Port price ($ per tonne)	Estimated landed value ($)
SNA 8	1,317	5710	7,520,070
BAR 7	8,119	430	3,491,170
TRE 7	1,931	1580	3,050,980
SCH 8	518	2430	1,258,740
JDO 2	140	6280	879,200
SPO 8	221	3740	826,540
FLA 2	256	2970	760,320
TAR 8	217	3080	668,360
GUR 8	212	2510	532,120
KAH 8	475	790	375,250
RCO 2	472	770	363,440
LEA 2	333	750	249,750
WAR 8	116	1090	126,440
SPD 8	220	320	70,400
BCO 8	14	4080	57,120

2.4.2 Quota trade prices

Quota trade price represents the value of expected future returns on that quota by selling ACE or selling fish caught. However, quota trade prices are not necessarily indicative of the true value of quota – although quota owners are required to report the volume of quota traded, there is no requirement to report the price. Also, quota is often traded within related companies for nominal prices, and for various reasons many trades are reported as either $0 or as very high values (outlier trades). Data on quota trade prices in **Table 5**

[54] Port price represents the value of sales of fish by fishers to licensed fish receivers, and is calculated by the Ministry for Primary Industries through an annual survey of licenced fish receivers.

are taken from the "Blue Book", which is already groomed to remove the outlier trades.[55] A long time series of transfer prices is used (average prices from 2001 to 2012) in order to capture the maximum number of quota trades and present a more stable picture of quota value for some of the key stocks caught in FMA 8.

The quota trade prices show that the most valuable quota in the South Taranaki Bight trawl fishery is snapper, with SNA 8 quota shares trading on average at nearly $49,000 per tonne. There is then a big drop to JDO 2 ($9,000 per tonne) and TRE 7 ($5,000 per tonne). The high value of SNA 8 quota shares, and the relatively small amount of SNA 8 shares traded over the last 11 years is a reflection of the relative scarcity of SNA 8 ACE.

Quota values of stocks targeted in the set net fisheries, while not matching the heights of SNA 8, are still strong – particularly for school shark (SCH 8 at nearly $15,000 per tonne) and rig (SPO 8 at $13,500 per tonne).

Table 5: Quota share transfer prices from 1 October 2001 to 31 October 2012

Stock	Quantity of shares traded	Number of transfers	Average price per share ($)	Average price per tonne ($)
SNA 8	29,397,704	63	0.6565	48,783.10
JDO 2	47,999,256	37	0.0251	9,327.33
TRE 7	23,994,765	80	0.1122	5,210.72
GUR 8	37,393,591	50	0.0147	2,716.01
LEA 2	88,283,716	82	0.0057	503.39
SCH 8	35,469,631	36	0.0763	14,881.00
SPO 8	69,214,838	30	0.0417	13,456.40
WAR 8	51,426,974	21	0.0056	2,436.21

2.4.3 Total asset value

The asset value of New Zealand's commercial fish resource is assessed by Statistics New Zealand using quota values and is published annually as the fish monetary stock account.[56] For the 2008/09 fishing year (the most recent year for which this publication is available), the total asset value for inshore finfish QMS species was approximately $1,060 million. This is about 25% of the total calculated asset value of New Zealand's commercial fish resource (which is $4,017 million).

Of the finfish species in the area of mining interest, snapper has the highest asset value of $262 million across all six snapper stocks. Tarakihi has an asset value of $75 million, jack mackerel $54 million, barracouta $40 million, blue cod $39 million and school shark $35 million. By way of comparison, rock lobster has an asset value of $771 million. (Note that these asset values refer to the species as a whole rather than the stock in FMA 8).

[55] Blue Book provided by FishServe https://www.fishserve.co.nz/information/the-blue-book
[56] Statistics New Zealand (2010)

3. Assessment of potential impacts on commercial fishing

Potential impacts of the sand mining operation on commercial fishing can be categorised as follows:

1. Impacts arising from spatial exclusion of commercial fishing activity;
2. Effects of the mining activity on fish species that are caught by commercial fishers in the immediate area of the mining operation;
3. Effects of the mining activity on fish species that are caught by commercial fishers in offsite areas (e.g., coastal reefs);
4. Broader impacts, including impacts on quota value and downstream businesses.

3.1 Spatial exclusion of commercial fishing activity

The NIWA analysis of effort and catch data includes density plots of effort and catch on a 0.1^{O} x 0.1^{O} grid. These plots illustrate where commercial fishing effort occurs and the relative sizes of catches taken within the area of interest.[57] While useful for indicating density of fishing catch and effort by method within the direct area of mining interest, NIWA's analysis does not assess catch or effort as a proportion of total catch and effort within the relevant QMAs. The proportion of total catch potentially displaced by mining activity is therefore not known precisely, but can be inferred from other information.

NIWA's plots show that the highest level of overall commercial fishing effort in the South Taranaki Bight occurs off the coastline between Hawera and Whanganui near the 50m contour. The highest concentration of catch is further out than the highest concentration of effort (well beyond the 50m contour), reflecting the large catches from the mid-water trawl fishery for jack mackerel. The NIWA analysis indicates that fisheries which have the strongest spatial overlap with the proposed mining area are the bottom trawl fishery and, in particular, the set net fishery. Both of these fisheries are likely to experience some spatial displacement as a result of exclusion zones and other mining infrastructure.

