NAFC Marine Centre

An investigation into the catch rates of artificial lures used in commercial jig fisheries

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Introduction

Artificial lures are frequently used by commercial and recreational fishermen targeting many of the species caught in the waters around Shetland. In a commercial setting, lures are often fished on automated jigging machines. A considerable number of lures can be deployed on lure rigs although, from an operational point of view, 6-12 lures are normally the preferred option.

A variety of different types of lure are available for use in commercial jig fisheries (Figure 1). They are often developed with the aim of triggering fish feeding behaviour in order to maximise catches and increase returns to fishermen. An abundance of lures have been formulated over the years with the intention of attracting specific fish species. Some of the more popular and commonly used lures include rubber eel tube lures, imitation sand eels, lures designed to imitate octopus and squid, and a variety of other plastic and metal lures designed to mimic small injured prey species. Many modern lures also employ other methods designed to attract fish. These include the use of fluorescent material in the construction of lures as an added stimulus as well as lures designed to emit sonic vibrations which are thought to act as a fish attractant.

The aim of this study was to investigate whether the species targeted in whitefish jig fishing operations around Shetland (lythe, saithe, cod, ling and tusk) exhibit preferences for specific lure types and colours.

Methods

During August-September 2006 and March 2007 two experiments were carried out on the NAFC Marine Centre's fishing vessel *Atlantia II* as part of a wider study into the commercial viability of jig fishing in Shetland coastal waters (see NAFC Fisheries Development Note No. 25). The first experiment was designed to investigate whether fish showed any preferences for specific lure types while the second was intended to examine whether any given colour of rubber eel tube lure fished better than others.

Figure 1: Different lures deployed during lure type and lure colour preference experiments. A: rubber eel tube lures; B: muppets; C: sonic lures; D: Red Gill lures; E: spoon lure.

Experiment 1: Comparison of lure type

Five different lure types: rubber eel, muppet, sonic lure, Red Gill and spoon (Figure 1), were fished simultaneously on five Oilwind jigging machines. Six lures of one specific lure type were fished on each machine and were numbered 1-6 from top to bottom. Lure colours were selected from those readily available to commercial fishermen. Six different coloured rubber eel, Red Gill and muppet lures were randomly assigned to the six positions on each machine. Only three colours of sonic lure were available for use, requiring each colour to be positioned twice on the rig. The three colours were randomly assigned to lure positions 1-3 and the pattern was repeated for lure positions 4-6. Spoon lures were only available in silver and as a result each hook was assigned the same coloured lures. The method of construction of each of the lure rigs was consistent with techniques used for specific rigs during the jig fishing pilot study.

Experiment 2: Comparison of lure colour

Five different colours of rubber eel tube lure (black, fluorescent red, pale blue, white, fluorescent green (Figure 1A)) were fished simultaneously on five Oilwind jigging machines. Six lures of one colour were fished on each machine and were numbered 1-6 from top to bottom. The method of construction of lure rigs was consistent with techniques used during the jig fishing pilot study.

Experimental protocol

To avoid any possible effect of machine or position, the lure rigs were rotated between machines a total of five times in each experiment, thus ensuring that each treatment was positioned on each machine once and next to each of the remaining treatments twice throughout the five rotations. Table 1 below shows the rotation pattern that was devised for the lure preference experiment while Table 2 shows the rotation pattern for the colour preference experiment.

During each experiment environmental data such as wind speed and direction, tide, sea state and weather conditions were recorded. Other data recorded included information on fishing grounds as well as the number of fish caught on each lure on each rig.

Table 1: Rotation pattern for each of the lure rigs used in the lure preference experiment.

	Machine 1	Machine 2	Machine 3	Machine 4	Machine 5
Rotation 1	**Red Gill**	**Rubber eel**	**Muppet**	**Sonic**	**Spoon**
Rotation 2	**Spoon**	**Muppet**	**Red Gill**	**Rubber eel**	**Sonic**
Rotation 3	**Sonic**	**Red Gill**	**Spoon**	**Muppet**	**Rubber eel**
Rotation 4	**Rubber eel**	**Spoon**	**Sonic**	**Red Gill**	**Muppet**
Rotation 5	**Muppet**	**Sonic**	**Rubber eel**	**Spoon**	**Red Gill**

Table 2: Rotation pattern for each of the lure rigs used in the colour preference experiment.

