



COMMERCIAL FISHERIES
RESEARCH FOUNDATION

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“Design and test of an innovative large mesh whiting trawl to reduce spiny dogfish bycatch in the Southern New England whiting fishery.”

Lead PI: Pingguo He— University of Massachusetts, Dartmouth

1. How closely did the research team follow the original planned scope of work?

He and collaborators closely followed their research plan and completed the four project objectives. The net was designed and constructed by Dantrawl, sea trials were conducted consisting of a “shake-down” cruise and then paired gear trials between the experimental and standard commercial net were conducted, and outreach and technology transfer was initiated after the results of the sea trials and analyses were known.

2. If there were differences between scheduled and completed tasks, did the project team address these and explain why there were differences?

In the Final Report, He and team stated up front that it took longer to tune the new to trawl and make adjustments and modifications. Overall, they accomplished their major tasks on time. As stated in the timeline of the original proposal, they delivered the report in November 2012.

3. In the results, analysis, and discussion sections of the report, did the team answer their original research question(s)?

Yes, they did. They wanted to show that an innovative net design could reduce the catch rates of dogfishes. The net did indeed do this and they showed graphically and statistically that this occurred. They did admit, however, that the observed differences were due to only six of 37 catches of dogfish which were large catches. The null hypothesis was directly tested and rejected for dogfish, unwanted bycatch, and desirable bycatch consisting of butterfish, and Atlantic mackerel. They could not show that catch rates increased for targeted whiting and red hake. They did not directly set this as an objective, but did present an alternate hypothesis stating that the new net design would increase the catch rates of hake and whiting. This alternate hypothesis which was not substantiated and the null hypothesis was not rejected for these two target species. They did fully discuss these findings in the results, analysis, and discussion.

4. Were analytical techniques appropriately used? Was the experimental methodology statistically sound and supportive of the conclusions drawn?

To analyze the catch rate results of the paired tows, the authors chose to use a non-parametric paired

randomization test. In the proposal, they stated that a number of analytical procedures might be used including ANOVA, paired t-tests, or the non-parametric randomization test. They did not state in the report why they chose to use the non-parametric approach though it is presumed the data were not normal or of equal variance. One problem in their analysis is that the chance of committing a Type I error is not accounted for. They could have tried a multivariate approach (GLM) and modeled the distributions for a possibly more insightful analysis.

5. Was the raw data included in the appendix complete?

Yes, the raw station (haul) information and catch data including lengths were included in tabular form in the appendix. In addition, net diagrams were included in the report itself.

6. Was the information clearly presented? Were figures and tables appropriately used?

Generally, yes. The information was efficiently presented and the most important tables and figures were presented up front. The cpue figures beginning with Figure 17 show continuous lines to connect what were independent paired trials. He should simply have used large markers for each treatment and trial for each species' graph.

7. In the discussion section, did the team offer comments on results including observations made while conducting the research; explanations of why a particular gear, sampling strategy, or laboratory technique may or may not have worked as anticipated; how project research results may have advanced the knowledge base about the research topic area; and ideas about follow up research?

Yes they did. They were up front about the limitations and ramifications of their findings, especially that the catch rates for both trawls were low during the experiment, that the experimental net did not result in an increased catch of whiting, and that the dogfish observations were limited to only 6 tows. They should have speculated why the catch rates were low, likely that the requirements of experimental paired towing were different from commercial fishing patterns. They did rightly highlight that the experimental trawl reduced the catch rates of unwanted and desirable bycatch species.

Finally, they also suggested that further experimental, paired tows in commercial areas and conditions would provide a better test than the results obtained in this experiment. My take it that the experimental trawl should be fished by itself and tweaked in commercial conditions to optimize its performance though minor design or deployment variations. Then the experimental net should be tested against the standard commercial gear. Regardless, funding the design, manufacture, and testing of this innovative net was a good investment, and the collaboration between academia and industry is resulting in potentially beneficial outcomes for improving bycatch reduction and fishery management.



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1. How closely did the research team follow the original planned scope of work?

The original scope of the planned research was maintained. However, specifics of the plan were adapted in response to knowledge gained during the initial field stages. These adaptations allowed the project to achieve its goal of designing and testing a new whiting trawl system that reduced dogfish bycatch. Modification and adjustment of the new trawl system took 11 vessel days (all of the 2010 field work) instead of the planned 3 days. Very large belly panel exit openings for dogfish apparently allowed too much whiting escape. The comparison tows were delayed until April 2011 and exit holes were replaced with 3.5 m mesh openings for comparative fishing in 2011. Thirty-seven tows pairs were completed: not as many as planned, due to the extra 2010 vessel days, but enough for adequate test results.

