

East English Channel Herring Spawning Report
2009 Update
For
East Channel Association



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Author(s) : Jonny Lewis

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RPS Energy,
Goldsworth House,
Denton Way, Goldsworth Park,
Woking, Surrey, GU21 3LG, UK.
T +44 (0)1483 746500
F +44 (0)1483 746505
E
W www.rpsgroup.com

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NOTES

This report updates the previous ECA Herring Spawning Assessment, carried out by RPS on behalf of the ECA, in 2008. This latest report incorporates data from the International Herring Larval Surveys of 2006/07 and 2007/08 spawning seasons.

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Abbreviations

BGS	British Geological Society
CEFAS	Centre for the Environment, Fisheries and Aquaculture Science
ECA	Eastern Channel Association
ECR	Eastern Channel Region
GV	Government View
ICES	International Council for the Exploration of the Seas
IHLS	International Herring Larval Surveys
MFA	Marine and Fisheries Agency
REA	Regional Environmental Assessment

1. INTRODUCTION

1.1. BACKGROUND

The East Channel Association (ECA) consists of six marine aggregate companies that in the period since 2000 have pursued a series of marine aggregate extraction applications in the East Channel Region (ECR) (see Figure 1.1).

In order to assess the potential environmental impacts of these proposals a Regional Environmental Assessment (REA) was carried out covering the ECR (Posford Haskoning, 2002). This report assessed the predicted environmental effects of proposals and provided the basis for future site-specific Environmental Impact Assessments (EIA), all of which have now been submitted to the relevant government departments.

In 2005, the ECR Regional Monitoring Blueprint v0.3 (Emu Ltd, 2005) was developed. This document set out the objectives, methodologies and rationale of an extensive monitoring programme which aimed to investigate and monitor the actual environmental effects of proposals. As part of the overall monitoring programme, the Monitoring Blueprint specified a commitment to collate and assess data related to the potential for the seabed within the ECR to support herring spawning activity.

Previous work investigating the herring spawning potential of the ECR has been undertaken by Gardline (2003) and Mills *et al.* (2003). The Gardline (2003) report was a regional level analysis investigating the potential of herring spawning within the proposed licence areas using benthic and hydrographic analyses. This report indicated that the central and southern areas of the ECR were characterised by high levels of coarse grained material and were given classifications for spawning potential ranging from medium to high. However, the authors concluded that the highest potential for herring spawning was located in a small area to the extreme south-west of the survey area, which was characterised by both coarse sediments and a strong hydrographic regime.

Mills *et al.* (2003) found that the greatest number of herring within the east English Channel, based on data from the International Herring Larval Survey (IHLS) over the period 1998-2002, was in the mid-Channel and in French waters. The main concentrations of 5-8mm larvae (the larval size class that indicate recent spawning activity – see Section 2.1.2) were to the south and south-west of the ECR dredging areas. Taking into account the findings of Gardline (2003), Mills *et al.* (2003) concluded that *“the prospecting areas in the south-west have a higher potential sensitivity than those further to the north”*.

As a result of the findings of these previous investigations, plus additional information presented within licence specific EIA undertaken by the individual developers, seasonal operation restrictions on extraction activity for two areas have been implemented via Government View (GV) conditions. The aim of these restrictions is to protect herring spawning activity in areas previously identified as having high spawning potential (see Table 1.1).

In order to examine the herring spawning potential of the ECR and specific licence areas within this region in more detail, RPS undertook a herring spawning assessment, on behalf of the ECA, in 2008 (RPS, 2008). This assessment used the following data sources to assign `ranks` to parts of the ECR;

- larval density data from the annual International Herring Larval Survey (IHLS);
- seabed sediment data from the EEC regional monitoring programme;
- seabed habitat data from the Eastern English Channel Marine Habitat Map; and
- fisheries overflight data from MFA.