The impacts on commercial fishing of spatial exclusion from fishing grounds depend on:

- the extent and duration of the exclusion; and
- the characteristics of the fishery.

As noted in Part 1 of this report, commercial fishing will be excluded from the area of the active mining block (an area approximately 3.7 km by 4 km) for 10 days at a time. There may also be smaller exclusions around vessel transfer areas. This level of spatial exclusion is likely to continue for the length of the mining operation (up to 12 years) although the precise location of the exclusion zones will vary as the active mining block shifts. The degree of real exclusion will also be influenced by:

- operational issues such as the location of export vessels and other support vessels, and movements of mining vessels within the broader area; and
- environmental considerations such as the length of time before fish move back into previously mined areas.

[57] See NIWA (2012), Figures 5-1 to 5-5.

Fishery-specific factors that contribute to impact of spatial exclusion include:

- the spatial distribution of the harvested species;
- the proportion of total catch taken in the excluded area;
- the practicality and cost of catching the species at other locations;
- cumulative impacts of all spatial exclusions in the fishery; and
- sustainability and utilisation implications arising from displaced fishing effort (e.g., displaced effort can put pressure on other parts of the fish stock or may increase tensions between recreational and commercial fishers).

These factors are discussed below for the bottom trawl fisheries and the set net fisheries.

3.1.1 Bottom trawl fisheries

Spatial distribution of stocks

Stocks that are commonly targeted in the South Taranaki trawl fishery are widely distributed. NIWA modelling of trawl catch rates for key target species such as trevally, gurnard and leatherjacket shows large areas of relatively high catch rates extending down the South Taranaki coast and further out into the EEZ.[58]

With the exception of tarakihi and red gurnard, the QMAs of most trawl-caught species extend beyond FMA 8, commonly encompassing FMA 9 (which extends up the west coast of the North Island to North Cape). For these multi-FMA stocks, the proportion of catch taken by inshore fisheries in FMA 8 is relatively small, as follows: [59]

- 12-15% of SNA 8
- 13-30% of TRE 7
- 3-5% of BAR 7
- 30-40% of JDO 2
- 20-30% of FLA 2.

This suggests that the proportion of total catch from these stocks taken in the excluded area (which is a very small part of FMA 8) is likely to be small.

Proportion of catch taken in excluded area

The extent of spatial displacement in the bottom trawl fishery is anticipated to be minor because the main areas of both effort and catch (as shown in the NIWA plots)[60] lie immediately beyond the 50m depth contour, whereas the proposed mining areas are within the 50m depth contour. In combination with the information on spatial distribution of stocks (above), this suggests that the proportion of total catch taken in the excluded area is likely to be minimal.

[58] NIWA (2012), Figures 12.14 (gurnard), 12.24 (leatherjacket) and 12.48 (trevally)
[59] Langley (2011)
[60] NIWA (2012), Figure 5.2

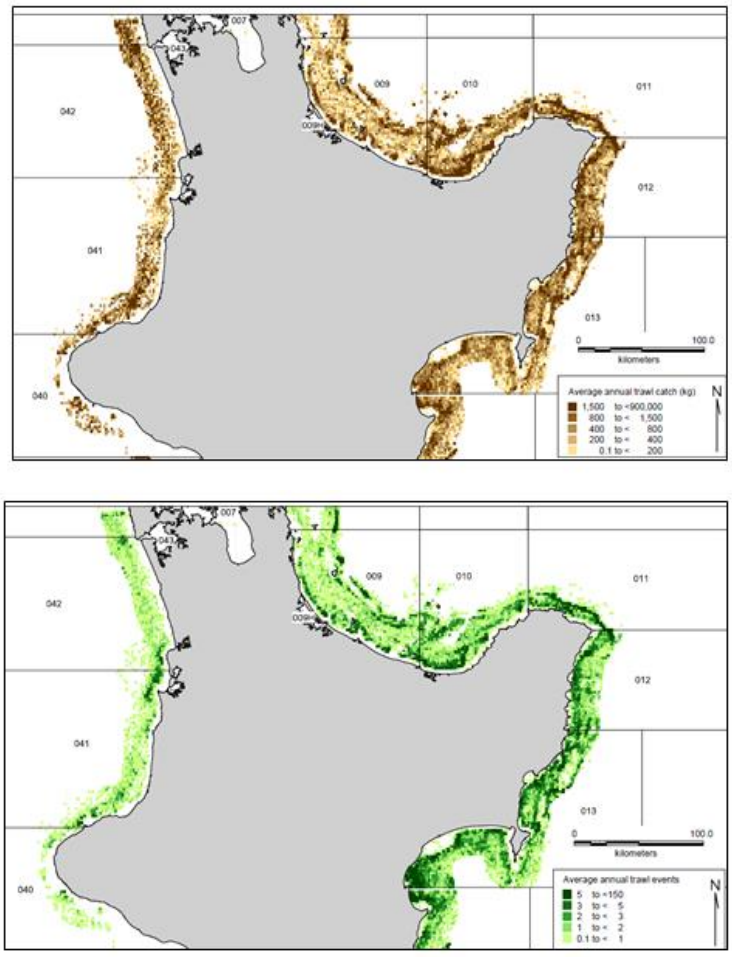
Nevertheless, for some fishers, the proportion of their individual catch taken in the area of the mining operation could be more significant. For example, Ian (Curly) Brown, a trawler operator from New Plymouth, has indicated that he focuses his effort on this area because it suits the mix of ACE that he owns.[61]

