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Comparison of catch efficiencies for king and queen scallops between the RV Prince Madog and the FV Alena

Final Report

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1. Introduction

In recent years (2008 – 2015) the RV Prince Madog has been used for stock assessment work. To assess whether a significant difference in catch efficiency exists between the Fishing Vessel (FV) Alena and the Research Vessel (RV) Prince Madog a catch efficiency trial was undertaken on 10th, 11th and 16th April 2015. Similar ship comparison trials have already been carried out by Bangor University in the Isle of Man (Hinz *et al*., 2009) with the FV Genesis and by CEFAS in the English Channel (Dare *et al.*, 1994) to ensure commercial catches and catches made by research vessels can be compared.

There are several advantages to using both vessel types. The RV Prince Madog has space for 10 scientists and can work 12 hour days without having to return to port in the evening, increasing the speed and number of stations (fishing grounds) which can be visited during a working day. The FV Alena while being much smaller in terms of available work space and space for scientists, has the advantage that the vessel is permanently based in the Isle of Man and can be scheduled at short notice to take advantage of good weather windows, whilst the RV Prince Madog has fixed, pre-booked dates that cannot be amended for adverse weather conditions.

2. Methods

2.1 Gear specifications

For the purpose of this ship comparison trial the 35 m RV Prince Madog and the 13.82 m (LOA) FV Alena utilised differing gear configurations. RV Prince Madog fishes a single tow bar from its stern while FV Alena is designed to fish two dredge bars simultaneously off beams on either side of the vessel. In order to ensure comparability FV Alena therefore equipped one of its dredge bars in an identical manner to RV Prince Madog and equipped the other dredge bar with four of its own commercial king scallop dredges. The single tow bar on RV Prince Madog and the survey tow bar on FV Alena were equipped with two Newhaven king dredges (K) and two Newhaven queen dredges (Q) in alternating order (K, Q, K, Q) following the specifications in Figure 1. Specifications for spring tensions were discussed prior to the commencement of the trial and warp was deployed at a standard rate of three times depth.

Specification	King Dredge	Queen Dredge
No. Teeth	9	10
Tooth length	110 mm	60 mm
Belly Ring diameter	80 mm	60 mm
Mesh size	90 mm single twine mesh	80 mm double twine mesh

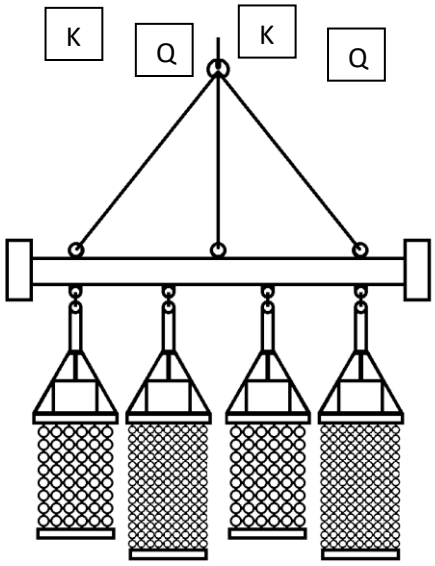

Figure 1. Gear set up and specifications for the survey tow bars deployed by RV Prince Madog and FV Alena where comparative tows were undertaken during the Isle of Man April 2015 scallop stock assessment survey.

2.2 Sampling sites

Dredging trials were undertaken in 3 different areas of the territorial sea each representing a different benthic substrate type. Area 1: East Douglas (EDG) coarse sand (LAX, 29, 24, EDG, 25), Area 2: Chickens (CHI) gravel (PSM, 37, 40, 39, 32), Area 3: Targets (TAR) cobbles (TAR, 5, 7, 9, 8) (Figure). Within each of the three areas five 20 minute tows were undertaken with both vessels fishing simultaneously offset by c. 100 m at a speed of approximately 2.6 knots. A deployment log was completed to record the start time and end time for each tow; this combined with data recorded every 30 seconds on a GPS logger carried aboard each vessel was used to accurately plot tow path and calculate tow lengths.