This study reached the following key conclusions;

Conclusion 1:

Larval data suggests that the potential for herring spawning could be less within the ECR than in the English Channel as a whole

Comparison of the 5-8mm and 9-12mm larval numbers recorded in the English Channel suggests that dredging areas are located within areas of relatively low larval numbers (<10,000 m⁻² larvae). Larvae have been sampled in much higher numbers elsewhere in the English Channel, such as south of the ECR, in French waters.

However, areas that appear to support significant spawning events (indicated by very high densities of 5-8mm larvae) do occasionally occur within the ECR. An example of such an area is the high densities of 5-8mm larvae recorded in a number of 1:9 rectangles close to active dredging areas in the 2003/04 survey period.

A longer time series would be required to determine the location of any consistent areas of concentrated spawning.

Conclusion 2:

It is likely that herring spawn throughout the ECR and the areas with higher spawning potential are likely to change between seasons

Suitable spawning habitat, such as coarse sediments, is found throughout the ECR. The coverage of 5-8mm larval data also indicates that herring are likely to spawn throughout the ECR. If it assumed that the areas of highest larval numbers represent the preferred spawning areas, the current study highlights that the location of preferred spawning areas changes significantly on an annual basis. Temporal and spatial variability characteristic of herring spawning is likely to be influenced by environmental factors, other than sediment type, that have not been investigated in this study, possibly such as variation in spawning stock biomass and water temperature.

Conclusion 3:

Comparison of the dredging areas suggests that 6 have a medium to high potential for herring spawning, which is concluded to be related to their seabed characteristics.

The results of the 2008 study support the conclusions of both Gardline (2003) and Mills *et al.* (2003), that the area to the south-west of the ECR area has a higher potential for spawning compared with other areas within the ECR. However, this report highlights that two of the northerly dredging areas also have a medium – high potential for herring spawning. Overall, the six dredging areas with a medium – high potential for herring spawning were Area 477 South, Area 478, Area 475, Area 474 Central, Area 473 East and Area 461.

This conclusion was derived primarily from the general sediment character and gravel content of these dredging areas and was not significantly influenced by larval number.

Conclusion 4:

Developing larvae spawned within the ECR are likely to move to the west and the north, although a dispersion rate cannot be determined.

The distinct bands of higher numbers of 9-12mm larvae within the ECR suggest that the developing larvae are dispersed in south-west and north-east directions. It has not been possible to determine the rate of dispersion as there is a lack of detailed hydrographic studies within the ECR.

1.2. OBJECTIVES OF 2009 UPDATE REPORT

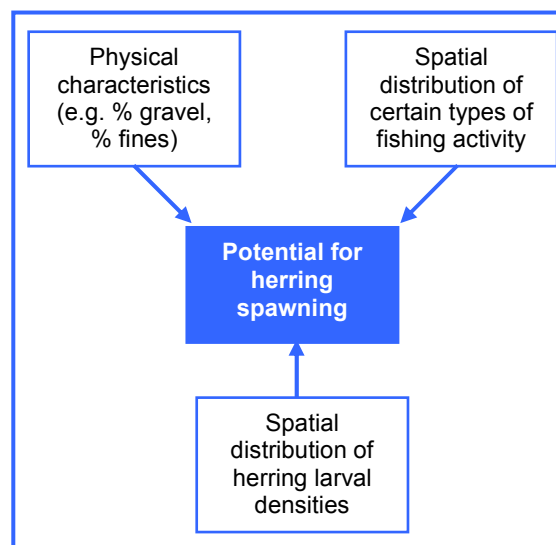
The main objective of this 2009 report is to update the dataset used in the 2008 assessment, with larval data from the 2006/07 and 2007/08 International Herring Larval Surveys, in order to see if the key conclusions presented in the 2008 report change in any way.

2. HABITAT SUITABILITY METHODOLOGY

2.1. BACKGROUND

The same methodology used in the 2008 assessment was used for the 2009 update assessment, i.e. the potential for herring spawning has been determined by a number of key identifying factors, which are;

- high numbers of 5-8mm larvae;
- presence of 9-12mm larvae;
- presence of sediments with high % of gravels;
- presence of sediments with low % of fines; and
- presence of commercial fishing activity (pelagic trawls).