Practicality and cost of fishing at other locations

The wide distribution of the targeted stocks suggests that exclusion from the immediate area of the mining operation will not prevent the fishery from continuing to operate in adjacent areas. Maps prepared by the Ministry for Primary Industries show that the highest densities of inshore trawl catch and effort occur further north on the west coast of the North Island (**Figure 7**). This northerly distribution of trawl effort supports the proposition that any catch that cannot be taken in the South Taranaki Bight as a result of exclusion from the mining blocks is likely to continue to be taken in the more heavily trawled areas either seaward of the mining operation or further to the north.

Figure 7: The general pattern of trawl catch (brown) and fishing events (green)[62]

The total annual catch and annual number of trawl events is shown for the position where each trawl tow started, averaged for all events starting in each 1 nm grid cell and for three fishing years 2007-2010.



[61] Ian (Curly) Brown, skipper of the Receiver, as reported to Keith Mawson, Egmont Fisheries. Pers comm (13 May 2013)

[62] Maps prepared by the Ministry for Primary Industries, and available at http://www.fish.govt.nz/en-nz/Commercial/About+the+Fishing+Industry/Maps+of+Commercial+Inshore+Fishing+Activity/default.htm

However, the pattern of fishing in trawl fisheries is complicated by the fact that multiple species are caught, requiring the fisher to have a package of ACE for all target and bycatch stocks that may be encountered on a fishing trip. As noted above, the reduction of the SNA 8 TACC in 2005 is a constraining factor in this fishery. Different areas have different ratios of target species (e.g., trevally) to bycatch (snapper), so the lack of availability of SNA 8 ACE can restrict where fishers are able to fish.

According to local commercial fishers, snapper is becoming increasingly abundant, especially in the northern part of SNA 8. At least one trawl operator has indicated that the area of the proposed mining operation has a favourable (i.e., high) ratio of trevally to snapper.[63] If fishers shift effort to other areas of the trawl fishery, they may need to either purchase additional SNA 8 ACE (expensive and tightly held) or pay deemed values to cover snapper bycatch for which they are not able to obtain ACE.[64] Either of these options could make fishing less economically viable for fishers who cannot acquire sufficient SNA 8 ACE to allow them to continue catching their intended target species. This could affect the New Plymouth-based trawler more than the Nelson trawlers which, as only occasional visitors to the area, have more flexibility to respond to any spatial exclusion.

Cumulative impacts of other spatial exclusions

There are a number of existing spatial exclusions for trawling in FMA 8, including:

- closures under the Fisheries (Central Area Commercial Fishing) Regulations 1986, such as:
    - regulation 6A, which prohibits trawling by vessels over 46m in a defined area of the FMA;
    - regulation 6B, which prohibits trawling on four west coast seamounts; and
    - regulation 14, which restricts fishing around the Sugar Loaf Islands; and
- closures under the Submarine Cables and Pipelines Protection Act to protect petroleum and gas infrastructure, including Oanui, Maui A and B, the Kupe gas project, and the Tui area.

Any additional exclusion as a result of the mining operations would have only a minimal cumulative effect.

It should also be noted that the Ministry for Primary Industries is currently consulting on a series of management interventions to protect Maui's dolphins. One of the options under consideration entails a regulatory closure to trawling between Kaipara Harbour and Kawhia Harbour out to 4 nm together with extensive monitoring of trawlers in the area between Maunganui Bluff and Pariokariwa Point (north Taranaki) from 2 nm to 7nm.[65] If implemented, these measures could result in a southerly displacement of trawl effort into the South Taranaki Bight.

While not directly relevant to the consideration of spatial displacement from the sand mining proposal, the prospect of further regulated closures under the Fisheries Act in the west coast North Island trawl fishery may influence fishers' reactions to the mining proposal.

[63] Ian (Curly) Brown, skipper of the Receiver, as reported to Keith Mawson, Egmont Fisheries. Pers com (13 May 2013)
[64] Deemed values are administrative penalties set under the Fisheries Act 1996. Deemed values are set at a level that is intended to remove the financial benefits of fishing without ACE.
[65] http://www.fish.govt.nz/en-nz/Consultations/Hector+and+Mauis+Dolphins+Threat+Management+Plan/default.htm?WBCMODE=PresentationUnpublished%23MainContentAnchor

Sustainability and utilisation considerations

Any catch displaced from the mining site is unlikely to place additional sustainability or utilisation pressures on fish stocks because the amount of displaced catch is minimal.

