Fisheries New Zealand
Tini a Tangaroa

Security Classification – *In-Confidence*

Internal Briefing to the Director-General

To:	**Ray Smith, Director-General**
CC:	Click here to type relevant Director/DDG.
From:	Stuart Anderson, Director Fisheries Management Steve Halley, Manager Inshore Fisheries David Scranney, Manager Customary Fisheries and Spatial Allocations
Contact:	Stuart Anderson; s 9(2)(a)
Date:	3/04/2019

Action required:	**Either agree or decline to grant** the Approval to use the trawl net
DG's due date of action:	As soon as practical

Subject:

Application by *Precision Seafood Harvesting Limited Partnership* for approval to use a trawl net for inshore fishing

PURPOSE

This paper provides you with advice on an application for a trawl net approval (for inshore fisheries) by Precision Seafood Harvesting Limited Partnership.

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1 EXECUTIVE SUMMARY

1. The Precision Seafood Harvesting Limited Partnership (PSH) has applied for approval of its Modular Harvest System (MHS) trawl net for commercial use under regulation 71A of the Fisheries (Commercial Fishing) Regulations 2001 (the Regulations). The application seeks approval to use the MHS trawl net in inshore bottom trawl fisheries targeting snapper, tarakihi, trevally, red gurnard, and John dory in the North Island fisheries management areas (FMAs) 1, 2, 8, and 9.

2. This approval is required before the MHS trawl net can be operated lawfully, as parts of these nets are not made from mesh and therefore do not meet the net mesh specifications in the Regulations.

3. The MHS trawl net was developed over seven years through the PSH Primary Growth Partnership programme. This programme is a 50:50 joint venture funding arrangement between three industry partners and MPI's Primary Growth Partnership (PGP) to develop an innovative seafood harvesting system. The programme ends on 30 September 2019. The MHS net represents a major innovation in trawl fishing, with PSH partners reporting greater operating efficiencies, health and safety benefits, and improved quality and higher value of fish landed through use of the net.

4. The Regulations were amended in 2017 to enable and allow for new innovations in trawl fishing gear to be approved for use, subject to certain criteria. Under the Regulations, you may approve the use of a new type of trawl net if you are satisfied that the net performs at least as well as an approved existing net in providing for the utilisation of fisheries resources while ensuring sustainability. The Regulations, and a Notice issued under them, provide the criteria for assessing the MHS trawl net to help you make your decision. The four key criteria considered are based on species and size composition of catch, and impacts on protected and benthic species.

5. The assessment of the application has relied on analysis of data that has been collected by PSH through trials and operational use of the MHS trawl net over the last seven years. This scientific analysis was considered alongside fisheries management objectives and measures, to assess whether the MHS trawl net meets the requirement of performing at least as well as a conventional net. We also considered operational practices, in terms of how the net will be used in these fisheries, to assess the likely combined impacts.

6. Where the data indicated a difference in performance of the gear based on the criteria we then assessed, given existing fisheries management systems and measures, whether that difference would create a sustainability or utilisation risk (as defined under the Fisheries Act). Differences in performance were identified around catching more juvenile snapper in some areas. There is uncertainty around whether this difference would pose a risk to sustainability of the fishery. In general, we consider that existing controls (regulatory closures and management processes (catch limits)) would adequately manage any possible risk. However, given uncertainty and because the snapper biomass is currently below management targets, we consider that conditions could be applied as a precautionary approach to ensure any potential risk is fully managed. We note that monitoring will allow these conditions to be reviewed and/or revoked in future. The over-arching consideration has been whether the MHS net, with these conditions applied, would perform at least as well as a conventional trawl net without any adverse impact on the sustainability of the fisheries.

7. We therefore do consider that the MHS trawl net will likely perform at least as well as a conventional net in providing for utilisation of fisheries resources whilst ensuring sustainability when targeting snapper, tarakihi, trevally, red gurnard, and John dory in FMAs 1, 2, 8, and 9. This is subject to the proposed conditions that we consider will satisfactorily address the risks that are associated with uncertainty in the evidence base.

8. Risks were identified around catching more juvenile snapper in some areas. We consider that this risk can be addressed by conditions being applied to the approval that will exclude the use of the MHS trawl net from the most important areas where juvenile snapper are found. Existing fisheries management controls would also continue to apply, and could be amended as appropriate if any concerns were to arise. The proposed conditions are:

    a) When fishing in FMA1, the MHS trawl net must not be used in:

i. waters shallower than 50m depth in -
   - that part of statistical area 005 north of the northernmost point of Little Barrier Island; and
   - all the waters of statistical area 008;

ii. that part of statistical area 005 south of the northernmost point of Little Barrier Island;
iii. all the waters of statistical area 006; and
iv. inshore of a line 4 nautical miles (nm) from the coast in statistical areas 009 and 010.

9. While no protected species were caught in formal trials, commercial fishers did report a higher capture rate of dolphins using the MHS trawl net while fishing under a special permit issued for trialling these nets. The difference cannot be confirmed as statistically significant due to the low number of captures, and it may be coincidental because the MHS trawl net is similar to a conventional net in the parts of the fishing gear most likely to interact with dolphins. However, given the importance of managing risks to Māui dolphins, we propose a precautionary approach that will exclude the MHS trawl net from use in key areas of their habitat, as follows:

   a) When fishing in FMA8 or FMA9 (west coast North Island), the MHS trawl net must not be used within 12nm of the coastline in the area between Maunganui Bluff and Pariokariwa Point.

10. Other conditions proposed relate to additional reporting that will allow Fisheries New Zealand to monitor the performance of the MHS trawl net, to ensure that no undue adverse effects arise. These include additional reporting of any vulnerable species interactions (e.g. sharks, and closer monitoring of the performance of the net in terms of catch rates, benthic footprint and other impacts.

11. We also note that the terms and conditions of an approval can be varied (including being revoked) at any time, should any further issues and risks be identified during its use.

2 PURPOSE

9. This paper provides you with advice on PSH's application under regulation 71A of the Regulations for approval to use the Modular Harvesting System trawl net to fish the inshore fisheries around the North Island.

10. The Regulations allow for nets to be approved for use that do not fit the standard specifications of trawl mesh nets.

3 THE PSH PGP PROGRAMME

11. PSH is a PGP-funded programme that was established by Aotearoa Fisheries (also known as Moana NZ), Sealord Group Limited, and Sanford Limited to manage the process of developing and commercialising an innovative trawl net over a seven-year period. The trawl net is known as the Modular Harvesting System (MHS).

12. The key aims of the programme were to achieve significant value and environmental benefits, including: more selective fishing in terms of juvenile fish and bycatch species; ability to return unwanted fish alive to the sea; and allowing fish to be landed fresher and in better condition to enable value added processing. The PSH PGP programme ends on 30 September 2019.

13. Approval to use the MHS trawl net in the deepwater fisheries for hoki, hake, and ling was granted on 24 May 2018.

4 THE CURRENT APPLICATION

14. On 29 March 2018, PSH applied for approval for year-round use of the MHS trawl net when fishing for snapper, tarakihi, trevally, red gurnard, John dory, and all other inshore finfish species in in FMAs 1, 2, 8, and 9 (Figure 1), but excluding Statistical Areas 005 and 006 in the Hauraki Gulf within FMA1 (Figure 2).

15. The MHS trawl net differs from a conventional trawl net in the structure and function of the end of the net. A conventional trawl net has a lengthener and codend consisting of net mesh panels. The MHS trawl net replaces the conventional mesh lengtheners and codend with s 9(2)(b)(ii)

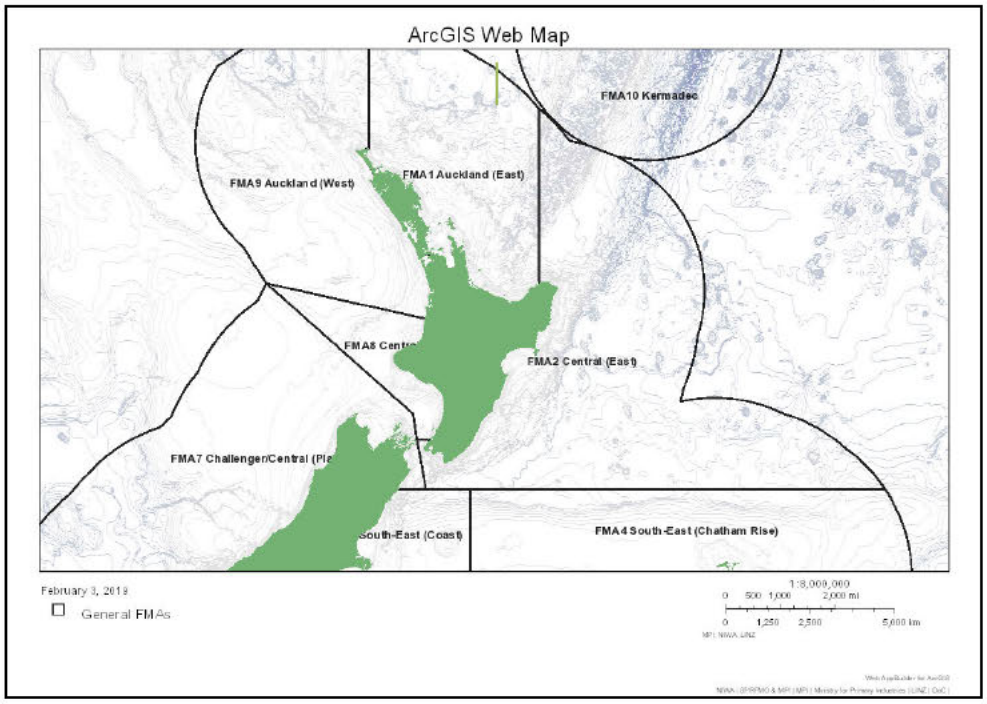

Figure 1. Fisheries Management Areas (FMAs) 1, 2, 8, and 9.

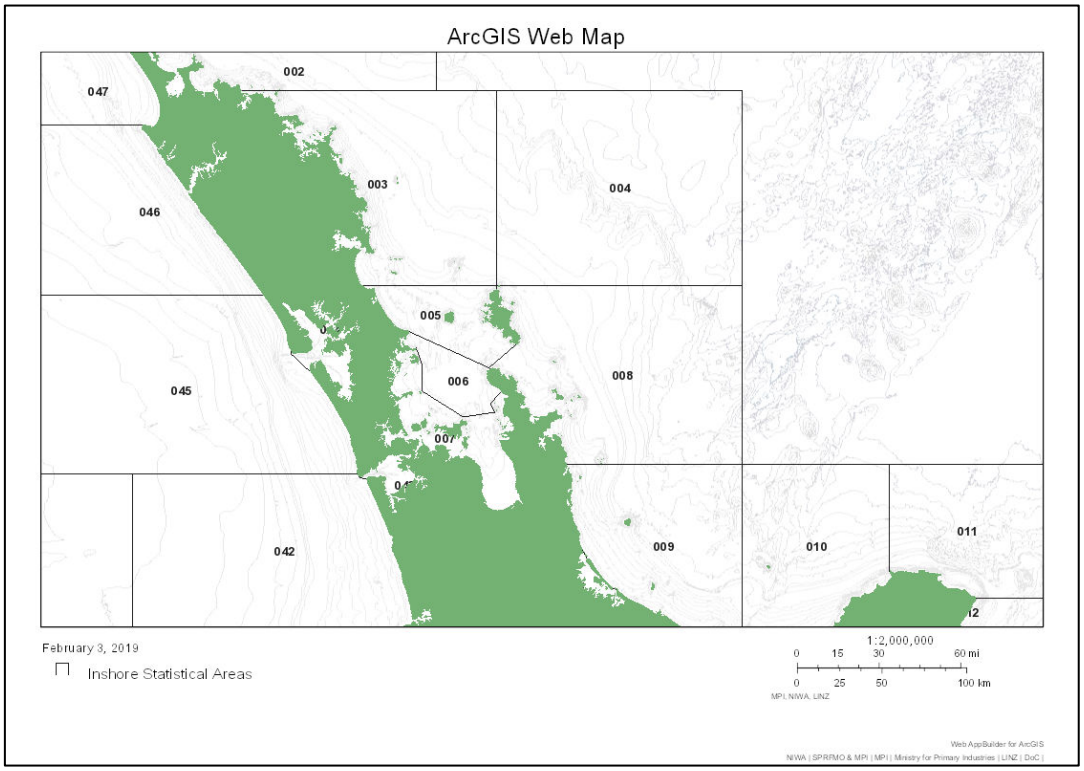

Figure 2. Auckland Fisheries Areas[1] for FMA1.