2.3 Catch analysis

Catches onboard FV Alena were sorted and measured by 1 scientist and 2 – 3 crewmen kneeling on deck, while aboard RV Prince Madog 7 – 8 scientists sorted and measured catches standing at a sorting table. For each tow, the total numbers of king and queen scallops caught by dredge were counted, measured, aged in the case of king scallops and assigned a damage score. As part of the wider scallop survey 20 king and 20 queen scallops from each site were retained for further analysis onshore.

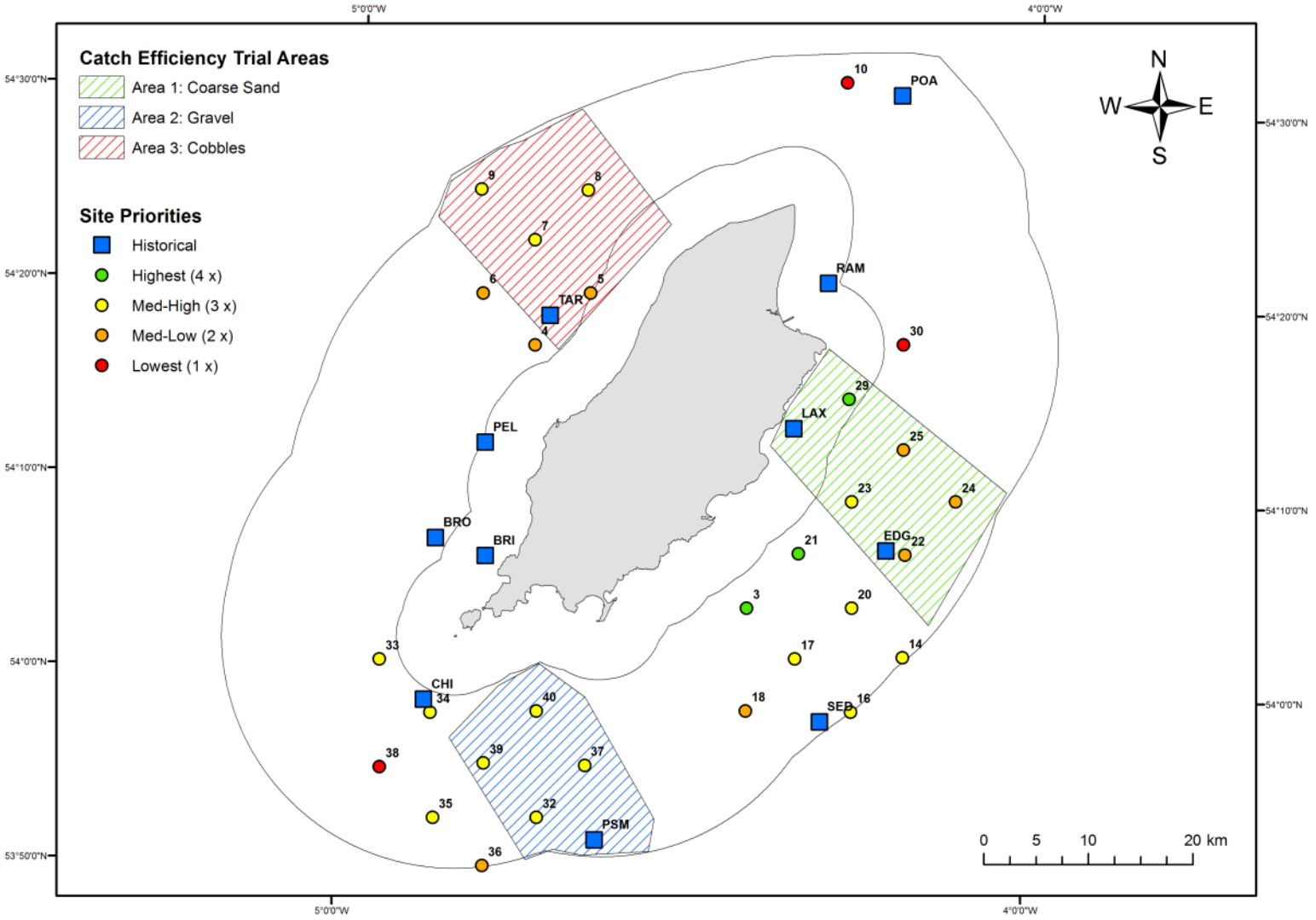

Figure 2. A map showing the location of dredge sites (Area 1: Coarse Sand; Area 2: Gravel & Area 3: Cobbles) where comparative tows will be undertaken by the RV Prince Madog and FV Alena during the Isle of Man April 2015 scallop stock assessment survey.