Conclusion for bottom trawling

Any effort and catch displaced from the trawl fishery as a result of the mining operation is likely to be minimal, and is unlikely to result in any wider negative impacts on commercial fishing or fisheries. Displaced catch can be caught elsewhere in the FMA with minimal, if any, increase in the overall cost of fishing.

However, costs for the New Plymouth-based trawl operator may increase if this fisher moves any displaced effort to areas where snapper are more abundant. More generally, fishers' perceptions of spatial displacement by mining may be influenced by the prospect of future Fisheries Act closures to protect Maui's dolphins. The exclusion zone and associated movements of mining vessels may also result in some inconvenience to all trawl vessel operators in the vicinity of the mining operation.

Inconvenience to trawl vessel operators can be minimised by implementing a communication system to alert trawl operators to the intended location and duration of mining activities on a regular basis.

3.1.3 Set net fisheries

Spatial distribution of stocks

Rig has a relatively confined distribution close to the shore along the Taranaki coast, whereas school shark has a wider distribution across inshore and deeper areas.[66] The main target species (rig, school shark and blue warehou) have QMAs that cover FMA 8 only.

Proportion of catch taken in excluded area

The impact of spatial exclusion on the set net fishery is likely to be greater than for the trawl fishery as the areas of greatest effort and catch in this fishery overlay the general vicinity of the proposed mining area around the 50m contour.[67] Information from fishers suggests that rig is most commonly targeted within 4 nm of the shore,[68] so it is likely that the species targeted in the proposed mining area is primarily school shark (SCH 8).

Although there is spatial overlap between the mining area and the set net fishery, the overall proportion of set net catch displaced across the three target species is likely to be small for the following reasons:

- 88% of set net effort occurs in the territorial sea within 4 nm of the coast[69] and will not be displaced by the mining activity;

[66] NIWA (2012) Figures 11-35 (school shark) and 11-42 (rig).
[67] NIWA (2012) Figure 5-4
[68] Industry submissions from SeaFIC and Challenger Finfisheries Management Company on government proposals to close the area between Pariokariwa Point and Hawera to set netting, as reported in Ministry for Primary Industries (2012b).
[69] Ministry for Primary Industries (2012). In this advice paper MPI states that 88% of set net effort in the area from New Plymouth to Hawera is within 4nm of the shore. It is likely that this trend continues further down the coast.

- In the EEZ, set net effort and catch is highest at an area that is immediately to the south of the area of mining interest[70] (i.e., where the 50m depth contour intersects the 12 nm territorial sea boundary off the coast of Patea) – mining activity is likely to be concentrated to the north of this area, further minimising the spatial overlap with the set net fishery; and
- The actual area of exclusion at any one time will be small.

In particular, the near-shore distribution of the rig and blue warehou target fisheries means that only a minimal proportion of catch from of these stocks is likely to be taken in the area of the mining operation.

Practicality and cost of fishing at other locations

As noted above, the set net fishery targeting school shark has the most spatial overlap with the mining operation. However, because set netters often operate across all three target fisheries at different times of the year, the practicality and cost of fishing at other locations needs to be examined in light of all three parts of the fishery. When viewed in this light, the ability of New Plymouth-based set netters to shift effort to other locations within FMA 8 is likely to be limited by several factors.

First, the relatively small QMAs for rig, school shark and blue warehou (covering FMA 8 only) provide fishers with less flexibility about where they can harvest their ACE than stocks which are managed in larger QMAs.

Secondly, the coastal area from Hawera to Whanganui is a particularly important part of the distribution of the rig fishery. Although set net catch of rig is spread across the three SPO 8 statistical reporting areas, area 040 (the area which includes the South Taranaki Bight) has been a stable and consistently important part of the SPO 8 fishery for many years. It is likely to become more important in future as catch is displaced from areas subject to regulatory closures to the north. Area 040 also plays an important seasonal role in the rig set net fishery as the reporting area to the north (area 041) has its highest catches in October and November, whereas area 040 peaks in January to March.[71]

The ability of fishers to take set net target species using alternative methods may also be limited. Although some rig is caught as bycatch in trawl fisheries, set netting is by far the most dominant method for rig with 75-89% of SPO 8 annually taken by this method.[72] Challenger Finfish Company has stated that blue warehou and rig are taken almost exclusively by set net in this area.[73] It is therefore unlikely that any major reduction in set net harvested rig or blue warehou would be made up through greater amounts of trawl caught rig. However, that may not be so for school shark, which is caught mainly (66%) by setnet but also by bottom longline (22%) and as a bycatch in trawl fisheries (10%).[74] These differences are illustrated in a summary of catch-by-method data for SPO 8 and SCH 8 (**Figure 8**).

The South Taranaki Bight set net fishery is also significant in terms of both effort and catch when seen in a broader regional context of adjacent FMAs (**Figure 9**).