16. PSH has provided the following information in support of their application:

    a) An application with appendices;

    b) A detailed report of the results of formal at-sea trials in the Hauraki Gulf to test the performance of the MHS trawl net;

    c) Analyses of data reported by commercial fishers and by Ministry for Primary Industries (MPI) Fisheries Observers; and

    d) Anecdotal video evidence of the MHS trawl net's performance.

4.1 ASSESSMENT OF THE AVAILABLE INFORMATION TO SUPPORT THE APPLICATION

17. Some aspects of PSH's application lacked all of the required information and robust supporting science. This increased uncertainty in comparing the performance of the MHS trawl net against a conventional net, and caused the assessment process to take considerably longer than it should have. These issues are discussed below and in the Technical Assessment in Appendix 4. The uncertainty in the science analysis was considered against fisheries management objectives and measures, and the proposed approval conditions were applied as appropriate to mitigate any risks that could arise from use of the MHS trawl net.

4.1.1 Detailed report of trials in the Hauraki Gulf

18. The application included a detailed report on the trials undertaken by NIWA to test the MHS trawl net relative to a conventional trawl net. The trials were carried out within FMA1 and mostly within the outer Hauraki Gulf.

[1] The Auckland Fisheries Area boundaries for 005, 006, 007 are the same as statistical areas 005, 006, and 007.

19. While the general information in this report addresses the requirements for trawl net comparison, the trial results are compromised to a degree by the unexpected effect of using cover nets[2]. This reduced the usefulness of the trial for understanding net selectivity, although the results of the trial do provide some helpful findings that have been drawn on to assess the application.

20. The trials also allow only limited inferences to be made for other FMAs.

4.1.2 Analyses of commercial fishing and observer data

21. The applicant provided analyses of the relative performance of the MHS trawl net and a conventional trawl net using data reported by commercial fishers under statutory reporting requirements, and data collected by MPI Fisheries Observers.[3] This data includes fishing in FMAs 1, 2, 8, and 9, but most of the data was derived from FMA1.

22. The results of these analyses were provided in draft Fisheries Assessment Reports and reviewed by Fisheries New Zealand's Statistical and Assessment Methods science working group. Although the working group considered the broad statistical approach to modelling was sound, the group was unable to assess any specific conclusions from the modelling, because:

    a) Insufficient information was provided to the working group;

    b) Many analyses needed to be repeated; and

    c) The impact of many potentially important assumptions had not been tested.

23. The working group recommended further work to overcome these deficiencies, but at the time of preparing this advice, no further analyses have been presented.

5 THE REGULATORY FRAMEWORK AND LEGAL CONSIDERATIONS

24. Regulations 71A - 71C of the Regulations provide the criteria against which you must consider an application for approval of the use of a new trawl net. These are set out in full in Appendix 3. These Regulations were amended in 2017 to enable innovation in the fishing sector and allow for use of new types of trawl fishing gear.

25. Under regulation 71A(1) you, as Director-General, may approve the use of the MHS trawl net if you are satisfied that the MHS trawl net performs at least as well as an approved specified net in providing for the utilisation of fisheries resources while ensuring sustainability. The use of the MHS trawl net must also be consistent with any relevant fisheries plans approved under section 11A of the Fisheries Act 1996 (the Act). Note that there are not currently any relevant inshore fisheries plans approved under section 11A of the Act.

26. When comparing the performance of the MHS trawl net with the specified net, the comparison must be made by assessing the following matters:

    a) Species composition;

    b) Size composition;

    c) Impact on protected species; and

    d) Impact on benthic species.

27. You may also assess other matters you consider relevant, including other matters relating to ensuring sustainability and matters relating to utilisation.

[2] A cover net is used to determine the amount and size of fish that a trawl net catches (the selectivity). The cover is put around the trawl net and catches all the fish that would otherwise escape through the net meshes. It was found that the cover nets affected the number and size of fish that entered the nets, which means that the ability to compare trawl net selectivity was reduced.

[3] MPI Fisheries Observers collected data from 828 (2%) of 44,926 tows using conventional nets; and 2,198 (35%) of 6,371 tows using the MHS trawl net in FMAs 1, 2, 8, and 9 combined.

5.1 INFORMATION PRINCIPLES

28. Section 10 of the Act (Information Principles) outlines your responsibilities as decision maker with regard to information availability and quality:

    a) Decisions should be based on the best available information;

    b) Decision makers should consider any uncertainty in the available information;

    c) Decision makers should be cautious when information is uncertain, unreliable, or inadequate; and

    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 the Act.

6 ASSESSMENT OF THE APPLICATION

29. Fisheries New Zealand has applied a risk-based approach to comparing MHS trawl net performance against conventional trawl nets. This approach was adopted to address deficiencies in and uncertainty of the available information, as discussed above. The possible risks identified through the information and analyses provided were considered against fisheries management objectives and approaches to assess whether they could be mitigated by applying appropriate conditions to the Approval. An assessment was undertaken separately for each FMA against the criteria set out in the Regulations.

6.1 CONSIDERATIONS FOR ASSESSMENT AGAINST CRITERIA

30. The purpose of the Act is to provide for the utilisation of fisheries resources while ensuring sustainability. Your consideration of this application should be framed by that purpose, based on the information principles set out above.

31. The following section, in summary, assesses results for all FMAs against the four key regulatory criteria. The full technical assessment for each FMA is provided in Appendix 4.

6.1.1 Species composition of catch

32. Fisheries New Zealand considers it likely that the MHS trawl net performs at least as well as a conventional net with respect to the overall species composition of catch, including vulnerable species.

33. For FMA1, the trial information shows that the MHS trawl net catches more snapper and leatherjackets, while a conventional net catches more red gurnard and John dory. With snapper being the dominant species in FMA1 catches, a higher catch rate could be an advantage for targeting snapper using the MHS trawl net, but could result in more fishing effort being needed to catch the same amount of gurnard and John dory.

34. The available information on species composition in FMAs is uncertain and caution is needed in the inferences drawn about species composition between FMAs.

6.1.2 Size composition of catch

35. Understanding size composition between the MHS trawl net and a conventional trawl net is important for fisheries management because catching too many small fish from a stock can adversely affect the productivity of that stock.

6.1.2.1 Snapper

36. Fisheries New Zealand considers that the MHS trawl net, if used in the same circumstances as a conventional net, is likely to catch more snapper at or below the size considered to be important for fisheries management (25cm). However, placing restrictions on how the MHS trawl net is used and shifting vessel operator behaviours (largely associated with fishing in deeper waters), can result

in the MHS trawl net catching fewer small snapper, likely bringing its catch size composition in line with a conventional trawl net, and thereby reducing risks to the sustainability of the snapper stock.

37. Fisheries New Zealand therefore considers that, based on the available information, the use of the MHS trawl net is not likely to adversely affect the productivity or rebuild of the snapper stock in FMA1 (SNA1) provided that the proposed approval conditions (see section 7 – Terms and Conditions) are applied to exclude its use from areas where juvenile snapper are likely to be more prevalent. In addition, existing management controls for all commercial trawling continue to apply, to manage and reduce the capture of juvenile snapper.

6.1.2.2 Other target species – terakihi, trevally, red gurnard, John dory

38. Fisheries New Zealand considers it likely that the MHS trawl net performs at least as well as a conventional net with respect to the size of other target species caught.

39. However, ongoing monitoring and analysis is recommended to better understand and confirm the size selectivity of the MHS trawl net and how it might affect stocks and fisheries in all FMAs. In addition, monitoring will provide information about changes in fishing behaviour when using the MHS trawl net.

6.1.3 Impact on protected species

40. Fisheries New Zealand considers that the MHS trawl net is likely to have no greater impact on protected species than a conventional net. Although fishers have reported higher interaction rates with cetaceans (whales, dolphins and porpoises) while using the MHS trawl net than a conventional trawl net, the low rates of capture means that these observed differences are not statistically definitive.

41. However, the MHS trawl net is new and relatively untested in terms of interactions with Māui dolphins. In addition, there is some uncertainty about the catch rates of the MHS trawl net. Lower catch rates could result in more trawling time needed to catch a given quantity of fish, and hence increase the risk of protected species interactions with the MHS trawl net.

42. The impact of a dolphin capture on the Māui dolphin population would be serious. Fisheries New Zealand therefore proposes a precautionary approach, with Approval conditions to exclude the MHS trawl net from use in key Māui dolphin habitat. Fisheries New Zealand also recommends ongoing monitoring and analysis to better understand the impact of the MHS trawl net on protected species. This will enable Fisheries New Zealand to identify and treat risks should they emerge.

6.1.4 Impact on benthic species

43. Fisheries New Zealand considers that the MHS trawl net is likely to perform at least as well as a conventional trawl net in terms of benthic (seabed) impacts. However, the spatial extent of the relevant trials was limited and comparable information from fishing in other areas is not available.

44. The MHS trawl net likely retains slightly more benthic species than a traditional trawl net because the MHS trawl net codend does not allow for species to fall through the net, whereas a mesh codend does. However, Fisheries New Zealand considers that the differences between the MHS trawl net and conventional trawl net are relatively minor in terms of swept area, catch rates, and amounts of benthic species retained.

6.2 ANY OTHER MATTERS CONSIDERED TO BE RELEVANT (REGULATION 71B(3))

45. The following additional information provided by PSH may be relevant to your decision.

6.2.1 Matters relating to ensuring sustainability

46. PSH provided information about escape mortality, post-capture survival, and the potential for releasing marine mammals from a MHS trawl net. However, assessment of this information (see Appendix 5) suggests further research and trials are required before conclusions can be drawn about these aspects of the MHS trawl net's performance. Fisheries New Zealand will continue to discuss these matters with PSH.

6.2.2 Matters relating to utilisation

47. The application notes that the co-investors have all reported a substantial improvement in value from the improved quality of fish landed from the MHS trawl net and improved operational benefits. The claimed benefits are detailed in the application.

48. These utilisation benefits include higher value fish, longer shelf life of fish, operational efficiencies, and health and safety of crew.

49. While a full assessment and quantification of the benefits is not possible until multiple vessels are using the MHS trawl net on a regular basis, PSH provided evidence of substantial improvements in the quality of fish landed and the higher prices obtained (as much as 25%). This has enabled access to new markets.

50. PSH noted operational benefits including longer product shelf life, the ability to extend processing times without loss of quality, and the potential to reduce fuel use.

7 TERMS AND CONDITIONS

51. Regulation 71A(3)(b) of the Regulations provides that you may grant an approval subject to the terms and conditions you think fit. Fisheries New Zealand provided PSH with a copy of the draft Approval to test the operational feasibility of the proposed conditions as part of normal commercial fishing operations. The Approval document is attached for your signature.