2.4 Statistical analysis

To determine differences between the catch efficiencies of the two vessels, abundances of queen and king scallops were compared by a two-way factorial ANOVA (GLM). The fixed factors were vessel (1, 2) and the 3 Areas (1, 2, 3). Five replicate samples (tows) were taken in each area. Data was Log transformed prior to analysis. Catches from the two gear types used, Pecten Dredges (PD) and Queen Dredges (QD) were analysed separately.

3. Results

3.1 King scallops – Pecten dredges

Overall, there was no significant difference in king scallop catches between the two vessels (see ANOVA results, Appendix 1 Table 1). On average Prince Madog caught 2.37 S.D. ± 4.61 and Alena 2.27 S.D. ± 5.13 individuals per 100 m^2 (Figure 2).

A summary of mean catches of both vessels for the different grounds and gears can be found in the Appendix Table 5.

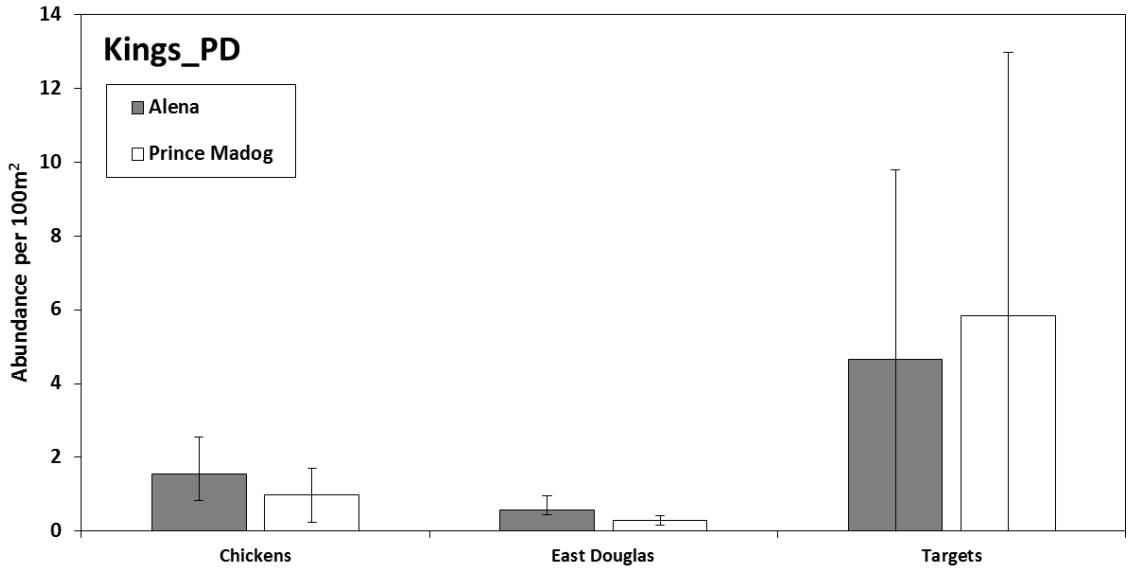

Figure 3. King scallop catches in king scallop dredges by RV Prince Madog and FV Alena from three different fishing grounds April 2015.

3.2 King scallops – Queen dredges

Overall, there was no significant difference in king scallop catches between the two vessels (see ANOVA results, Appendix 1 Table 4). On average Prince Madog caught 3.34 S.D. ± 6.43 and Alena 3.06 S.D. ± 4.82 individuals per 100 m^2 (Figure 3).