[70] NIWA (2012)
[71] Kendrick and Bentley (2012)
[72] Kendrick and Bentley (2012)
[73] As reported in Ministry for Primary Industries (2012b)
[74] Ministry for Primary Industries (2012)

Figure 8: Catch by method for SPO 8 (left) and SCH 8 (right) [75]

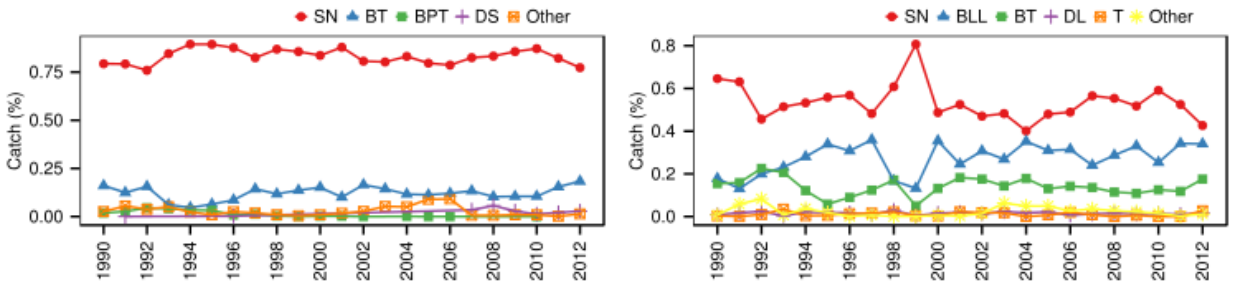
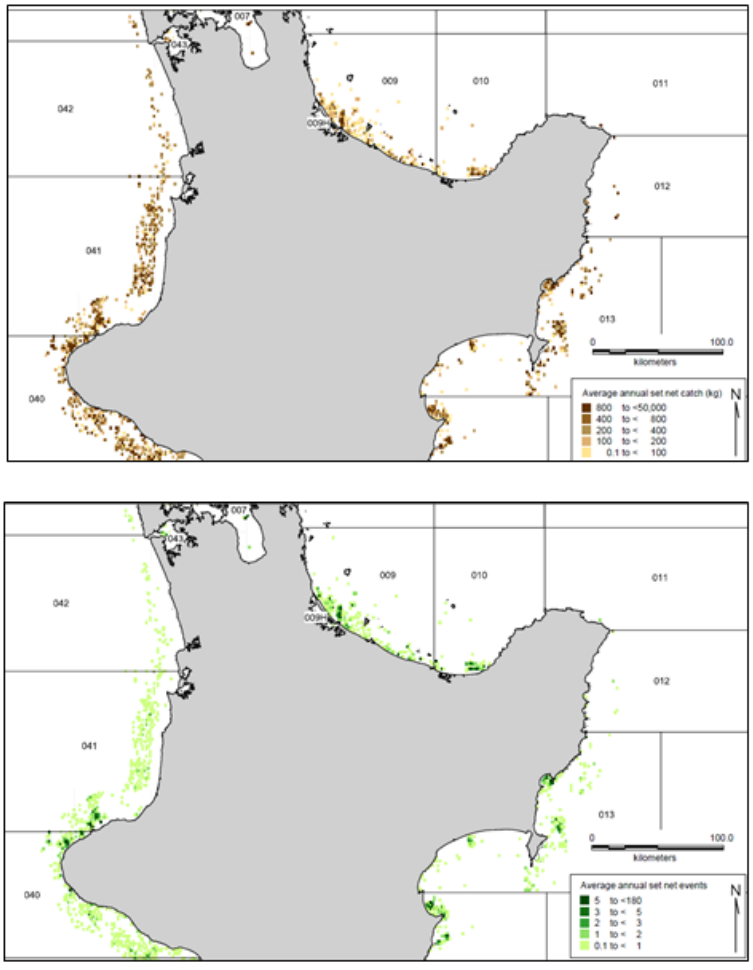


Figure 9: General pattern of set net catch (brown) and fishing events (green)[76]

Total annual catch of all species harvested by set net is shown for the position where each set net event started, averaged for all events starting in each 1 nm grid cell and for three fishing years 2007-10. These maps only show events that report co-ordinates of fishing position (about 33% of set netting events).



[75] Catch by method summary prepared by Trident Systems. Key: SN = set net; BLL = bottom longline; BT = bottom trawl; BPT = bottom pair trawl; DL = dropline; DS = Danish seine. http://www.fonz.tridentsystems.co.nz/

[76] Maps prepared by the Ministry for Primary Industries, and available at http://www.fish.govt.nz/en-nz/Commercial/About+the+Fishing+Industry/Maps+of+Commercial+Inshore+Fishing+Activity/default.htm

Taken together (and considering the effect of the cumulative spatial exclusions discussed below), these factors suggest that New Plymouth based set net fishers have limited flexibility to take any displaced catch elsewhere in the QMA. The situation is different for South Island set netters who fish occasionally in the South Taranaki Bight, as these fishers tend to have more diverse fishing operations, providing them with greater choice as to fishing method and area of operation.