7.1 COMMENCEMENT DATE OF APPROVAL

52. Fisheries New Zealand proposes that the Approval commences on 1 July 2019. This provides a 3-month period for Fishery Officers to undertake Approval-related education and compliance checks, and ensure all processes are in place before the Approval commences. Vessels have been fishing with the MHS trawl net under special permit provisions as part of the PGP programme. The special permit was issued under section s 97 of the Act. Fisheries New Zealand has extended the current special permits until the commencement date, to allow a smooth transition to the new requirements.

7.2 TECHNICAL SPECIFICATIONS AND LABELLING OF MHS NETS

53. Fisheries New Zealand proposes that conditions be placed on the Approval to ensure that vessel operators are fishing with authentic MHS trawl net modules and that these modules are configured correctly. If approval is granted, the MHS trawl net can be used by all vessel operators in the approved FMAs.

54. The proposed Approval:

    a) Defines the MHS trawl net by its United States patent number and provides a generic descriptor that refers to a separate Technical Specifications Document held by Fisheries New Zealand (refer condition 2.6). The Technical Specifications document provides details of how to configure and sequence the net modules correctly.[4]

[4] PSH considers these details to be intellectual property. The PSH PGP contract includes a clause that provides for the exclusive use of the MHS trawl net for three years from the completion of the programme (at 31 March 2019). Therefore, the Technical Specifications are not included in the Approval which must be published on an MPI website once granted.

b) Requires vessel operators to demonstrate to a Fishery Officer that the MHS trawl net is correctly identified, labelled and meet the approved specifications (refer condition 2.7). This approach is the same as for other fishing equipment, such as a traditional mesh net.

7.3 PROPOSED RESTRICTIONS ON TARGET FISH STOCKS, FISHERIES MANAGEMENT AREAS, AND AUTHORISED DEPTH

55. PSH applied for use of the MHS trawl net in FMAs 1, 2, 8, and 9 when targeting five specified inshore species, and all other inshore finfish species. Fisheries New Zealand is satisfied the MHS trawl net is likely to perform as least as well as a traditional mesh trawl net for the specified species and all FMAs applied for, provided the proposed Approval conditions are applied. Fisheries New Zealand considers that there is inadequate information to support approval for other target species, but notes that associated species can be caught as unavoidable bycatch while fishing in the approved target fisheries.

56. Therefore, Fisheries New Zealand proposes that Approval is granted to use the MHS trawl net for targeting snapper, tarakihi, trevally, gurnard, and John dory in FMAs 1, 2, 8, and 9, with the following conditions on areas and depths in FMA1 to address the risks of higher catches of juvenile snapper.

Statistical Area	Proposed Condition
005	MHS trawl net use must be deeper than 50m north of the northernmost of Little Barrier Island, No MHS trawl net use south of the northernmost point of Little Barrier Island.
006[5]	No MHS trawl net use allowed.
008	All MHS trawl net fishing must be deeper than 50m.
009 and 010	All MHS trawl net fishing must be further than 4nm of the coastline.

57. The available science shows that the MHS trawl net catches more sub-legal snapper than a conventional trawl net under the same circumstances. Sub-legal snapper are most abundant within the 50m depth contour across FMA1, and especially abundant in Auckland Fisheries Areas 005 and 006 in the Hauraki Gulf. Catching more juvenile snapper, in sufficient quantities, could be a sustainability risk through impact on stock productivity and the rebuild of the SNA1 stock.

58. The risk of catching small snapper is currently mitigated via existing regulatory and voluntary measures. These measures include requirements to report the catch of small snapper (<25cm), to move on to a different area if a high proportion of small snapper are caught, and some areas are closed to trawling. These rules would also apply to the use of the MHS trawl net.

59. Fisheries New Zealand considers the proposed Approval conditions, in addition to the existing fisheries management measures, should address concerns that the MHS trawl net could adversely affect the rebuild of the SNA1 stock. Any potential sustainability issues presented by the introduction of the MHS trawl net can be readily managed by varying, as necessary, the existing controls under the regulations that control all fishing activity across the area. These controls include commercial catch limits and, specifically, the allowance set to cover sources of mortality from fishing in addition to the landed catch.

[5] All trawling, including using a MHS trawl net, is prohibited by regulation in part of statistical area 006; the Approval would exclude MHS trawling from the entire statistical area. All trawling is prohibited by regulation in statistical area 007, and therefore 007 does not need to be excluded.

7.4 PROTECTION AND REPORTING OF PROTECTED SPECIES

60. Fisheries New Zealand proposes Approval conditions for FMA8 and 9 to minimise any risk to Māui dolphins:

    a) The MHS trawl net may not be used within 12nm from the coastline in the area between Maunganui Bluff and Pariokariwa Point.

61. The area between Maunganui Bluff and Pariokariwa Point is the currently agreed geographic range of the dolphins, and is currently closed to trawling to protect Māui dolphins. The existing closure to trawling extends to 2nm offshore through most of the area, and to 4nm offshore through the core range of the dolphins from the Manukau Harbour to Port Waikato. The proposed closure to 12nm is intended to minimise the risk of a dolphin capture by the MHS nets. Fisheries New Zealand notes that the area covered by protection/monitoring will be considered as part of the review of the dolphin Threat Management Plan that is currently underway (in conjunction with DOC). If the area changes as a result of Ministers' decisions on the Threat Management Plan measures, Fisheries New Zealand has the ability to amend the Approval conditions accordingly.

62. Fisheries New Zealand considers that ongoing monitoring of the interaction between the inshore MHS trawl net and protected species will be done through the requirements of fisheries reporting regulations and by deployment of MPI Fisheries Observers to gather more data, should this be necessary.

7.5 REPORTING OF VULNERABLE SPECIES

63. The best available information on use of the MHS trawl net in inshore fishing suggests it is likely that the MHS trawl net poses no greater risk to vulnerable species in the inshore fisheries than a conventional trawl net. However, the information is not strong as it is based on the limited set of NIWA trials in the Hauraki Gulf. In the deepwater fisheries, detailed statistical analysis suggests the capture rates of vulnerable deepwater sharks is at least 10% higher in the MHS trawl net compared to conventional nets, with no clear reason evident. Given this uncertainty, Fisheries New Zealand considers that a cautious approach is appropriate for inshore fisheries and it is important to monitor the bycatch of vulnerable species to improve understanding of interactions between the MHS trawl net and vulnerable species in inshore FMAs.

64. Information on capture of vulnerable species is reported for those fishers electronically reporting under the new requirements currently being rolled out across inshore fisheries. For those fishers not yet operating under the new requirements and still using paper-based reporting, Fisheries New Zealand proposes a condition on the Approval (refer to condition 2.8) requiring fishers to complete a form. This condition applies to FMAs 1, 2, 8, and 9. This is the same approach that was taken for the approval granted to PSH for use of the MHS net in selected deepwater fisheries in May 2018.

65. Fisheries New Zealand has other tools to monitor vulnerable species capture rates, and other aspects of fishing, by deploying MPI Fisheries Observers to gather more data, if necessary. We will closely monitor the reporting of these capture rates to determine if further monitoring and/or measures (such as changes to approval conditions) are required at any stage.

8 CONCLUSIONS

66. We have assessed the application against the relevant matters prescribed in the Regulations. We consider that the available information supports the conclusion that the MHS trawl net is likely to perform at least as well as traditional mesh trawl nets in providing for the utilisation of fisheries resources while ensuring sustainability when targeting snapper, tarakihi, trevally, gurnard, and John dory in FMAs 1, 2, 8, and 9, and provided that the proposed restrictions noted above are applied.

67. The available information shows that the MHS trawl net catches more undersized snapper where they are prevalent in FMA1. High catches of small snapper, in sufficient amounts, could pose a sustainability risk and compromise the rebuilding of SNA1. However, we are satisfied that the risk

can be managed by the proposed approval conditions for FMA1 that exclude its use from areas where juvenile snapper are likely to be more prevalent, together with the existing regulatory and voluntary measures for all commercial fishing in place to manage the catch of small snapper.

68. There is no strong evidence to show that the MHS trawl net performs worse than conventional nets in terms of marine mammal capture, but the nets are still relatively new and untested compared to conventional nets. To address this uncertainty, and the serious consequences of a Māui dolphin capture, we propose approval conditions to exclude use of MHS trawl nets from those parts of FMAs 8 and 9 which intersect with the greatest part of the Marine Mammal Sanctuary and the habitat of the Māui dolphin.

69. To respond to the uncertainty in the information and the requirement to act with caution, we propose ongoing monitoring of MHS performance and additional reporting of captures of vulnerable species where permit holders are not yet using electronic reporting.

70. We note that most of the information available for comparison of trawl net performance is from fishing within FMA1. Statistical analyses and models of the limited available data to enable definitive conclusions about net performance in FMAs 2, 8, and 9 have not been presented at this time. However, based on its performance in FMA 1, observations from its use and considering fisheries management objectives and measures across the other fisheries, Fisheries New Zealand concludes that it is likely the MHS trawl net should perform at least as well as conventional nets, provided that the proposed conditions are applied to address the risks identified.

71. The MHS trawl net must be operated in accordance with current regulatory requirements relating to all trawling (e.g., areas which may be fished, reporting). These measures will also mitigate some of the risks of operating the MHS trawl net.

72. PSH have advised that there are economic benefits of landing better quality fish, creating higher returns, and also operational advantages. We consider potential advancements in using the MHS trawl net (e.g., improvements to harvest operations and on-board handling systems) are likely to contribute to lower fishing costs and/or increase economic benefits. We also expect that use of the net will continue to drive changes in behaviour and fishing practices, as well as incentivising further innovation in its use and other new trawl technologies.

73. We also note that the approval conditions can be amended (or even revoked) at any time, should any concerns or new risks emerge through its use and the associated reporting and monitoring that we will require.

74. Based on the above assessment, we recommend that you approve the MHS trawl net for use in the snapper, tarakihi, trevally, gurnard, and John dory bottom trawl fisheries in FMAs 1, 2, 8, and 9, subject to the terms and conditions set out in the attached Approval.

9 NEXT STEPS

75. Should you agree with this assessment and sign the attached Approval and decision letter, please note the following actions:

    a) We will notify PSH of the decision and send your signed letter;

    b) We will arrange for the Approval to be published on the MPI website, and advise MPI Fisheries Compliance;

    c) We will develop a work programme for Fisheries Officers to undertake Approval-related education and compliance checks, before the Approval commences.

    d) We will monitor and analyse the incoming catch and effort data (including the catch of sub-legal snapper, tarakihi, trevally, and the catch of vulnerable species) for vessels using the MHS trawl net to improve understanding of net performance;

    e) We will develop and operate a programme of Fisheries Observer sampling of fish lengths and other relevant data from commercial fisheries using MHS trawl nets and conventional trawl nets;

f) PSH will be invoiced for the costs associated with assessing the application, at an hourly rate of $150.65 including GST, as per the requirements in the Regulations (hours and final cost yet to be calculated).

76. Note also that regulation 71A(4) of the Regulations provides that all persons using an approved trawl net may apply to vary one or more of the terms or conditions of this approval. The PSH industry partners could continue to trial the MHS trawl net under special permit to collect additional data to support an application to vary the terms and conditions of this Approval in the future.