	Machine 1	Machine 2	Machine 3	Machine 4	Machine 5
Rotation 1	**Black**	**Pale blue**	**Flr. green**	**Flr. Red**	**White**
Rotation 2	**White**	**Flr. green**	**Black**	**Pale blue**	**Flr. Red**
Rotation 3	**Flr. Red**	**Black**	**White**	**Flr. green**	**Pale blue**
Rotation 4	**Pale blue**	**White**	**Flr. Red**	**Black**	**Flr. green**
Rotation 5	**Flr. green**	**Flr. Red**	**Pale blue**	**White**	**Black**

Results

Experiment 1: Comparison of lure type

Ten hours were spent carrying out a total of five gear rotations in a number of locations at the northern end of the Shetland Isles (Figure 2). Each rotation was fished for a total of 120 minutes, although in some cases this was spread over more than one location. The time spent fishing at each location ranged from 15 to 90 minutes.

A total of 238 fish were caught on the five different lure types during five rotations. Sixty two fish were caught on the muppets making them the most successful lures (Table 3). Rubber eel lures caught 56 fish while spoon and Red Gill lures caught 55 and 41 fish respectively. The lowest numbers of fish were caught on the sonic lures. A 2-way ANOVA statistical test showed that there was no statistically significant difference in the number of fish caught with the five different lures.

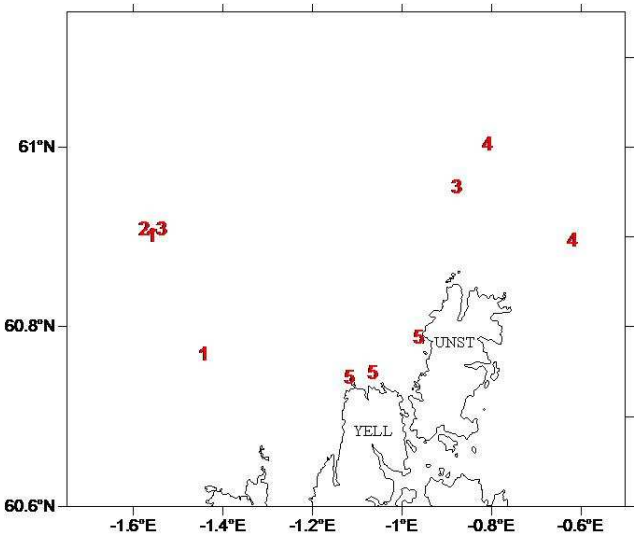

Figure 2: Geographic location of each of the 5 rotations carried out during lure preference trials at the northern end of the Shetland Isles.

Table 3: Total number of fish caught on five different lure types during March 2007.

Species	Lure type				
	Red Gill	Rubber eel	Muppet	Sonic	Spoon
Lythe	21	27	28	4	25
Cod	0	0	0	1	0
Saithe	18	28	29	15	28
Tusk	0	1	3	1	0
Ling	0	0	0	0	1
Total	41	56	62	24	55

A 1-way ANOVA showed that significantly more lythe were caught with the muppet and rubber eel lures than with the sonic lures. The highest catch rates for saithe occurred on muppet, spoon and rubber eel lures while catches on Red Gill and sonic lures were lower (Table 3). However, there was no significant difference in the catch rates of saithe between the five lure types. There were no statistically significant differences in catches between lure positions for saithe or lythe. Catches of cod, ling and tusk were low throughout the experiment; too small to distinguish any difference between the lures or between lure positions.

Figure 3 shows that the few tusk caught during the study were all caught on lure number 6, the one closest to the seabed, regardless of lure type. Lythe showed different lure preferences between the 5 lure types. On Redgill lures there were higher catches on the bottom three lures. Catches on rubber eel, muppet and spoon lures did not show any real patterns of preference between the 6 lure positions.

Saithe also exhibited a pattern of increasing catch rates from lure position 1 to 6 on both Red Gill and spoon lures. Such a pattern was less evident with rubber eel lures although catches were generally higher on the bottom four lures. There were no real lure position

preferences evident from the data for muppet and sonic lures.