Cumulative impacts of other spatial exclusions

Set net fisheries generally, and on the west coast of the North Island in particular, are under increasing pressure from regulatory closures under the Fisheries Act intended to protect Maui's dolphins. In 2008 a set net ban was imposed from Maunganui Bluff (north of Auckland) south to Pariokariwa Point (north Taranaki) offshore to 7 nm. It is likely that set net effort was displaced into the New Plymouth / South Taranaki Bight area as a result of these closures.

Additional "interim" regulatory measures put in place in July 2012 extended the closed area south to Hawera, with a complete set net ban operating out to 2 nm and a requirement to carry observers on set net vessels within the 2 nm to 7 nm area (see **Figure 10**). This requirement effectively closed the coastal area north of Hawera to set netting out to 7 nm, resulting in further displacement of set netting effort into the South Taranaki Bight.[77] The Government is currently consulting on additional measures, although none of the options under consideration propose extending the southern boundary of the current closure.[78]

The remaining open area of the fishery is therefore extremely important to the commercial set netters. In comparison with the extensive, permanent regulatory closures to protect dolphins, the potential displacement from mining activities is small, temporary and mobile. Although the additional exclusion as a result of the mining has only a minimal cumulative effect in comparison with existing closures, the recent history of displacement may mean it is nevertheless perceived as significant by commercial set netters.

Sustainability and utilisation considerations

Any displaced catch is unlikely to place additional sustainability or utilisation pressures on fish stocks because the amount of displaced catch is minimal.

Conclusion for set netting

Set net catch and effort displaced by the mining operation will primarily affect the school shark target fishery. The overall proportion of school shark catch taken from the proposed mining site is unknown but is likely to be small due to the small spatial extent of the proposed mining blocks. However, even a small amount of displaced catch may still be perceived as significant by affected fishers because the set net fishery has been subject to extensive closures to protect Maui's dolphins. This has had the effect of:

- displacing effort in the northern part of FMA 8 south into the South Taranaki Bight;
- displacing effort from the inshore part of the fishery (targeting rig) into deeper waters (targeting primarily school shark); and

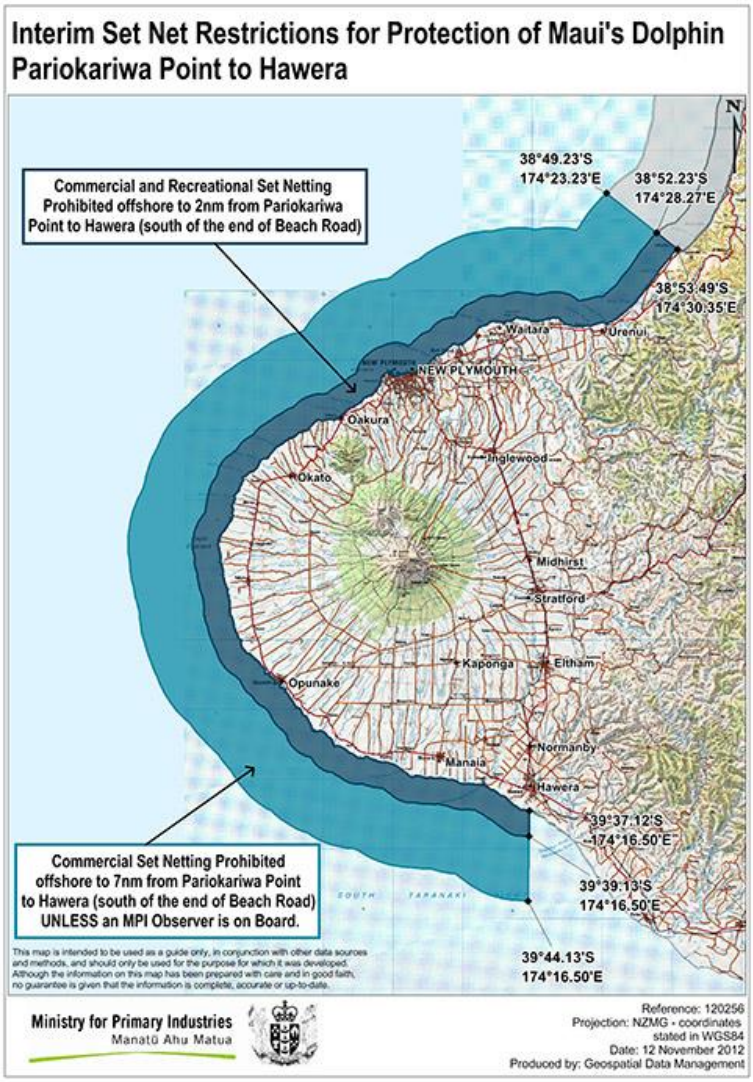
[77] Keith Mawson, Egmont Seafoods, pers com (8 May 2013)

[78] http://www.fish.govt.nz/en-nz/Consultations/Hector+and+Mauis+Dolphins+Threat+Management+Plan/default.htm?WBCMODE=PresentationUnpublished

- leaving New Plymouth based set netters with minimal flexibility to respond and adjust to additional closures.