10 RECOMMENDATION

77. Fisheries New Zealand recommends that you:

a) **Note** that under the Regulations, you may approve the use of the MHS trawl net if satisfied that it performs as least as well as the specified conventional mesh trawl net in providing for the utilisation of fisheries resources while ensuring sustainability, and the use of the MHS trawl net is consistent with relevant fisheries plans approved under section 11A of the Fisheries Act 1996;

Noted

b) **Agree** that overall the MHS trawl net is likely to perform at least as well as the specified conventional mesh trawl net for targeting snapper, trevally, tarakihi, red gurnard, and John dory in FMAs 1, 2, 8, and 9, provided that the recommended terms and conditions (see below) are applied, in providing for the utilisation of those fisheries resources while ensuring sustainability;

Agree / Not agreed

c) **Agree** to approve the use of the MHS trawl net for targeting snapper, trevally, tarakihi, red gurnard, and John dory, subject to the following terms and conditions in the attached Approval:

i.	Species	**Agreed / Not agreed**
ii.	Fisheries Management Areas	**Agreed / Not agreed**
iii.	Restrictions in FMA1	**Agreed / Not agreed**
iv.	Restrictions in FMA8 and FMA9	**Agreed / Not agreed**
v.	Fishing Methods	**Agreed / Not agreed**
vi.	Technical Specifications	**Agreed / Not agreed**
vii.	Requirements to demonstrate technical specifications	**Agreed / Not agreed**
viii.	Vessel Reporting Requirements	**Agreed / Not agreed**
ix.	General Conditions	**Agreed / Not agreed**

d) **Sign** the attached Approval; and

Signed

e) **Sign** the attached confidential Precision Seafood Harvesting Modular Harvest System Trawl Net Technical Specifications Document; and

Signed

f) **Sign** the attached letter advising Precision Seafood Harvesting Limited Partnership of your decision.

Signed

Stuart Anderson
Director Fisheries Management
Fisheries New Zealand
April 2019

Ray Smith
Director-General
Ministry for Primary Industries
April 2019

11 APPENDICES

APPENDIX 1: APPLICATION FOR APPROVAL OF THE INSHORE MODULAR HARVESTING SYSTEM (MHS) TRAWL NET

The assessment has considered the following supplementary information, provided in support of the application.

List of Documents

Inshore MHS – Revised Application for Approval of Trawl Net, Final 2018 2 November
November application Appendix 1 – MHS Module Identification
November application Appendix 2 SOP for Inshore PSH Modular Harvest Systems and Fishing Handling – Draft V3.0
November application Appendix 3 – SNZ-PSH-BT-Trident
November application Appendix 4 – NFPS –Trident
November application Appendix 5 – UCK Equivalence Analysis – Russel Millar Sep – 18
November application Appendix 6 – Exploratory analyses of UCK – Trident Oct – 18
November application Appendix 7 – SNA 1 Selectivity report_FINAL – NIWA
November application Appendix 8 – 2017 PSH1801 simulation analysis Revised Final
November application Appendix 9 – An analysis of catches and fish survival associated with MHS and conventional trawl
November application Appendix 10 – Acute post-harvest survival of sub-legal snapper – PFR
November application Appendix 11 – MHS Safety Guidelines – PSH
November application Appendix 12 – Analyses of observer data – Trident Nov -18
Trident Report – Catch composition from PSH and BT methods for North Island FMAs, 2017-18

s 9(2)(b)(ii)

Additional information resources provided by PSH during the assessment process

November application FAR2001_78
November application estimating collateral mortality Broadhurst_et_al_2006_Fish_and _Fisheries
November application Harley et al 2000 snapper unaccounted fishing mortality
November application Kaiser and Spencer 1995 survival of bycatch
November application Main and Sangster 1990 scale damage

APPENDIX 2: NET SPECIFICATIONS

1. A conventional trawl net and the MHS trawl net differ only in the structure and function of the end of the net. The conventional trawl net has a lengthener and codend consisting of net mesh panels (see Figure 3). In comparison, the MHS trawl net replaces the conventional mesh lengtheners and codend with s 9(2)(b)(ii) as described below.

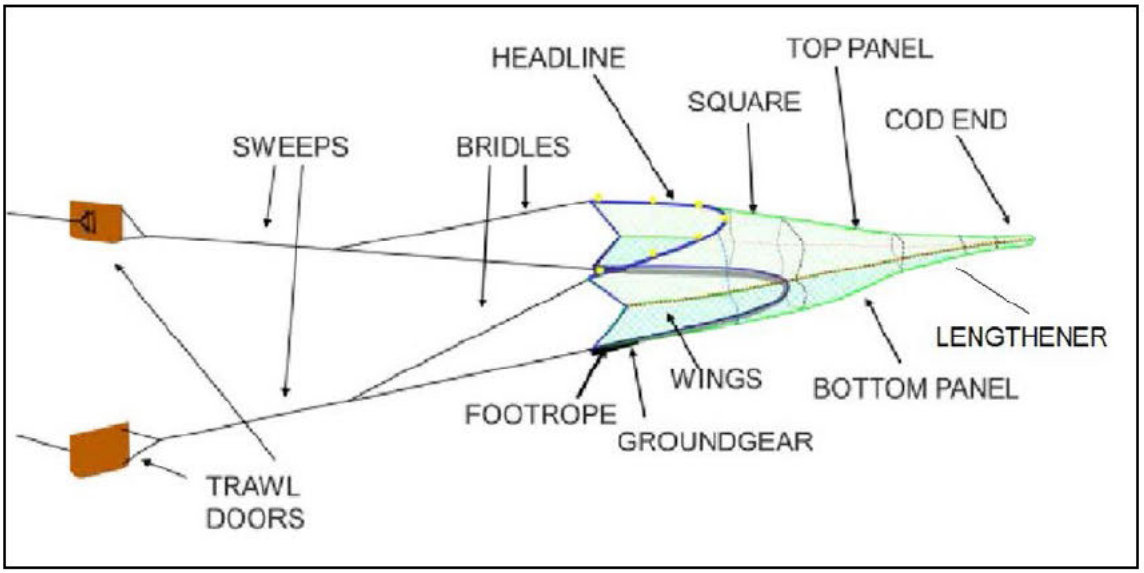

Figure 3. Diagram of a conventional trawl net (from Appendix 1).

2. s 9(2)(b)(ii)

   a) s 9(2)(b)(ii)

   b) s 9(2)(b)(ii)

   c) s 9(2)(b)(ii)

[6] The construction method is different for each material; however, PSH state the overall physical dimensions and performance of the MHS trawl net is the same.

s 9(2)(b)(ii)

3. s 9(2)(b)(ii)

4. s 9(2)(b)(ii)

5. s 9(2)(b)(ii)

6. s 9(2)(b)(ii)

APPENDIX 3: REGULATORY CRITERIA

Approval of trawl nets

1. Before approving a trawl net, you must be satisfied that —

   a) The new trawl net (net A) performs at least as well as a specified net (net B) in providing for the utilisation of fisheries resources while ensuring sustainability; and

   b) The use of A is consistent with relevant fisheries plans approved under section 11A of the Fisheries Act 1996.

2. There are not currently any relevant inshore fisheries plans approved under section 11A of the Fisheries Act 1996.

3. "Ensuring sustainability" is defined in the Act as: "maintaining the potential of fisheries resources to meet the reasonably foreseeable needs of future generations; and avoiding, remedying, or mitigating any adverse effects of fishing on the aquatic environment".

4. "Utilisation" of fisheries resources is defined as "conserving, using, enhancing, and developing fisheries resources to enable people to provide for their social, economic, and cultural wellbeing".

5. Regulation 71A(2) provides that the specified net (B), means a trawl net that —

   a) at the time of the application, may be used for fishing under regulation 71 or under other regulations in force under the Fisheries Act 1996 that relate to commercial fishing in a specified area of New Zealand fisheries waters; and

   b) the chief executive otherwise considers is appropriate to use for the comparison under subclause (1), having regard to the kinds of net that are commonly used, or are approved for use under this regulation, for taking at least 1 of those species in at least 1 of those areas or in a similar area.

Consideration of application for approval

6. Regulation 71B(2) states that the comparison between nets A and B must be made by assessing the following matters:

   a) *Species composition*

      - *how A compares (or is likely to compare) with B with respect to the relative species composition (including both quota management system and non-quota management system species):*

   b) *Size composition*

      - *how A compares (or is likely to compare) with B with respect to the relative size composition (including both quota management system and non-quota management system species):*

   c) *Impact on protected species*

      - *how the number of protected species injured or killed by A compares (or is likely to compare) with the number of protected species injured or killed by B:*

   d) *Impact on benthic species*

      - *how the weight of benthic species, or the area of seabed, impacted by A compares (or is likely to compare) with the weight of benthic species, or the area of seabed, impacted by B.*

7. Protected species are any marine wildlife (as defined in the Wildlife Act 1953) that is absolutely protected under that Act; and any marine mammal (as defined in the Marine Mammals Protection Act 1978).

8. Regulation 71B(3) provides that the comparison may also include assessing any other matter that you consider relevant, including—

   a) *matters relating to ensuring sustainability other than those described in subclause (2); and*

   b) *matters relating to utilisation (for example, the value of the catch).*

9. Regulation 71C allows the chief executive to issue, amend, or revoke a notice specifying certain technical details relating to –

   a) The manner in which a comparison must be made under regulation 71B, including –

      i. matters that the chief executive must have regard to when deciding whether information from trials is required;

      ii. what information from trials is required (if any);

   b) information that must be included in an application under regulation 71A(1) or (4).

10. As provided for by regulation 71C, the Fisheries (Innovative Trawl Technologies) Notice 2017 (the Notice) was issued on 12 October 2017 (link to Notice). The Notice includes technical specifications about how comparisons between net A and net B must be made, and the information required to support an application for approval. Information provided by the applicant must include consolidated results from the complete trial, and must be statistically robust.

Issuing an approval

11. Regulation 71A(3) states the approval —

   a) must be notified on an Internet site maintained by or on behalf of the Ministry; and

   b) may be given on the terms and conditions that the chief executive thinks fit.

APPENDIX 4: FULL TECHNICAL ASSESSMENT UNDERTAKEN BY FISHERIES NEW ZEALAND BY FMA

FMA1 – ASSESSMENT

Species composition

1. The application lists snapper SNA (*Pagrus auratus*), tarakihi TAR (*Nemadactylus macropterus; Nemadactylus sp.*), Trevally TRE (*Pseudocaranx dentex*), red gurnard GUR (*Chelidonichthys kumu*), and John dory JDO (*Zeus faber*) as the primary target species. The application notes that it is not limited to these species.

2. The application notes the areas applied for, so the stock codes can be determined – SNA 1, 2, 8, 9; TAR 1, 2, 8; TRE 1, 2, 7 (northern part); GUR 1, 2, 8; JDO 1, 2.

Formal trials in Hauraki Gulf – direct comparisons of the nets

3. The results of the formal trials in the Hauraki Gulf are described well in NIWA's report, although the utility of the trials is low given the cover net effect experienced and the consequent limitations of reliance on comparisons between the uncovered nets only.

4. The results, at face value, show that the MHS net generally did not perform 'at least as well as' the conventional (128mm mesh codend) net, although the differences are small (apart from the higher catch of sub-legal and small legal-sized snapper discussed in the size selectivity section), as shown by the information below:

    a) The MHS net caught a slightly lower weight of QMS species relative to non-QMS species (ratio of 9.2:1 compared with 10.2:1). The total catch rate of QMS species in the MHS net was 445kg/km^2, which is lower than 477kg/km^2 in the conventional net.

    b) The catch rate of snapper in the trials was almost 30% greater in the MHS net compared to the conventional net, and the proportion of snapper in the catch was 53% for MHS and 39% for mesh nets. In general, the higher catch rate in the MHS net is a positive result and would mean possibly reduced fishing effort to catch a given amount of snapper and hence reduced benthic impact (discussed further below). However, lower catch rates for other important species would mean that increased effort would be needed, or that full utilisation of those lesser species might not be feasible.

    c) The next most abundant species in the catch was trevally, and overall the MHS net caught relatively fewer trevally. Trevally comprised 11% of the catch in the MHS net compared to 32% in the conventional net.

    d) The remaining QMS species generally accounted for 5% or less of the catch for both nets, with the MHS catching more leatherjackets, while the conventional net caught more John dory and red gurnard.

    e) In this trial, non-QMS species comprised 10% of the total catch in the MHS net compared with 9% for the conventional net.