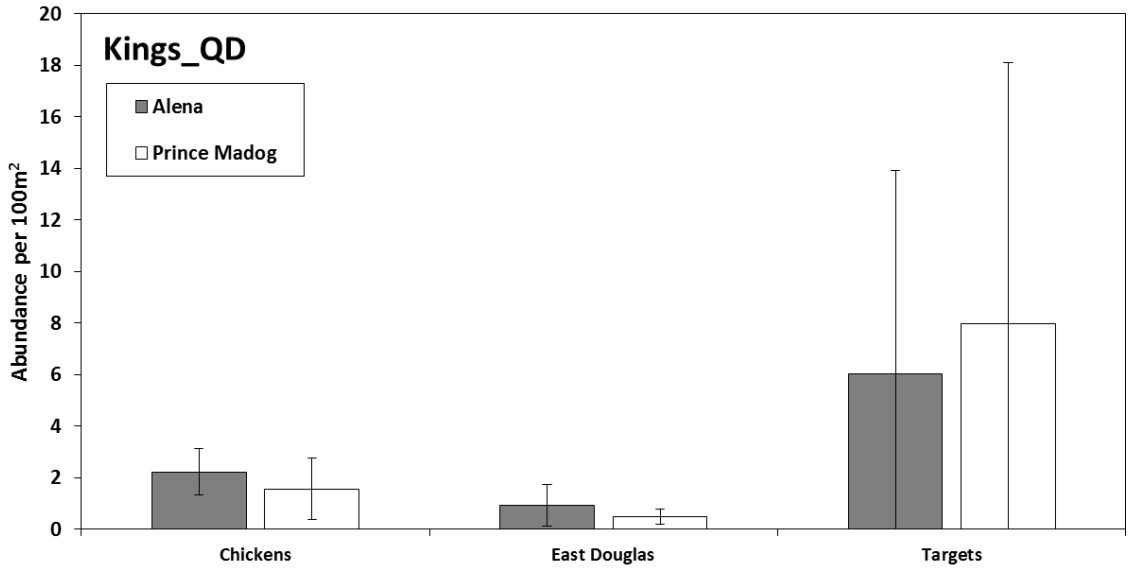

Figure 4. King scallop catches in queen scallop dredges by RV Prince Madog and FV Alena from three different fishing grounds April 2015.

3.3 Queen scallops – Pecten dredges

Overall, there was no significant difference in queen scallop catches between the two vessels (see ANOVA results, Appendix 1 Table 3). On average Prince Madog caught 4.44 S.D. ± 9.16 and Alena 3.6 S.D. ± 9.33 individuals per 100 m^2.

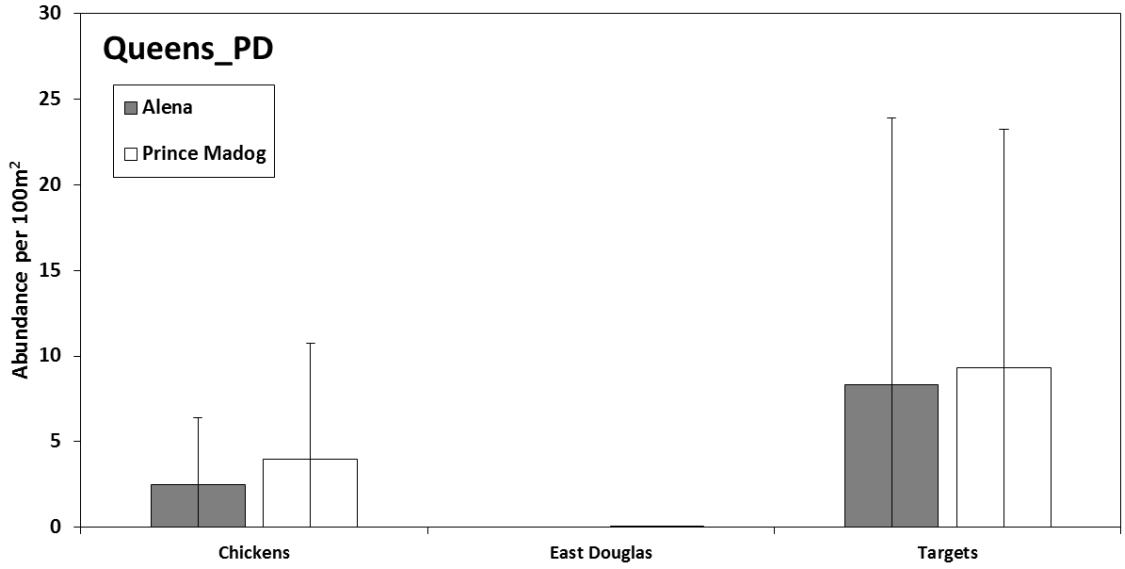

Figure 5. Queen scallop catches in king scallop dredges by RV Prince Madog and FV Alena from three different fishing grounds April 2015.