It is possible that further discussions with individual set netters may result in more precise information on location and seasonality of set net effort in the vicinity of the mining operation. With this knowledge, the mining operational plan could be tailored to minimise impacts on commercial set netters. Inconvenience to set netters from the mining operations can be further reduced by implementing a communication system to alert vessel operators to the intended location and duration of mining activities on a regular basis.

Figure 10: Recent regulatory closures to commercial set netting in the vicinity of the mining area[79]



[79] Map from Ministry of Fisheries, http://www.fish.govt.nz/en-nz/Consultations/Archive/2012/Mauis+dolphin+Mortality/default.htm?wbc_purpose=Basic&WBCMODE=Autho%2523MainContentAnchor%2cAutho%23MainContentAnchor

3.2 Impacts on commercially fished species in the area of the mining operation

Indirect effects on commercial fishing may arise if the distribution or abundance of commercially fished species is affected by the mining activity.

3.2.1 Abundance of commercial fish species

In a report prepared for TTR on the South Taranaki Bight Fish and Fisheries, NIWA concluded that:[80]

- deaths of demersal and pelagic fish species caused directly by the iron sand extraction process are unlikely; and
- the use of seawater to pump iron sands to the processing vessel is likely to have negligible effects on larvae of fish species or their planktonic prey.

The sand mining operation is therefore unlikely to affect the abundance of commercially fished species in the immediate area.

3.2.2 Distribution of commercial fish species

NIWA has suggested that demersal and pelagic fish species will move away from the area of mining operations due to underwater noise, surface lights, vessel movements and the sediment plume.[81] However, NIWA does not draw detailed conclusions about the scale and duration of displacement of fish species.

The spatial and temporal scale of displacement of commercially-caught fish species is a key consideration for commercial fishing. As commercial fishing will also be excluded from the mining site, any temporary change in distribution of commercially fished species at the mining site is unlikely to have a negative effect on commercial fishing. Such displacement may even mitigate any effects of spatial displacement of fishing activity if the displaced fish are able to be caught elsewhere in the QMA. However, if fish are also displaced from the surrounding area, then the effective "excluded area" for commercial fishing will be larger than anticipated.

Once mining in a particular block has ceased, the resumption of commercial fishing in that area will be dependent on the recolonisation of the area by commercially fished species. Fishers have indicated that they believe the undulating seafloor of the rolling ground is important in ensuring the productivity of the fishery. The extent to which the seafloor can be returned to its current state and the time taken for this to occur are therefore key considerations. Research undertaken by NIWA for TTR indicates that:[82]

- the seabed environment in the vicinity of the mining operation is highly dynamic, with high rates of natural disturbance;
- the sandy habitats have relatively low species abundance and richness; and
- there is no significant relationship between iron concentration and community structure (meaning that pre- and post-mining species composition is likely to be similar).

[80] NIWA (2012)
[81] NIWA (2012)
[82] NIWA (2013)

These findings suggest that there are unlikely to be any lingering or permanent effects on commercial fishing arising from changes in fish distribution after the mining of a block has been completed.

3.3 Offsite impacts on commercially fished species

Offsite impacts on commercial fishing may occur if the mining operation affects the marine environment in ways that alter the productivity, abundance or distribution of fisheries resources of commercial significance. The main aspect of the mining operation that could affect fisheries resources in this way is the release of sediment into the water column during either extraction or disposal of tailings on the seabed, and the dispersal of sediment to other parts of the marine environment.

3.3.1 Offsite impacts on EEZ fisheries

If sediment disperses further out into the EEZ, it is unlikely to have an adverse effect on pelagic and demersal fish species as these species are mobile and can move away to unaffected areas. Sediment from the mining activity is therefore unlikely to have an adverse effect on commercial fisheries seaward of the mining activity, such as the mid-water trawl fishery for jack mackerel and barracouta.

However, it will be important for the mine operators to establish a mechanism for communicating with vessels in this deeper fishery, particularly with respect to the movements of mining support and export vessels (for contacts, see Appendix).

3.3.2 Offsite impacts on coastal reef fisheries

If sediment disperses from the mining operation on to coastal reefs on the South Taranaki coast, reef ecosystems and associated species may be affected through physical burial, ablation, clogging of respiratory surfaces and reduction of primary production through shading effects. The degree of impact will depend on amount of sediment introduced into reef environment,[83] the nature of the sediment, and its persistence in the coastal environment. The main reef species of commercial significance is rock lobster.

Rock lobster

In the event of sediment deposition on inshore reefs, adult rock lobsters are likely to be able to migrate to unaffected reefs.[84] However, the report prepared for TTR by NIWA identifies that rock lobsters could still potentially be affected by sediment in the following ways:

- smothering of juvenile lobsters (juveniles are less mobile and therefore less likely to migrate to unaffected reefs);
- trophic level impacts (rock lobsters are predatory species and may be affected if their prey is smothered); and
- impacts on larval dispersal.