Analysis of commercial fishing data

5. The total catches of QMS and non-QMS species by MHS and conventional trawl in FMA1, during the 2017-18 fishing year only, are shown below (and the catches by species and ratios of each QMS species to total catch are provided in Table 3 of Trident Report – Catch composition from PSH and BT methods for North Island FMAs, 2017-18. The conventional and MHS nets both catch considerably more QMS species than non-QMS, with the catch by MHS being slightly less, likely as a result of less fishing effort. The MHS trawl net appears to catch a higher proportion of non-QMS fish than mesh nets (10.7% compared with 8.5%).

	non-QMS (tonnes)	QMS (tonnes)
Conventional trawl	342.63	2857.44
MHS	233.90	2530.57

6. The analysis shows that, while all the target species applied for are important in each FMA, there are regional differences. In FMA1, the catch is dominated by snapper (23% of total catch by conventional trawl and 37% by MHS), followed by trevally (9% by conventional and 23% by MHS), tarakihi (13% conventional and 8% MHS), John dory (2% conventional and 3% MHS), and gurnard (2% conventional and 3% MHS). The combined catch of the main species is 49% by conventional and 74% by MHS.

7. The application document provides information from the NIWA trials in the Gulf (which had limited spatial extent - see page 22 of the application document listed in Appendix 1). At a group level - 'skates and rays' made up 5-6% of the conventional net catch and 3-4% of the MHS catch; and the catch rates of 'all elasmobranchs' (sharks, rays, skates) were slightly higher in the conventional nets at 36.5 kg/km^2 compared to 33.1 kg/km^2 in the MHS net.

8. The total catch of all species summed from the 102 pairs of trial tows is provided in Appendix 7 of the application document. Table 1 below shows the vulnerable species and quantities (from the uncovered nets) taken in the trial. A list of vulnerable species in included in Schedule 2 of the Fisheries (Innovative Trawl Technologies) Notice 2017. The vulnerable species are mostly sharks and rays.

Table 1 Vulnerable species caught during Hauraki Gulf selectivity trials (note proportions of primary target species not provided)

	Conventional net		MHS net	
Vulnerable species	catch (kg)	% of combined catch	catch (kg)	% of combined catch
electric ray	44.4	0.44	16.4	0.21
short-tailed black ray	196.1	1.96	92.3	1.18
bronze whaler shark	-		120 (estimated)	1.53
carpet shark	50.9	0.51	28.6	0.37
eagle ray	90	0.86	45.2	0.58
Total of all non-QMS elasmobranchs = 'vulnerable species'	405.8	4.02	312.8	3.99

9. The available information shows the proportions of catch (uncovered nets) are similar for vulnerable skates and rays (5.8% in the conventional net and 4.5% in the MHS), and non-QMS elasmobranchs (4% in both types of net). The identified vulnerable species catch was generally lower in the MHS net in the formal trial in the Hauraki Gulf.

10. While there is no information to suggest that the MHS net would catch more vulnerable species inshore, we do know that in the hoki fishery the MHS net caught as much as 10% more vulnerable species and the approval for use of MHS nets in deepwater fisheries included conditions requiring additional monitoring.

11. It is not clear why the MHS trawl net should catch more vulnerable species than conventional mesh net, and we consider that if the MHS trawl net is approved for commercial use inshore, the potential risk can be mitigated and better understood by monitoring the catch of vulnerable species in commercial fishing. This would be consistent with New Zealand's commitment to maintaining the biodiversity and long-term viability of sharks. We propose that if approved, the approval has a condition requiring the reporting of vulnerable species taken.

Assessment

12. Based on the available information, Fisheries New Zealand considers that it is likely that the MHS net performs at least as well as the conventional net with respect to the overall species composition of the catch.

13. The trial information shows that the MHS net catches more snapper and leatherjackets, while the conventional net catches more red gurnard and John dory. With snapper being the dominant species in the catch in FMA1, a higher catch rate could be an advantage for targeting snapper using the MHS net, but result in more effort being needed to catch the same amount of gurnard and John dory.

14. We note that the available information on species composition is uncertain and the inferences to be drawn are limited. The analysis presented does not consider the multi-species aspects which would enable full consideration of the implications of the MHS net performance given the different species and species mixes known to be a feature in the different FMAs.

Size composition – length specific selectivity

15. The data from the Hauraki Gulf trials showed that the selectivity of the mesh net was affected by the cover net and hence the covered-codend selectivity could not be used. Instead, an alternate-haul analysis using paired hauls was used to estimate selectivity for both the conventional and MHS nets.

Snapper

16. The selectivity curves for snapper caught in the conventional and MHS nets are shown in Figures 5 and 6. The L_{50} and SR for each net are shown in Table 2.

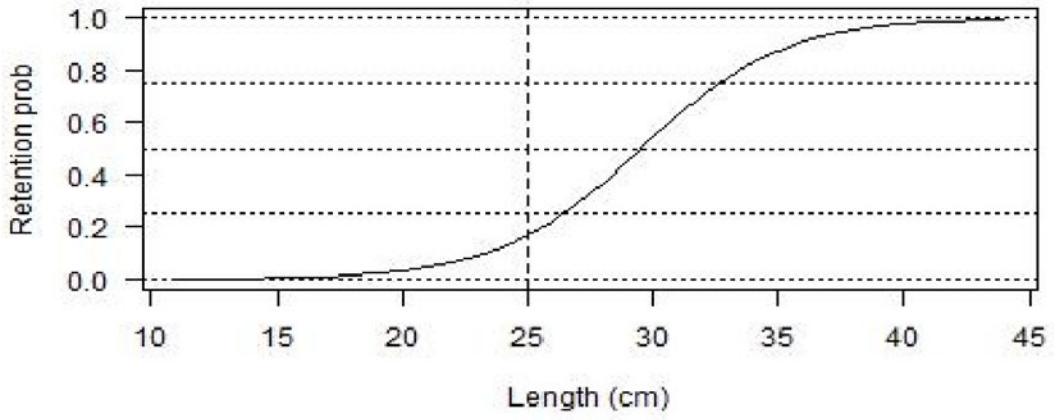

Figure 1. Estimated selection curve of the conventional trawl net configuration, with 128mm diamond mesh lengthener and codend. Dashed lines indicate lengths at 0%, 25%, 50%, 75%, and 100% retention (from Appendix 7 of the application).

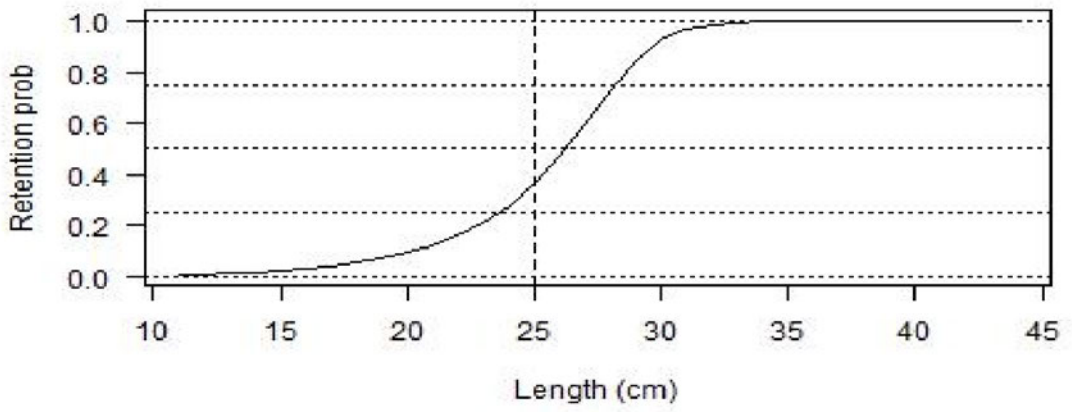

Figure 2. Estimated selection curve of the 1480mm diameter MHS trawl net (Mk6.20.136.136.136.142.30). Dashed lines indicate lengths at 0%, 25%, 50%, 75%, and 100% retention (from Appendix 7 of the application).

Table 2. Length at which 50% of the fish are retained (L_{50}) and the length range of between 25% and 75% retention (Selection Range SR).

	L_{50}	SR
Conventional net	29.5cm (95% confidence intervals 27.7-30.7cm)	6.2cm (95% confidence 3.8-6.8cm)
MHS net	26.3cm (95% confidence 25.1-28.9cm)	4.5cm (95% confidence 3.7-7.3cm)

17. The L_{50} estimates show that the MHS net selected for smaller snapper (approximately 3cm smaller).

18. The length range of snapper caught in the trial was from 10-80cm, with a peak between 24 and 26cm. The MHS net had higher catch rates of legal-sized snapper than the conventional net, particularly in the 25-30cm range. However, the MHS net caught more undersized snapper per kilogram of legal-sized snapper caught (0.655 undersized fish per kilogram (+- 0.11) compared to 0.508 (+- 0.11) for the conventional net).

19. Further comparison of the conventional and MHS nets was undertaken by analysing the commercial catch and effort data. These analyses have not yet been finalised to include many suggestions for improvement made by FNZ's Statistical Assessment Methods Working Group (SAM-WG), but that working group agreed (on 26 February 2019) that all the available information combined supports a conclusion that the MHS net catches more undersized snapper and more small legal-sized snapper than a conventional mesh trawl.

20. The catch of undersized snapper per kilogram of legal-sized catch (UCK) from commercial data in FMA 1 is lower than those in the Hauraki Gulf trials, especially if statistical areas 5 and 6 (which cover the outer parts of the Hauraki Gulf) are excluded. For tows targeting snapper outside the Gulf, the average reported UCK using MHS net was 11% lower than for the conventional net and 12% lower for tows outside statistical areas 5 and 6. Depth was found to have a strong effect on the difference in UCK between the MHS and conventional nets.

21. Recognising the lower UCK outside of statistical areas 5 and 6, the application excluded those areas.

Other target species - Tarakihi, trevally, red gurnard, John dory

22. The formal Gulf trials also examined size selectivity for tarakihi, trevally, red gurnard, and John dory. However, because of low and/or patchy catch rates together with limited numbers of smaller fish of some species, it was possible only to determine feasible selectivity curves for trevally in the conventional net (see Figure 7 below) and red gurnard in the MHS net (see Figure 8). These are not very helpful results because they do not provide any comparisons between MHS and conventional mesh net.

Tarakihi

23. For tarakihi, the observed mean lengths from FNZ Observers and some preliminary modelling reviewed by Statistical and Assessment Methods science working group (SAM-WG) suggest that the MHS net generally catches slightly larger fish compared to the conventional net. This was agreed by SAM-WG for FMA1 and, with less certainty, for FMA2.

Trevally

24. Insufficient data are available to make comparisons.

Size composition – proportion at size less than that deemed important for fisheries management

25. Schedule 3 of the Notice provides a list of species and sizes deemed important for fisheries management purposes. Snapper (minimum legal size of 25cm for commercial catch and approximate length at 50% maturity), tarakihi (MLS of 25cm and L50 of 30cm), trevally (MLS of 25cm and L50 of 35cm), and red gurnard (L50 of 25cm) are included in the list.