In order to use these data within the assessment process, a weighted ranking system was developed for each data-set. Using the high-resolution grid developed by RPS (54 squares per ICES rectangle), each individual grid square was scored using this ranking system. The potential for herring spawning in any one square was indicated by the value of this score, with the higher the score representing the greatest potential for herring spawning in that particular square.

2.2. ADDITIONAL LARVAL DATA USED IN 2009 ASSESSMENT

Details of the additional larval data-sets obtained for this assessment are provided below in Table 2.1.

SAMPLE SEASON REFERENCE	START DATE	END DATE	NO OF DAYS SAMPLED	NO OF SAMPLES TAKEN
25	16 Dec 1996	24 Jan 1997	7	116
26	15 Dec 1997	23 Jan 1998	9	147
27	14 Dec 1998	22 Jan 1999	9	145
28	20 Dec 1999	21 Jan 2000	9	144
29	18 Dec 2000	18 Jan 2001	7	168
30	17 Dec 2001	18 Jan 2002	9	183
31	16 Dec 2002	24 Jan 2003	9	156
32	15 Dec 2003	23 Jan 2004	9	169
33	14 Dec 2004	20 Jan 2005	11	243
34	19 Dec 2005	20 Jan 2006	9	172
35	18 Dec 2006	26 Jan 2007	11	159
36	17 Dec 2007	18 Jan 2008	9	141

Table 2.1 Summary of IHLS data used in the most recent (2009) assessment

Note: Although IHLS samples were collated for 34 seasons (1972/73 to 2005/06) for the 2008 assessment, after a review of the robustness of these data it was decided to only use the previous 10 seasons of sample data (1996/97 to 2005/06). This decision was based on the observation that sampling effort in the last ten seasons showed the greatest degree of consistency between years, with respect to the number of days sampled and the number of samples taken during the season (see Table 2.1). The data-sets shaded green were those used in the 2008 assessment, with the new data used in this 2009 update, shaded in orange.

2.3. ASSESSMENT OF SPAWNING POTENTIAL

2.3.1. Assignment of Ranks

The same ranking matrix developed for the 2008 assessment was used for the 2009 update. Details are summarised below;

- 5-8mm larvae (data from IHLS) – weighting of 3
- 9–12mm larvae (data from IHLS) - weighting of 2

- General seabed type (data from EECMHM) - weighting of 2
- Seabed condition - % gravels (data from ECR Regional Baseline) - weighting of 2
- Seabed condition - % fines (data from ECR Regional Baseline) - weighting of 2

2.3.1.1. Summary of ranks and weighting for data-sets used in the assessment

Table 2.2 summarises the ranking, weighting and subsequent scores for the various data-sets, as described above.

PARAMETER	SCORING SYSTEM	RANK	WEIGHTING	SCORE (RANK X WEIGHTING)
Larval number (5-8mm per m²)	1,000,000+	5	3	15
	100,000 - <1,000,000	4	3	12
	10,000 - <100,000	3	3	9
	1,000 - <10,000	2	3	6
	0 - <1000	1	3	3
	0	0	3	0
Larval number (9-12mm per m²)	1,000,000+	5	2	10
	100,000 - <1,000,000	4	2	8
	10,000 - <100,000	3	2	6
	1,000 - <10,000	2	2	4
	0 - <1000	1	2	2
	0	0	2	0
General seabed type	Coarse sediment	5	2	10
	Coarse sediment / Rock	4	2	8
	Rock	3	2	6
	Sandy sediment / Coarse sediment	2	2	4
	Sandy sediment / Rock	2	2	4
	Sandy sediment	1	2	2
Seabed condition (% gravel)	>60	4	2	8
	41-60	3	2	6
	21-40	2	2	4
	1-20	1	2	2
	0	0	2	0
Seabed condition (% fines)	0	4	2	8
	1-5	3	2	6
	6-10	2	2	4
	11-20	1	2	2
	>20	0	2	0

Table 2.2 Division of the parameter data and the ranking system used to prioritise the data groups

2.3.2. Scoring Process

Following the development of this weighted ranking system, the raw data available within the GIS project was assessed at the different spatial scales described in Section 3.2. For the area covered by the 1:54 rectangle grid developed by RPS, the “score” per square was calculated.