3.4 Queen scallops – Queen dredges

Overall, there was no significant difference in queen scallop catches between the two vessels (see ANOVA results, Appendix 1 Table 4). On average Prince Madog caught 15.29 S.D. ± 37.33 and Alena 18.24 S.D. ± 32.23 individuals per 100 m^2.

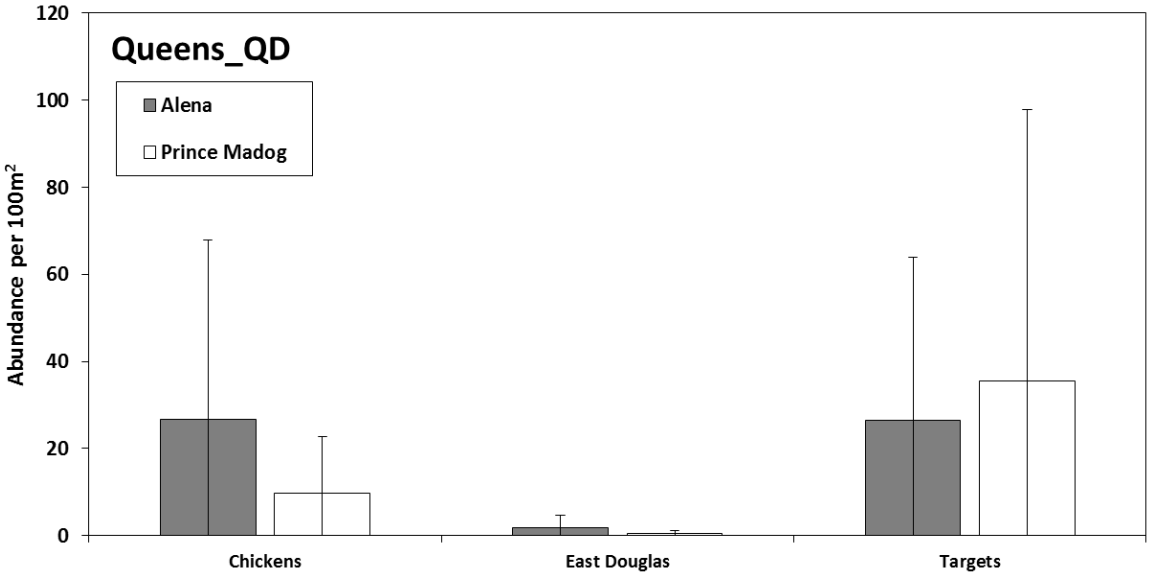

Figure 6. Queen scallop catches in queen scallop dredges by RV Prince Madog and FV Alena from three different fishing grounds April 2015.

4. Conclusion

The analysis showed that none of the catches of either species made with either gear type differed significantly between the commercial and research vessels. The standard deviation between the sites chosen to represent each fishing ground was very high, a fact reflective of the patchy nature of scallops.

A similar comparison study conducted alongside FV Genesis in 2008 concluded that RV Prince Madog caught significantly more queen scallop recruits, probably due to the better sorting as a result of better facilities and an increased number of scientists onboard; a similar trend could not be detected in 2015. One potential reason for this could be the fact that in October 2008 when the FV Genesis catch comparison trial was conducted recruit abundances around the island were generally much higher than at present, consequently as a result of the lesser number of scallops coming on deck one might expect the RV Prince Madog,s advantage in this regard to have diminished somewhat.

The main concern that catch efficiencies of the Prince Madog would be lower compared to a commercial vessel could not be verified by this study. It can be concluded that the Prince Madog is a suitable vessel for stock assessment and that data collected about FV Alena in future, provided the same gear configuration is used, is comparable to data collected aboard RV Prince Madog.