Snapper

26. Catching too many small fish from a stock can adversely affect the productivity of that stock. Current management measures that are in place to mitigate the capture of undersize or small snapper include:

    a) A ban on use of trawl gear in the inner Hauraki Gulf (statistical area 7);

    b) A requirement to report the volume of undersize snapper that are returned to the sea (to enable this source of mortality to be taken into account when adjusting the commercial catch limit for SNA1); and

    c) The adoption of a voluntary "move on" rule that encourages vessel operators to shift to a different fishing location when they encounter elevated catches of small snapper.

27. Reporting of undersize snapper returned to the sea commenced in 2014, together with the adoption of the "move on" rule. Over the subsequent four fishing years, these measures have maintained the estimated catch of undersize snapper between 108 and 124 tonnes which represents a relatively small proportion of the total volume of commercial catch extracted from this stock (the TACC of 4500 tonnes is fully caught most years).

28. While existing management measures designed to avoid capture of small snapper would also apply to any MHS trawls deployed in SNA1 fishery, it should be noted that the volume of small snapper (< 25cm in length) that are caught and retained by the MHS is relatively higher than for conventional trawl nets. On the basis of the Hauraki Gulf trials undertaken by NIWA, snapper of exactly 25 cm were estimated to have a retention probability of less than 2 percent in the conventional net and almost 4 percent in the MHS trawl net.

29. Modelling of commercial catch data from FMA1 by Russell Millar (a gear selectivity expert at the University of Auckland) and Trident Systems Ltd., both led to similar conclusions, i.e.: that The MHS trawl net catches a higher proportion of undersized snapper (about 30 percent more) than mesh net if fished in the same place at the same time. The SAM-WG agreed that the available information supports such a conclusion.

30. However, in the context of applying the overarching regulatory test of whether the MHS trawl net performs "at least as well as" conventional nets, there is uncertainty about whether higher retention

of small snapper by the MHS trawl net actually reflects a higher level of fishing related mortality than that caused by conventional trawl nets. This is because, escapement of small snapper from conventional trawls will be associated with an (unknown) level of "cryptic" mortality due to some of these fish being injured as they pass through the mesh in the cod end of the net.

31. The inability to quantify the level of cryptic mortality that is caused by conventional trawl nets means that the total mortality of small snapper that each net type causes cannot be directly compared. An additional factor is that small snapper caught in waters deeper than 30m are more likely to be affected by barotrauma when they are landed. These fish are less likely to survive (survivability is discussed in Appendix 5 below). As mentioned above, the best available information suggests the MHS trawl net is likely to capture and retain higher quantities of small snapper. However, there is insufficient information to assume that the higher retention of small snapper by the MHS trawl net actually reflects a higher level of mortality than that caused by conventional nets. For this reason, we suggest aligning the conditions placed on the use of MHS trawl net in the SNA1 fishery with the general approach applied to limiting conventional trawl impacts on small snapper.

32. As noted above, the current suite of measures in place to manage the mortality of small snapper within the SNA1 fishery include a mix of:

    a) Area closures from which trawling is excluded;

    b) Quantifying the total catch of small snapper and accounting for this by setting an allowance within the catch limit; and,

    c) Encouraging fishers to avoid concentrations of small snapper by applying a voluntary "move on" rule.

33. Following discussion of potential conditions with the PSH industry partners, we propose to build on this existing platform to deliver a package of conditions that take into account uncertainties and risk whilst allowing for sustainable utilisation.

Area closures

34. These involve a mix of measures to exclude trawling from inshore waters where small snapper tend to be more abundant, with the inshore limit for trawling being defined either by the 50m depth contour or a fixed 4 nautical mile distance offshore:

Fisheries statistical areas: 002, 003, 004	No restriction on MHS use other than existing regulations that already apply
Fisheries statistical area 005	MHS allowed deeper than 50m north of Little Barrier Island, and not south of Little Barrier
Fisheries statistical areas 006 & 007[7]	No MHS fishing allowed
Fisheries statistical area 008	MHS fishing allowed deeper than 50m
Fisheries statistical areas 009 & 010	MHS fishing allowed outside 4nm from the coastline

Quantifying the catch of small snapper

35. Existing requirements to report the volume of small snapper (below the minimum legal size) which are returned to the sea will be maintained and reinforced through the conditions placed on the use of the MHS trawl net.

36. Being able to accurately estimate the volume of small snapper that are returned to the sea is critical to enabling this source of fishing mortality to be managed through compensatory adjustment of total allowable commercial catch (TACC) for the SNA1 stock. For this reason, users of MHS trawl

[7] All trawling, including using a MHS trawl net, is prohibited in Fisheries statistical area 007, and part of area 006.

net will be required to accurately monitor and report the volumes of small snapper that they return to sea following each net haul.

37. Reporting on the location of net hauls in which small snapper (< 25cm in length) are caught will also enable active monitoring of the interaction between users of the MHS trawl net and small snapper. Over time this will provide the opportunity to map the distribution of such catches and adjust the boundaries of area closures if required.

Avoidance of small snapper by vessel operators

38. The existing voluntary code of practice encouraging vessel operators to move to a new location when they encounter elevated levels of small snapper in their gear had been implemented via a collective agreement between commercial fishing interests that was negotiated in 2013. This agreement has widespread support across participants in the SNA1 fishery and for this reason, we do not consider it is necessary to include the "move on" rule within the conditions applied to the MHS approval.

Status of the SNA1 stock

39. The last scientific assessment of the status of the SNA1 stock was conducted in 2013 and estimated that at this time the biomass of snapper within the Bay of Plenty stood at 19 percent of its historic unfished biomass (B_0), while the biomass for East Northland stood at 24 percent of B_0.

40. In addition to supporting a valuable commercial fishery, the SNA1 stock is also important to recreational fishers and has great cultural significance to Māori. The stock is subject to a management plan that aims to restore it to 40% B_0 within the next 23 years.

41. The significance of the shared interest in the fishery, can be gauged by the level of recreational fishing effort that the stock receives. In 2011/12, the inner Hauraki Gulf received 30 percent of all recreational fishing effort nationwide[8] and the level of recreational pressure is increasing as the Auckland metropolitan population grows.[9]

42. In response, Fisheries New Zealand has had to reduce recreational bag limits and closely control the commercial catch to ensure that fishing pressure is maintained at levels that will allow the stock to rebuild.[10]

43. In the context of the significant interest in the SNA1 fishery across all fishing sectors and the gradual pace of the current rebuilding effort, it is critical that the effects that introducing MHS trawl net to the SNA1 fishery will have on the viability of the rebuild are fully considered and managed.

44. Fisheries New Zealand's assessment of the science analysis is that, from a fisheries management perspective, the proposed conditions for approval of MHS trawl nets for use in the SNA1 fishery will not adversely affect the rebuild of the stock, and that any sustainability issues presented by the introduction of the MHS trawl net can be readily managed.

Conclusion

45. Our assessment of the available information suggests that the use of the MHS trawl net will not adversely affect the productivity or the rebuilding of the snapper stock in SNA1, due to existing fisheries management measures, and provided that the proposed approval conditions are applied.

[8] Hartill, B., (2014) Recreational Fisheries in the Hauraki Gulf, presentation to the Sea Change – Tai Timu Tai Pari Working Group meeting 26 August 2014.

[9] Ministry for Primary Industries (2013) Review of sustainability and other management controls for snapper 1 (SNA1). MPI Discussion Paper No: 2013/31 - ISBN No: 978-0-478-41482-0 (online).

[10] Ministry for Primary Industries (2014) Recreational bag limits and minimum legal size in the Auckland (East) snapper (SNA1) fishery. Regulatory Impact Statement - ISBN No: 978-0-478-42369-3 (online).

Tarakihi, trevally, red gurnard, John dory

46. From the Hauraki Gulf trials, although there were limited numbers of smaller fish for some species, the peak in length for tarakihi, trevally, red gurnard, and John dory was above 30cm, which is above the length range deemed important for fisheries management.

47. We consider the selectivity characteristics of the MHS trawl net are probably acceptable for the fishery targeting tarakihi, trevally, John dory and gurnard in FMA1.

Impact on protected species

48. The application provides analyses of the reported interactions between commercial fishing gear for seabirds, cetaceans (whales and dolphins), and pinnipeds (seals and sealions).

49. No protected species were caught by either net during the Hauraki Gulf trials.

50. A comparison of seabird captures using data reported by commercial fishers (on the Non-Fish Protected Species Catch Returns - NFPSCR) over the 2016, 2017, and 2018 (incomplete - October – January) fishing years found no difference in capture rates between the conventional net used in bottom trawling and MHS nets (both were 0.005 captures/tonne). The data used included fishing in all the FMAs applied for, although the majority of the data are from FMA1. There were 163 seabird captures by 44 926 conventional net tows and 91 captures by 6 371 MHS tows. Data from observed trips showed 21 captures from 828 conventional tows and 20 from 2198 MHS tows. Approximately three times as many MHS tows were observed than conventional tows.

51. Commercial fishers reported on NFPSCR forms that conventional nets caught 20 cetaceans (whales and dolphins) in 44 926 tows (one dolphin for every 2246 tows) compared with six caught in 6371 MHS tows (one dolphin for every 1062 tows). Reports from observed trips showed two captures by conventional nets and five by the MHS. The application notes that, since December 2016, no dolphin captures have been reported from MHS tows with 100% observer coverage in place and an increased number of trawl tows using the MHS nets.

52. Capture rates for other protected fish and reptiles were negligible for both net types and capture rates were effectively zero.

53. The forward part of the MHS trawl net (that is, in front of the cone, retention module, and lift bag) is the same as conventional nets. Therefore, Fisheries New Zealand considers there is no obvious reason to expect a difference in the warp interactions between seabirds and the MHS trawl net compared with a conventional trawl net, unless fishing effort is greater and there is more exposure to warp strike.

54. The low rates of capture of marine mammals makes comparison difficult and means that the observed differences should not be taken as definitive. Further, captures of several protected species are aggregated into three broad groups in the summaries above (cetaceans, pinnipeds, and seabirds) and species vary substantially in their distribution and vulnerability to fishing gear. It is not known if the spatial and temporal distribution of the tows are sufficiently similar for a meaningful comparison and statistical models are typically used to examine and, ideally, correct for such problems. No such models have yet been completed although preliminary models have been discussed by SAM-WG. Therefore, there remains substantial uncertainty regarding the impact of the commercial use of the MHS trawl net on protected species. We consider this uncertainty can be managed through terms and conditions of MHS trawl net use, if approved.

Protected species – Mitigation

55. The application provides a list of mitigation procedures and processes which are all part of the Snapper 1 Commercial Agreement. However, none of these measures are directed at mitigating adverse effects on protected species or would apply to users of MHS nets who are not party to the Snapper 1 Commercial Agreement.

Assessment

56. Fisheries New Zealand considers that, although fishers' reported interaction rates with cetaceans are higher in MHS nets than in conventional nets and this may suggest some caution where interactions with endangered species are possible, this is not a reliable guide. Overall, the available evidence does not suggest that a greater impact on protected species by MHS nets is likely and that there is no clear reason to expect worse performance of the MHS trawl net than conventional nets in FMA1.

57. However, the conclusions are uncertain and ongoing monitoring and analysis is strongly recommended to better understand impacts on protected species. This will enable us to identify and treat risks should they emerge.

58. Fisheries New Zealand notes that existing mitigation measures aimed at mitigating impacts of trawling on protected species will apply to MHS use.