On the last point, NIWA notes that numbers of rock lobster larvae entering the South Taranaki region should be unaffected by the mining. Modelling indicated this area is most dependent on larval supply from

[83] NIWA (2012)
[84] NIWA (2012)

Fiordland, Southland and Stewart Island with only 17% of CRA 9 larvae originating from adult CRA 9 lobsters. However, CRA 9 lobsters make a very significant contribution to larvae further north in the CRA 1 region.

Developing fisheries

There are several inshore shellfish species present in the South Taranaki Bight that, while not currently the target of commercial fisheries, may have development potential.

Paua (*Haliotis iris, Haliotis australis*) are found on reefs in South Taranaki but, because the mature paua in this area do not reach the minimum legal size of 125mm there is no current commercial fishery. This may change if regulations are adjusted to reflect the size of paua at sexual maturity. As a sedentary species, paua is unlikely to be able to move away to unaffected reefs and is therefore vulnerable to sediment effects. Paua are grazers and may also be indirectly affected if their algal food sources are smothered.

Several species of surf clam in FMA 8 have reasonable TACCs but, as yet, no reported commercial catch (e.g., ringed dosinia, trough shell, large trough shell and triangle shell). Surf clams are found in and immediately beyond the surf zone of exposed sandy beaches, out to 10m deep. The mobile surf zone environment is unlikely to be affected by sedimentation from mining operations.

3.3.3 Conclusion on offsite impacts on commercial fishing

The mining operation is unlikely to have any adverse effects on commercial fishing further out in the EEZ.

The degree of impact on fisheries along the Taranaki coast, including rock lobsters and other developing commercial fisheries, will depend on the amount of sediment that is introduced into the reef environment over and above the natural range, and the persistence of the sediment in the coastal environment. The naturally high levels of wave energy in the region may prevent the accumulation of additional sediments within the reef ecosystems along this coast.[85]

3.4 Broader impacts of spatial displacement

As noted in section 3.2 above, the level of displacement of commercial effort and catch as a result of the mining operations is likely to be minimal in the trawl fisheries, and small in the set net fishery (entailing some possible displacement of school shark catch). The relatively small amount of displacement in both cases is unlikely to result in any wider negative impacts on the commercial fishing industry. In particular, there are:

- no anticipated reductions in quota value;
- no anticipated downstream business impacts on fish processing or other fisheries-related services;
- no anticipated increased sustainability risks to fish stocks as a result of displaced effort and catch; and
- no anticipated increased risk of conflict with other resource users.

[85] NIWA (2012)

3.5 Summary of suggested mitigation measures

Mitigation measures that could be adopted by TTR to minimise any impacts of the proposed mining activity on commercial fishing in the South Taranaki Bight include:

- developing a contact list of companies and vessels operating in the area;
- designing and implementing a communication system to alert vessel operators to the intended location and duration of mining activities on a regular basis;
- developing a more precise understanding of the location and seasonality of set net effort in the area of the mining operation, and designing the mining operational plan to minimise any impacts on this fishery; and
- undertaking the mining operation in a manner that minimises the risk of sediment dispersal in the wider marine environment.

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Appendix

Abbreviations used in this report

Abbreviations		Species codes	
ACE	Annual Catch Entitlement	**BAR**	Barracouta
EEZ	Exclusive Economic Zone	**BCO**	Blue cod
FMA	Fisheries Management Area	**BNS**	Bluenose
FPSO	Floating Production Storage and Offloading vessel	**CRA**	Rock lobster
FSO	Floating Storage and Offloading vessel	**FLA**	Flatfish
ITQ	Individual Transferable Quota	**GUR**	Red gurnard
NIWA	National Institute of Water and Atmospheric Research	**JDO**	John dory
nm	Nautical mile (1.85 km)	**JMA**	Jack mackerel
QMA	Quota Management Area	**KAH**	Kahawai
QMS	Quota Management System	**KIN**	Kingfish
TAC	Total Allowable Catch	**LEA**	Leatherjacket
TACC	Total Allowable Commercial Catch	**PIL**	Pilchard
TTR	Trans-Tasman Resources	**RCO**	Red cod
		SCH	School shark
		SNA	Snapper
		SPD	Spiny dogfish
		SPO	Rig
		TAR	Tarakihi
		TRE	Trevally
		WAR	Blue warehou

Fishing industry contacts

The main industry contacts for the inshore fisheries in the South Taranaki Bight are:

Keith Mawson
Egmont Seafoods
keith@egmontseafoods.co.nz

Doug Saunders Loder
Talleys Fisheries
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Laws Lawson
Fisheries Inshore New Zealand
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Carol Scott
Southern Inshore Fisheries Management Company
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Daryl Sykes
NZ Rock Lobster Industry Council
lobster@seafood.co.nz

Key commercial fishermen known to be operating in the South Taranaki Bight include the following. Fishermen should be contacted via the main industry contacts listed above.

Trawlers:

- Ian (Curly) Brown from New Plymouth
- Nelson vessels (contact Doug Saunders-Loder)
- Connor family from Picton (contact Doug Saunders-Loder)

Set netters:

- Ian McDougall from New Plymouth
- Lyle Jenkins from New Plymouth

Mid water trawling (jack mackerel etc)

- Sealord
- Talleys, Nelson