5. References

Dare, P.J., Palmer, D.W., Howell, M.L. & Darby, C.D. 1994, *Experiments to assess the relative dredging performances of research and commercial vessels for estimating the abundance of scallops (Pecten maximus) in the western English Channel fishery*, Ministry of Agriculture, Fisheries and Food Directorate of Fisheries Research.

Hinz, H., Murray, L.G. & Kaiser, M.J. 2009, *Comparison of catch efficiencies for King and Queen Scallops between the RV 'Prince Madog' and the commercial trawler 'Genesis'*, Bangor University.

Appendix 1.

Table 1. Results of the two-way factorial ANOVA for king scallops caught with a Pecten Dredge (PD)

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	14.348[b]	5	2.870	1.095	.389
Intercept	63.208	1	63.208	24.110	.000
Ship	.342	1	.342	.130	.721
Site	13.582	2	6.791	2.590	.096
Ship * Site	.424	2	.212	.081	.923
Error	62.920	24	2.622		
Total	140.476	30			
Corrected Total	77.268	29			

R Squared = .186 (Adjusted R Squared = .016)

Table 2. Results of the two-way factorial ANOVA for king scallops caught with a Queen Dredge (QD)

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	7.934[b]	5	1.587	1.204	.337
Intercept	14.755	1	14.755	11.197	.003
Ship	.144	1	.144	.109	.744
Site	7.754	2	3.877	2.942	.072
Ship * Site	.037	2	.018	.014	.986
Error	31.627	24	1.318		
Total	54.317	30			
Corrected Total	39.562	29			

R Squared = .201 (Adjusted R Squared = .034)

Table 3. Results of the two-way factorial ANOVA for queen scallops caught with a Pecten Dredge (QD)

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	5.443[b]	5	1.089	1.814	.148
Intercept	29.513	1	29.513	49.185	.000
Ship	.098	1	.098	.163	.690
Site	5.083	2	2.542	4.236	.027
Ship * Site	.262	2	.131	.218	.806
Error	14.401	24	.600		
Total	49.356	30			
Corrected Total	19.844	29			

R Squared = .274 (Adjusted R Squared = .123)

Table 4. Results of the two-way factorial ANOVA for queen scallops caught with a Queenn Dredge (QD)

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	5.487[b]	5	1.097	2.367	.070
Intercept	20.170	1	20.170	43.496	.000
Ship	.162	1	.162	.349	.560
Site	5.233	2	2.617	5.643	.010
Ship * Site	.092	2	.046	.099	.906
Error	11.129	24	.464		
Total	36.786	30			
Corrected Total	16.616	29			

R Squared = .330 (Adjusted R Squared = .191)

Appendix 2.

Table 5. Mean catches of king and queen scallop made by RV Prince Madog and FV Alena at different fishing grounds with Pecten Dredges (PD) and Queen Dredges (QD).

Species_Dredge	**Chickens**		**East Douglas**		**Targets**	
Queens_QD	Mean	S.D.	Mean	S.D.	Mean	S.D.
Alena	**26.61**	41.27	**1.72**	2.87	**26.37**	37.59
Prince Madog	**9.82**	12.82	**0.54**	0.66	**35.51**	62.39
Total	**18.22**	30.14	**1.13**	2.06	**30.94**	48.80
Queens_PD	Mean	S.D.	Mean	S.D.	Mean	S.D.
Alena	**2.47**	3.95	**0.00**	0.00	**8.33**	15.59
Prince Madog	**4.00**	6.76	**0.04**	0.05	**9.29**	13.94
Total	**3.23**	5.28	**0.02**	0.04	**8.81**	13.95
Kings_QD	Mean	S.D.	Mean	S.D.	Mean	S.D.
Alena	**2.23**	0.90	**0.93**	0.80	**6.03**	7.90
Prince Madog	**1.56**	1.20	**0.49**	0.29	**7.98**	10.11
Total	**1.89**	1.06	**0.71**	0.61	**7.00**	8.61
Kings_PD	Mean	S.D.	Mean	S.D.	Mean	S.D.
Alena	**1.56**	0.99	**0.58**	0.37	**4.66**	5.13
Prince Madog	**0.97**	0.73	**0.29**	0.13	**5.84**	7.14
Total	**1.26**	0.87	**0.44**	0.30	**5.25**	5.90