Impact on benthic species – Area of seafloor affected

59. Catch rates and swept areas are important to consider as these metrics indicate the likely differences in fishing effort required to catch a given amount of fish and the associated relative benthic impact. The swept area is the area of seabed disturbed to catch a given amount of fish, and this is inversely related to the catch rate of fish. Higher catch rates for snapper, for example, are likely to have positive benefits for the impact on benthic animals and seabed habitat by lowering the area disturbed by trawling to catch the same volume of fish. However, lower catch rates for other species could mean that increased effort and impact would result from trying to catch the same amount of those species

60. The Hauraki Gulf trial results indicate that the area swept by the nets per tonne of all QMS catch differed slightly, with the MHS net having a slightly greater swept area averaging 2.25km2 compared to 2.14km2 for the conventional net.

61. The total catch rate of QMS species was higher in the conventional net at 477 kg/km2 compared to 445 kg/km2 in the MHS ne. A higher catch rate per unit area swept is likely to be associated with reduced impact.

62. Data available from commercial fishing in FMA 1 with conventional and MHS nets were analysed to determine catch rates per nautical mile for each species to evaluate relative benthic impacts. These analyses were not accepted by the Working Group at the time of drafting this advice.

Impact on benthic species – Weight caught

63. The trials in the Hauraki Gulf revealed that the conventional net caught less benthic invertebrates than did the MHS net (2-3% by weight compared to 5-6% respectively), and that catch rates in the conventional net were slightly lower than in the MHS net (1.6 kg/km2 compared to 2.8 kg/km2 respectively).

64. Analysis of commercial data suggests the capture rates of benthic organisms (including corals, sponges, and other benthos) were slightly lower using conventional nets compared to MHS nets (0.019 items per tonne compared to 0.062 items per tonne respectively). The higher MHS capture rates mainly resulted from one vessel reporting greater capture of sponges.

65. Fisheries New Zealand considers that the disturbance of benthic material by the conventional and MHS nets would be unlikely to differ markedly because the construction of the nets is no different with respect to the components (including trawl doors and footropes) which are in contact with the sea floor. The application notes, and we concur, that because the terminal end of the MHS net differs by having a s 9(2)(b)(ii) the retention in the MHS net of non-swimming species such as corals and sponges is expected to be higher than the conventional net where such species can fall through the meshes. Thus, we do not consider that the higher catch rate of benthic invertebrates in MHS trawl net is meaningful or indicative of greater impact on benthic species or habitats.

66. Fisheries New Zealand considers that the differences in swept areas, catch rates, and amounts of benthic species retained are relatively minor and in part explained by the higher retention of items in the MHS codend, which does not allow for species to fall through as does a mesh codend. We therefore consider, based on the available information and considering the associated uncertainties arising from the limited spatial extent of the trials, it is likely that the MHS net performs at least was well as the conventional net in terms of benthic impacts.

Assessment of risks identified and proposed mitigation measures associated with use of the MHS trawl

67. The approval conditions we propose to address risks are stated in the table below in bold. Your consideration of these controls is provided for in the section of this document where you note your decisions. The controls that you agree to adopt will be included within the final approval document. The other monitoring and associated measures noted in the tables below are the responsibility of either fishers or Fisheries New Zealand to undertake. Existing mitigation and reporting requirements are mandatory.

Table 3. Risks and mitigation for FMA1

FMA1		
Risks identified if MHS used	**Proposed measures to address risks**	**Other comments**
Species and size composition		
1. Impact on productivity through higher catch rate of smaller fish in shallower areas, especially snapper.	1. **Condition Approval to exclude fishing in known areas of high juvenile snapper abundance in FMA1: including 50m depth restrictions in that part of area 005 north of Little Barrier and area 008; exclude use in area 006 and 007; and offshore of 4nm in areas 009 and 010.** 2. Ongoing monitoring of juvenile (sub-legal) catch of snapper (SNX), terakihi (TAX), trevally, with programme for Observer sampling and measuring fish lengths 3. Apply controls in future as needed to address risks which may emerge.	Note PSH applied to exclude stat areas 5/6 to avoid high catch rates of small snapper and also commented about using MHS in deeper waters to avoid juveniles while still catching quality fish. Following further discussions, PSH amended the proposal for depth and area restrictions to mitigate the small snapper issue as in Condition 1. Fisheries New Zealand's assessment is that these measures will adequately address the risk to SNA1. Risks include compromising productivity and rebuild of SNA1 stock.
Protected species		
1.Lower CPUE would mean more fishing effort for given amount of catch, which could result in more protected species interactions	1. Protected species interactions must be reported under current regulations 2. Monitor reported interactions to detect differences/trends/changes 3. Existing mitigation measures applying to trawl must be used 4. Operation of on-board cameras would provide for observation/monitoring and verification of statutory reports	Seabirds - Substantial risk for some species at risk such as Black Petrel and Flesh-footed Shearwater in FMA1 (highest and third most at-risk seabirds). These are diving birds and mortalities can result from being caught in the net rather than warp strikes. Inshore trawl is the third highest risk fishery for black petrel and the highest risk fishery for flesh-footed shearwater. Evidence, especially observer records, suggests that MHS trawl net may result in fewer seabird mortalities per fishing event

	5. Apply appropriate controls if necessary in future to mitigate emerging risks	because the birds are less attracted to the MHS terminal net than conventional nets. Cetaceans - Some evidence that the MHS trawl net catches more cetaceans (common / bottlenosed dolphin), but that evidence based on sparse fisher-reported data. Observer data are very sparse, but show similar rates Pinnipeds - No obvious reason to think risk would be worse than conventional nets, but data are very sparse. Unlike for birds, warp strike is not a factor.
2.Vulnerable species catch could impact sustainability of species	1. **Condition approval to require additional reporting of vulnerable species catch until ER/GPR adopted** 2. Ongoing monitoring 3. Apply appropriate controls if necessary in future to address emerging risks	Available information is limited, but suggests low likelihood of impact. Kaharoa trials suggested MHS may have lower catch rates of carpet shark and other non-QMS "sharks" in Hauraki Gulf, but differences are slight. However, deepwater use of MHS resulted in unexplained greater catch of vulnerable sharks so monitoring proposed to better understand risk. Current reporting requirements do not provide for full reporting of vulnerable species, but this changes on adoption of ER/GPR.
Benthic impacts		
1.Lower CPUE would mean more fishing to catch given amount and hence more benthic impacts	1. Ongoing monitoring of catch and fishing effort by location to determine trends and changes. 2. ER/GPR adoption will provide improved and more timely data. 3. Apply future controls as needed.	Kaharoa trials suggested MHS had higher CPUE for snapper but lower for other key targets. Preliminary models of statutory data showed different patterns. Unlikely to be different impact per km towed since most of the gear in contact with the benthic environment is the same. Should trawling intensify, or occur in new areas, concerns would arise.

FMA2 – ASSESSMENT

68. The best available information specific to FMA2 is the analysis of species composition determined from the catch and effort reports of commercial fishers during the 2017-18 fishing year.

69. The inshore trawl catch in FMA2 is dominated by tarakihi with relatively little snapper and trevally. The total catches of QMS and non-QMS species by MHS and conventional trawl in FMA2 are shown below (and the catches by species and ratios of each QMS species to total catch are provided in Table 4 of Appendix 5). The conventional and MHS nets both catch considerably more QMS species than non-QMS, with the overall catch by MHS being substantially less, most likely as a result of substantially less fishing effort by MHS. The MHS trawl net appears to catch a slightly higher proportion of non-QMS fish than mesh nets (6.8% compared with 5.8%).

	non-QMS (tonnes)	QMS (tonnes)
Conventional trawl	379.05	6133.38
MHS	43.98	602.76

70. The analysis shows that, while all the target species applied for are important in each FMA, there are regional differences. In FMA2, the catch is dominated by tarakihi (24% of total catch by conventional trawl and 36% by MHS), with trevally 4% by conventional and 4% by MHS, gurnard 8% conventional and 3% MHS, John dory 1% conventional and <1% MHS, and snapper 5%

conventional and 8% MHS. The combined catch of the main species as a percentage of the total by each method is 42% by conventional and 51% by MHS.

71. Fisheries New Zealand considers that the available information, although uncertain and not statistically robust, does not suggest a marked difference between the MHS trawl net and conventional nets. Our assessment, based on the available information, is that the MHS trawl net is likely to perform at least as well as conventional nets in FMA2.

72. Expert opinion has been applied to develop the following identification of risks and proposed measures to mitigate risks. Fisheries New Zealand considers that, based on the available information for FMA2, and assuming that the proposed approval conditions are applied and adhered to, it is likely that the MHS will perform at least as well as the conventional nets in FMA2.

FMA2 – Assessment of risks identified and proposed mitigation measures associated with use of the MHS trawl

Table 4. Risks and mitigation for FMA2

FMA2		
Risks identified if MHS used	**Possible measures to address risks**	**Other comments**
Species and size composition		
1. Impact on productivity through higher catch rate of smaller fish in shallower areas, especially snapper.	1. Ongoing monitoring of juvenile tarakihi catch (TAX), with programme for Observer sampling 2. Ongoing monitoring of catch composition 3. Apply controls as needed.	Note TAR2 is one of the stocks under stress and being rebuilt. Reporting of undersized TAR catch (TAX code) is mandatory Available evidence suggests that MHS tends to catch slightly larger TAR than conventional gear, so risk is reduced. Some evidence that SNX in FMA2 are most common in areas where trawling cannot easily be conducted (e.g., Wairoa Hard) so risk for snapper may be lower than in FMA1
Protected species		
1. Lower CPUE would mean more fishing for given amount of catch, which could result in more protected species interactions.	1. Protected species interactions must be reported under current regulations. 2. Monitor reported interactions to detect trends/changes. 3. Operation of on-board cameras would provide for observation/monitoring and verification of statutory reports 4. Apply appropriate controls if necessary.	Seabirds - Risks include catch of Salvin's albatross (second most at-risk seabird species) in southern area of FMA2. Albatross mortalities are associated with warp strikes and inshore trawl is the highest risk fishery for Salvin's albatross. Evidence suggests that The MHS trawl net may result in fewer seabird mortalities because the birds are less attracted to the MHS terminal net than conventional and less likely to entangle their feet. However, more fishing time means more interactions with warps are likely (particularly relevant for albatrosses). Cetaceans - Some evidence that the MHS trawl net catches more cetaceans, but that evidence based on sparse fisher-reported data, mostly from FMA1 Pinnipeds - No obvious reason to think risk would be worse than conventional

		nets. Unlike for birds, warp strike not a factor.
2.Vulnerable species catch could impact sustainability of species	1. **Condition approval to require additional reporting until ER/GPR adopted** 2. Ongoing monitoring. 3. Apply controls as needed.	Available information is limited, but suggests low likelihood of impact of MHS being worse than conventional nets. Current reporting requirements do not provide for full reporting of vulnerable species, but this changes with adoption of ER/GPR.
Benthic impacts		
1.Lower CPUE could mean more fishing to catch given amount and hence more benthic impacts	1. Ongoing monitoring of catch and fishing effort by location to determine trends and changes 2. ER/GPR adoption will provide improved data. 3. Apply controls as needed.	Unlikely to be different impact per km trawled since most of the gear in contact with the benthic environment is the same. Preliminary models suggest catch rates for some target species lower using The MHS trawl net. Should trawling intensify, or occur in new areas, concerns would arise.

FMA8 – ASSESSMENT

73. The best available information specific to FMA8 is the analysis of species composition determined from the catch and effort reports of commercial fishers during 2017-18.