It is not clear whether the planned video observations of the gear took place. Such observations were not described, though they may have been part of the modification and adjustment work.

Outreach is described as ongoing, with presentations at two meetings so far.

2. If there were differences between scheduled and completed tasks, did the project team address these and explain why there were differences?

The researchers did not describe any of their observations from the 2010 field work, leading to their conclusion that the original design would not be useful to test due to excessive whiting escape. Doubtless, the 11 days of work included trials of many alternative riggings and modifications to improve performance, and an exhaustive accounting of those would not be useful. However, if any of the lessons learned in that process might be useful in future projects, they should be described, along with a better description of the ‘too big’ exit holes. I assume that the drawing from the proposal is not part of the report. Noting the “Confidential. Limited distribution only.” notes on the gear drawings made me wonder what description will be generally provided and whether that would allow implementation.

3. In the results, analysis, and discussion sections of the report, did the team answer their original research question(s)?

Yes, the original question was answered by the study. The research team designed and tested a trawl system that effectively caught whiting with reduced dogfish bycatch. They did caution that additional testing should be done to confirm the performance of the new trawl system where catch rates of whiting are higher than those observed during testing. Whiting concentrations encountered were not considered to be at commercial levels.

4. Were analytical techniques appropriately used? Was the experimental methodology statistically sound and supportive of the conclusions drawn?

The analytical techniques were appropriate and sufficient for this experiment. Analysis of the dogfish results were challenging due to the high number of tows with zero catch in both nets. The randomization technique used is less reliant on assumptions about data distribution than any other alternative available and hence a good choice. Fortunately, the differences observed during the few large tows with dogfish were strong and consistent.

Only one change of nets between vessels was accomplished and that was accompanied by a change in the sweep/bridle length and footrope weighting of the experimental net. This risked confounding of gear differences and vessel effects. Neither that change, nor its potential effects were discussed. It was strange that this change was immediately followed by a series of 7 tows where the experimental net strongly outperformed the control net on whiting, but that that difference did not persist. On the other hand, that difference did not persist through the end of testing, nor were those tows notable for any other species.

5. Was the raw data included in the appendix complete?

Full catch and size composition data from 2011 comparison tows were included, as were gear rigging and fishing comments from the vessel towing experimental gear.

6. Was the information clearly presented? Were figures and tables appropriately used?

Overall the information was clearly presented. Figure 6 compiles the key catch results into a single plot, while the catch results by haul were useful in understanding and assessing effects of catch differences encountered through the experiment. The combination of length frequencies and selectivity plots (where significant) were valuable for examining size selectivity differences.

Diagrams or descriptions of the doors and sweep / bridle rigging of the control trawl would have been useful, particularly in understanding the reasoning for the change in the experimental trawl rigging at the gear switch. It was not stated that control trawl rigging was identical between vessels.

7. In the discussion section, did the team offer comments on results including observations made while conducting the research; explanations of why a particular gear, sampling strategy, or laboratory technique may or may not have worked as anticipated; how project research results may have advanced the knowledge base about the research topic area; and ideas about follow up research?

The report's discussion focused on the performance results described above and emphasized the need for

testing at commercial catch rates for whiting. The resulting trawl system shows promise to reduce dogfish bycatch and potentially increase whiting catch rates. I would have been interested any comments or reactions from the fishermen in how the new gear handled and towed and whether they thought it would find acceptance in the fishery.



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1. How closely did the research team follow the original planned scope of work?

The proposal stated that the “main purpose of the experiment is to demonstrate if the new trawl system is feasible in catching whiting while reducing dogfish with the secondary aim to understand why the new system would result in better catch and less bycatch through underwater observation and trawl system monitoring.” With regard to the main purpose, the project largely followed the research proposal, including gear design and deployment. However, there are exceptions. For instance, in the proposal 3 d were proposed for gear observation and adjustment, but actually 11 fishing days (6 by one vessel, 5 by the other) were needed for this purpose in September 2010. A total of 40-60 paired tows were originally planned to be conducted between August and September 2010. However, these sea trials were not conducted until April and May 2011 and the actual number of tows fell slightly short of the lower end of this target range, as a total of 37 paired tows were completed. Only 36 valid paired tows were valid, because one tow using the control trawl was not brought onboard owing to excessive dogfish catch. Sampling methods paralleled those proposed with one exception. The proposal indicated that control and experimental trawl systems would be switched daily if feasible, but at least every 2 d. However, the report indicates that the gear was switched among vessels after 3 d during the 6-days of paired fishing in 2011. With regard to the secondary aim *to understand why the new system would result in better catch and less bycatch through underwater observation and trawl system monitoring*, the report does not provide evidence that this purpose was addressed. Toward this secondary aim, the proposal indicated that the gear and fish behavior would be observed at various locations of the gear. Also, the proposal indicated that “a temperature recorder will be attached to each trawl to record water temperature at the fishing depth during each tow.” This either did not occur or the temperature data were not provided in the Appendix. Finally, the fourth project objective was to conduct outreach and technology transfer. However, the report does not describe any activities pursuant to this last objective.