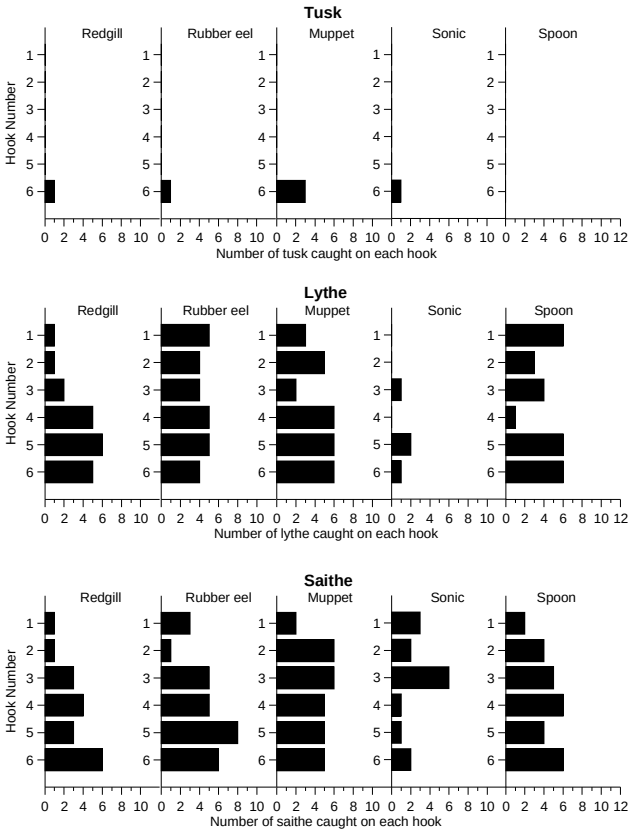

Figure 3: Numbers of tusk, lythe and saithe recorded on each lure position on each of the different lure types during the lure colour experiment.

Experiment 2: Comparison of lure colour

Five different rotations were carried out at a number of locations throughout the Shetland Isles (Figure 4). Each rotation was fished for a total of 120 minutes, although in some cases this was spread over more than one location. The time spent fishing in each location ranged from 15 to 90 minutes.

A total of 492 fish were caught during the five rotations. Fluorescent red lures caught the most fish followed by black and then white (Table 4). Only 89 fish were caught on the pale blue lure while fluorescent green caught the least fish. However, a 2-way ANOVA statistical test showed that there was no significant difference in the total catch of the five colours, or for individual species.

The data presented in Figure 5 show that for cod the lowest lure position (no. 6) caught the most fish on each of the rigs and that there appears to be a strong preference for the lower positions on the rig when the lures are black, white or fluorescent red, however this pattern is less evident with either the pale blue or green lures. Lythe demonstrated a less obvious lure position preference although the upper three lures tended to catch fewer lythe than the lower three lures though this was least pronounced with the fluorescent red lures. The least evidence of lure preference was observed in the data from saithe catches although lure position 6 with each of the black, fluorescent red and fluorescent green lures caught slightly fewer saithe than the other hooks.

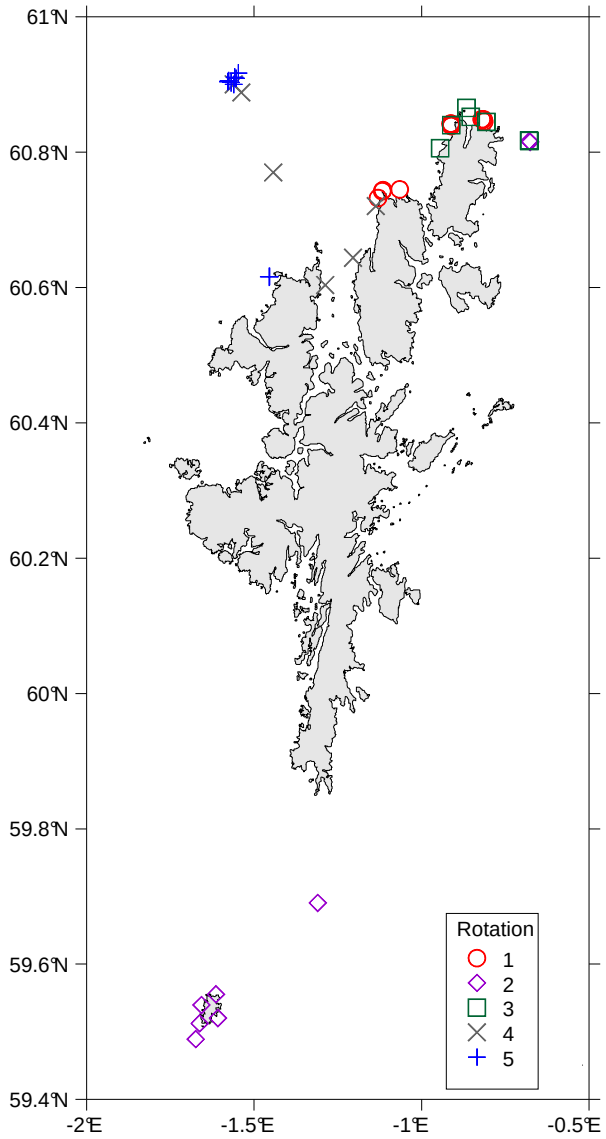

Figure 4: Geographical location of each of five rotations carried out during the lure colour preference experiment.