74. The inshore trawl catch in FMA8 has generally similar catches of trevally, tarakihi, snapper and less gurnard and John dory. The total catches of QMS and non-QMS species by MHS and conventional trawl in FMA8 are shown below (and the catches by species and ratios of each QMS species to total catch are provided in Table 5 of Appendix 5). The conventional and MHS nets both catch considerably more QMS species than non-QMS, with the overall catch by MHS being substantially less, most likely as a result of substantially less fishing effort by MHS. The MHS trawl net appears to catch a slightly higher proportion of non-QMS fish than mesh nets (10.7% compared with 9.8%).

	non-QMS (tonnes)	**QMS (tonnes)**
Conventional trawl	138.62	1280.66
MHS	5.58	46.40

75. The analysis shows that, while all the target species applied for are important in each FMA, there are regional differences. In FMA8, the catch is more evenly spread across the three main species, with tarakihi 11% by conventional and 20% MHS, trevally 14% by conventional and 19% by MHS, gurnard 13% conventional and 1% MHS, John dory 4% conventional and 2% MHS, and snapper 14% conventional and 1% MHS. The combined catch of the main species as a percentage of the total by each method is 56% by conventional and 43% by MHS.

76. Expert opinion has been applied to develop the following identification of risks and proposed measures to mitigate risks. Fisheries New Zealand considers that, based on the available information for FMA8, and assuming that the proposed approval conditions are applied and adhered to, it is likely that the MHS will perform at least as well as the conventional nets in FMA8.

FMA8 – Assessment of risks identified and proposed mitigation measures associated with use of the MHS trawl

Table 5. Risks and mitigation for FMA8

FMA8		
Risks identified if MHS used	**Possible measures to address risks**	**Other comments**
Species and size composition		
1. Impact on productivity through higher catch rate of smaller fish in shallower areas, especially snapper.	1. Ongoing monitoring of juvenile catch required, with programme for Observer sampling. 2. Ongoing monitoring of catch composition. 3. Apply controls as needed.	FMA8 associated with generally larger snapper and many fewer juveniles than further north.
Protected species		
1.Lower CPUE could mean more fishing for given amount of catch, which could result in more protected species interactions	1. Protected species interactions must be reported under current regulations. 2. Monitor reported interactions to detect trends/changes. 3. Operation of on-board cameras would provide for observation/monitoring. 4. **Condition to exclude use of MHS from that part of the Maui dolphin range from Maunganui Bluff to Pariokariwa Point and out to 12nm offshore.** 5. Apply appropriate controls if necessary.	Seabirds - risks include catch of Salvin's albatross in southern area of FMA8. Albatross mortalities from warp strikes. Salvin's is the second most at-risk seabird species and inshore trawl is the highest risk fishery for this species. Evidence suggests that The MHS trawl net results in fewer seabird mortalities because the birds are less attracted to the MHS terminal net than conventional. However, more effort means higher chance of warp interactions particularly relevant to albatrosses. Cetaceans (specific concern re critically endangered Māui dolphins) - some evidence that the MHS trawl net catches more cetaceans, but that evidence based on sparse data. Range of Māui dolphins extends into FMA8 and status of Māui means risk to be avoided. Pinnipeds - No obvious reason to think risk would be worse than conventional gear, but data are very sparse. Unlike for birds, warp strike not a factor.
2.Vulnerable species catch could impact sustainability of species	1. **Condition approval to require additional reporting until ER/GPR adopted.** 2. Ongoing monitoring. 3. Apply controls as needed.	Available information is limited, but suggests low likelihood of impact of the MHS trawl net being worse than conventional nets. Current reporting requirements do not provide for full reporting of vulnerable species, but this changes with adoption of ER/GPR.

Benthic impacts		
1.Lower CPUE could mean more fishing to catch given amount and hence more benthic impacts	1. Ongoing monitoring of catch and fishing effort by location to determine trends and changes. 2. ER/GPR adoption will provide improved data. 3. Apply controls as needed.	Unlikely to be different impact per km trawled since most of the gear in contact with the benthic environment is the same. Preliminary models suggest catch rates for some target species lower using the MHS trawl net. Should trawling intensify, or occur in new areas, concerns would arise.

FMA 9 – ASSESSMENT

77. The best available information specific to FMA9 is the analysis of species composition determined from the catch and effort reports of commercial fishers during 2017-18.

78. The inshore trawl catch in FMA9 has generally similar catches of trevally, snapper, and tarakihi, with less gurnard and John dory. The total catches of QMS and non-QMS species by MHS and conventional trawl in FMA9 are shown below (and the catches by species and ratios of each QMS species to total catch are provided in Table 6 of Appendix 5). The conventional and MHS nets both catch considerably more QMS species than non-QMS, with the overall catch by MHS being substantially less, most likely as a result of substantially less fishing effort by MHS. tappears to catch a substantially higher proportion of non-QMS fish than mesh nets (12.4% compared with 6.1%).

	non-QMS (tonnes)	QMS (tonnes)
Conventional trawl	248.84	3852.60
MHS	123.37	872.69

79. The analysis shows that, while all the target species applied for are important in each FMA, there are regional differences. In FMA9, the catch is more evenly spread across the three main species, with snapper 18% conventional and 19% MHS, tarakihi 7% by conventional and 14% MHS, trevally 22% by conventional and 16% by MHS, gurnard 8% conventional and 9% MHS, John dory 2% conventional and 3% MHS. The combined catch of the main species as a percentage of the total by each method is 57% by conventional and 51% by MHS.

80. Expert opinion has been applied to develop the following identification of risks and proposed measures to mitigate risks. Fisheries New Zealand considers that, based on the available information for FMA9, and assuming that the proposed approval conditions are applied and adhered to, it is likely that the MHS will perform at least as well as the conventional nets in FMA9.

FMA9 – Assessment of risks identified and proposed mitigation measures associated with use of the MHS trawl

Table 6. Risks and mitigation for FMA9

FMA9		
Risks identified if MHS used	**Possible measures to address risks**	**Other comments**
Species and size composition		
1. Impact on productivity through higher catch rate of smaller fish in shallower areas,	1. Ongoing monitoring of juvenile catch (SNX) required together with size frequencies of other main species, with programme for Observer sampling.	Capture of more small snapper could impact rebuild of SNA8 stock. Risk reduced by distribution of many small/juvenile snapper and trevally (TRE7 stock likely at/above target) in harbours/estuaries out of reach of trawl.

especially snapper.	2. Ongoing monitoring of catch composition. 3. Apply controls as needed.	Existing controls on trawling keep effort some distance offshore.
Protected species		
1.Lower CPUE means more fishing for given amount of catch, which could result in more protected species interactions	1. Protected species interactions must be reported under current regulations. 2. Monitor reported interactions to detect trends/changes. 3. Operation of on-board cameras would provide for observation/monitoring **4. Condition to exclude use of MHS from that part of the Maui dolphin range from Maunganui Bluff to Pariokariwa Point and out to 12nm offshore.** 5. Apply appropriate controls if necessary.	Seabirds - Evidence suggests that the MHS trawl net may result in fewer seabird mortalities because the birds are less attracted to the MHS terminal net than conventional and less likely birds are snagged. Cetaceans (specific concern re Māui) - Risk of capturing Māui dolphin has HIGH or VERY HIGH severity. Some evidence that the MHS trawl net catches more cetaceans, but that evidence based on sparse data for other dolphin species (common/bottlenosed dolphins). Uncertainty re performance of the MHS trawl net suggests risk to be avoided. Risk mitigated by existing and proposed measures to exclude trawl from dolphin areas. Pinnipeds - No obvious reason to think risk would be worse than conventional gear, but data very sparse. Unlike for birds, warp strike not a factor.
2.Vulnerable species catch could impact sustainability of species	**1. Condition approval to require additional reporting until ER/GPR adopted** 2. Ongoing monitoring 3. Apply controls as needed.	Available information is limited, but suggests low likelihood of impact of MHS being worse than conventional gear. Current reporting requirements do not provide for full reporting of vulnerable species but changes with adoption of ER/GPR
Benthic impacts		
1.Lower CPUE could mean more fishing to catch given amount and hence more benthic impacts	1. Ongoing monitoring of catch and fishing effort by location to determine trends and changes 2. ER/GPR adoption will provide improved data 3. Apply controls as needed.	Unlikely to be different impact per km trawled since most of the gear in contact with the benthic environment is the same Preliminary models suggest catch rates for some target species lower using the MHS trawl net.

APPENDIX 5: ASSESSMENT OF OTHER MATTERS THAT EFFECT SUSTAINABILITY

Escapement mortality

1. The application proposes that the mortality of fish that escape the nets through the meshes of conventional nets will be greater than that for the MHS nets. The application provides video footage of hoki and results from the scientific literature regarding abrasion and scale loss from fish affected by turbulence in and escaping from mesh nets as supporting rationale. Reducing the associated incidental mortality would be beneficial to the fish stocks concerned.

2. Fisheries New Zealand notes that the video files provided are useful to illustrate how the MHS trawl net is designed to work and show the contrasts between the MHS and conventional nets. However, the videos were selected by the applicants and not analysed in any scientific way. We conclude that they cannot be used to infer survival rates of fish of any species in any particular circumstances as is implied by the application.

3. Similarly, although the scientific references are relevant to the matter of fish release mortality, they do not provide a strong justification for any of the assumptions in the modelling of release mortality (discussed further below).

4. Although the available information is inadequate to determine and compare survival rates between the nets, we consider it is likely, given the way the MHS trawl net is designed to work, that survival rates of fish escaping the MHS trawl nets would be at least as good as from conventional nets.

Survivability after capture and release

5. The application proposes that the MHS trawl net has the potential to significantly improve the survival of sub-legal sized snapper and other unintended catch that might be released after capture. The application refers to the research done by PFR on the short-term survival of sub-legal snapper taken by the MHS trawl nets.

6. The application refers to modelled scenarios taking into account the discard survival rates and escape mortality which suggest that the MHS nets would perform significantly better than conventional nets and have the potential to almost halve the total incidental mortality of sub-legal snapper.

7. While assessing the relative impacts of escape and post-capture release survival rates of snapper on stock productivity is important to evaluate the performance of the nets, we note that neither of these survival rates has been reliably estimated, based on the following reasons:

    a) Unrealistically high survival of fish caught deeper than 90m and reports from observers that the fish transferred to the holding tanks (used to assess survival) were not randomly selected (ie fish in better condition were selected, favourably biasing the findings).

    b) The report from the Gulf trials notes that fish taken at depth can suffer from pressure-related injuries (‘barotrauma’) when brought to the surface, and these injuries can impact survival. In the trials, examination of more than 900 sub-legal snapper showed a high percentage of barotrauma signs (80% floated indicating ruptured swim bladders, and 11% showed the hind gut had been forced out of the gut cavity).

    c) Fishing during the experiment was unlikely reflective of general commercial fishing operations when the focus is likely on maintaining the quality of fish to be retained rather than those to be released (fish handling prior to release is a critical factor determining survival)

    d) Only snapper were considered, but several other species are caught.

Marine mammal interactions

8. The application notes that another potential benefit of the MHS nets would be to release unharmed fish as a consequence of opening the net at depth to allow the escape of a captured marine mammal.

The application notes that the ongoing development of underwater cameras as part of the MHS development will greatly assist.

9. While further innovations are encouraged, we note again that the release of quota species fish already captured within commercial fishing gear is prohibited under the Fisheries Act 1996. Realising the potential benefit discussed above would require a change to the Act.

10. The application also notes the potential for longer, all-night, tows using MHS nets while retaining fish quality. While this might have advantages, we note that it follows that marine mammals and seabirds (depending on the depth the gear is held at) could be exposed to entanglement in the MHS trawl nets for a longer period of time than if the gear was hauled without interruption. The magnitude of any increased risk (if any) is not known, because the trials did not include any extended tow times. We will continue to monitor the accidental capture of marine mammals and seabirds, and if warranted, will consider introducing a new condition that operators may not undertake extended tow times.

APPENDIX 6: MAP OF THE WEST COAST MARINE MAMMAL SANCTUARY