2. If there were differences between scheduled and completed tasks, did the project team address these and explain why there were differences?

The report does not clarify why the paired trawling was not conducted in August and September 2010, as planned. It also does not explain why the number of paired tows did not achieve the target of 40-60 and why the gear was switched once after 3 d. Also, the proposal review panel recommended that the sex of dogfish should be noted, but it was not apparent from the description of methods that sex data were collected for dogfish. Also, sex is not indicated on the raw data reported in Appendix II. The report also

does not describe outreach and technology transfer. The lack of video observations and temperature data collection need to be described. If these observations were taken but not reported, then they should be reported. The temperature data should be included in the raw data in Appendix II. It would seem that the video observations would provide insight into the finding that the experimental gear catches smaller fish of some species. This shift in size distribution of the catch of some species is somewhat unexpected and may be a negative outcome of the new gear to be resolved with future gear modifications.

3. In the results, analysis, and discussion sections of the report, did the team answer their original research question(s)?

The researchers addressed most of their original research questions. However, it did not address the secondary aim to understand why the new system would result in better catch and less bycatch through underwater observation and trawl system monitoring. Also, it does not appear that the project addressed the outreach and technology transfer objective. With regard to the questions addressed, the low catch rates, and the variability in catch rates for some species, inhibit generalization of results to real fishing operations under typical commercial target catch rates. That is, it is not clear that the general trend of reduced bycatch without loss of target catch (except for mackerel) would be maintained under higher fish densities as the trawl begins to fill and performance characteristics may change. It is not clear if the shift in experimental fishing from August/September to April/May was responsible for the low catch rates of the target species. This possibility, as well as other differences in proposed vs. realized methods (see 2 above), should be described in an expanded Discussion section. One perhaps unexpected outcome is that the experimental net appeared to catch smaller fish than the control net for a number of species (e.g., whiting, squid). The reduction in catch of most bycatch species is encouraging, despite the low catch rates overall. However, the apparent reduced catch rates of mackerel (target species) and the catch of smaller whiting and squid (target species) may detract from the apparent benefits of the bycatch reduction and should be briefly discussed, as well. Namely, are the smaller whiting and squid marketable or would the experimental net encourage discards of undersized target species? If so, this could replace one conservation issue (bycatch) with another (discards of undersized target species). Also, the proposal review panel commented about the cost of the net and doors. An expanded Discussion could briefly discuss these costs relative to costs of typical gear used in the fishery.

4. Were analytical techniques appropriately used? Was the experimental methodology statistically sound and supportive of the conclusions drawn?

The statistical methods appear to be appropriate, as proposed. Some results appear not to be statistically significant (e.g., whiting) owing to small sample size. A statistical power test could be conducted for such situations to indicate the sample size needed to detect differences of the magnitude observed.

5. Was the raw data included in the appendix complete?

I was unsure how to interpret the 36 tow descriptions in Appendix I. I would have expected 36 pairs of descriptions for the two vessels. However, tows 1-19 pertain to the F/V Cody and tows 20-36 pertain to the F/V Enterprise. Raw catch data are reported in Appendix II. However, raw temperature data were

either not collected or not reported. They should be reported. If they were not collected, then an explanation should be provided.

6. Was the information clearly presented? Were figures and tables appropriately used?

The information presented in the report is fairly clear, albeit very brief. Additional discussion is recommended in 3 (above). The figures and tables are appropriate and are clearly presented.

7. In the discussion section, did the team offer comments on results including observations made while conducting the research; explanations of why a particular gear, sampling strategy, or laboratory technique may or may not have worked as anticipated; how project research results may have advanced the knowledge base about the research topic area; and ideas about follow up research?

The Discussion is very brief and does not discuss changes in methods from those proposed. The Discussion should clarify what worked well and what did not. It should also explain deviations for original plans. See comments in 3 (above).