Table 4: Number of fish caught on different coloured rubber eel lures during an experiment in August-September 2006.

	Lure colour				
Species	**Black**	**White**	**Fluorescent Green**	**Fluorescent Red**	**Pale Blue**
Lythe	54	51	35	72	51
Cod	13	12	9	12	5
Saithe	39	42	25	36	32
Ling	1	0	0	0	0
Tusk	0	1	0	1	1
Total	107	106	69	121	89

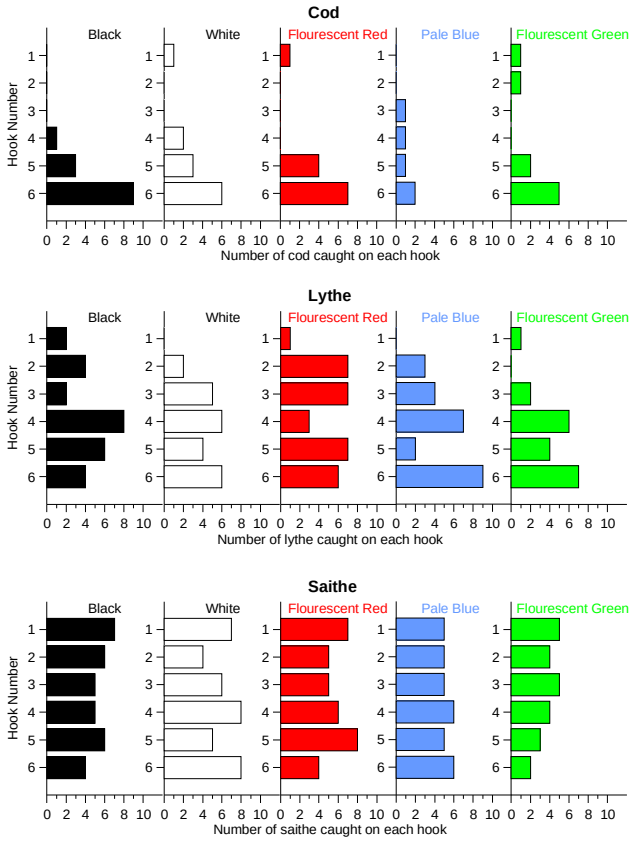

Figure 5: Numbers of cod, lythe and saithe recorded on each lure position on each of the different coloured lures during the lure colour experiment.

Discussion

Experiment 1: Comparison of lure type

Results from the lure preference study indicate that catch rates do not differ significantly between various lure types, although the sonic lure appears to be less effective. Rubber eel, Red Gill, muppet and spoon lures are commonly used by commercial fishermen in the Shetland Isles while the sonic lure is a newly developed lure previously untried in the waters around Shetland. Results suggest that those lures commonly used by commercial fishermen are the most suitable for species targeted during white fish jig fishing operations.

The effectiveness of different lures may change throughout the year. Many predatory fish are known to change prey depending on the availability of certain species at different times of the year[1].

Experiment 2: Comparison of lure colour

The colour preference study results indicate that lythe, saithe and cod do not exhibit significant preferences for different coloured lures. It is unclear to what extent fish can distinguish different colours, and in any case absorption of light means that much of the lures' colour is likely to be lost in deeper waters.

The relative catch rates of the five different coloured lures used in this study during August-September may not necessarily be representative of catches at other times of year. A number of environmental and seasonal variables are known to affect fish feeding behaviour[2] and these changes may have an influence on fish responses to artificial lures.

It is also worth noting that the colour trials were conducted with only one type of lure, rubber eels. Although some colours may have been more effective than others for catching lythe on rubber eel lures it may not necessarily be the most effective colour when using other types of lure.

In both experiments the distribution of fish between the 6 lure positions was consistent with the biology of each species. Tusk and cod are typically more closely associated with the sea-bed, and thus more likely to be caught on lures closer to the sea-bed, while lythe and saithe have a wider vertical distribution and so may be caught on lures further from the sea-bed.

Conclusion

The results of these studies indicate that the species targeted in a commercial whitefish jig fishery around Shetland do not show statistically significant preferences for any of the specific types or colours of lure trialled here. Further studies, carried out at different times of year, may determine whether changes in lure type and colour preferences do occur over time. Such studies may reveal which lure types and colours would result in optimum catches of each of the target species throughout the year.

Acknowledgements

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References

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