These scores were plotted to produce a colour-coded chart of the area, illustrating those areas where the potential for herring spawning was judged to be the greatest. However, the boundaries of several dredging areas were located within more than one 1:54 rectangle. For each dredging area, the sum of the ranks of the 1:54 rectangles that correspond with each individual dredging area was taken, and then averaged to provide an overall rank for the dredging area. Although relatively crude, this method of assessment does enable comparisons between the different dredging areas to be made more easily. However, it must also be recognised that this crude methodology can result in an over-estimation of the importance of certain dredging areas in terms of herring spawning. This is because although a dredging area may lie within the boundary of a 1:54 square with a high larval density figure, in reality only a small % of the dredging area may overlap with the square. Therefore, the dredging area may be assigned as having high larval density, although the actual sampling point for the IHLS was located >10km away from the dredging area.

3. SPAWNING ASSESSMENT: 2009 Update - RESULTS

3.1. ENGLISH CHANNEL SURVEY AREA

3.1.1. Larval data

Herring larval data was available over the entire English Channel region. Larval numbers recorded during the seasons from 1996/97 to 2007/08 were assessed using the project-specific GIS. The locations of the maximum numbers of 5-8mm larvae and 9-12mm larvae were determined for each sampling event over the 12 seasons (Table 3.1, Figure 3.1(a) and (b)).

Spawning period	Maximum number of 5-8mm larvae per season	Location of max number – ICES square (1:9 rectangle)	Dredging areas within area of max number of 5-8mm larvae
1996/97	69.7 m ²	29 F0 (340)	None
1997/98	9,717.5 m ²	28 F0 (278)	None
1998/99	39.8 m ²	29 F0 (310)	Area 475 (partial *)
1999/00	82.4 m ²	28 E9 (248)	None
2000/01	529.6 m ²	29 E9 (249)	None
2001/02	267.1 m ²	29 F1 (369)	None
2002/03	131.8 m ²	29 F0 (310)	Area 475 (partial *)
2003/04	2,368,262.2 m ²	29 F0 (340)	None
2004/05	1,842.8 m ²	29 F0 (341)	Area 474 east
2005/06	339.3 m ²	29 F0 (311)	Area 473 west (partial *) Areas 473 east (partial *) Area 464-2 & 458 (partial *) Area 474 east (partial *) Area 475 (partial *) Area 474 central Area 474 west
2006/07	3,555.01 m ²	29 F0 (280)	Area 461, Area 475 (partial)
2007/08	445.29 m ²	29 E9 (249)	None

Table 3.1 (a) Maximum number of 5-8mm larvae recorded within 1:9 rectangles for each spawning season

(partial *) - Only part of the dredging licence area lies within the 1:9 rectangle in which the maximum density of larvae were recorded

Spawning period	Maximum number of 9-12 mm larvae per season	Location of max number – ICES square (1:9 rectangle)	Dredging areas within area of max number of 9-12 mm larvae
1996/97	291.0 m ²	28 F0 (278)	None
1997/98	529.7 m ²	29 F0 (309)	None
1998/99	1,264.3 m ²	29 F0 (310)	Area 475 (partial *)
1999/00	336.3 m ²	29 F0 (340)	None
2000/01	2,121.6 m ²	29 E9 (249)	None
2001/02	614. 6 m ²	29 F0 (280)	Area 461 Area 475 (partial *)
2002/03	1,641.8 m ²	29 F0 (310)	Area 475 (partial *)
2003/04	4, 594,354.1 m ²	29 F0 (340)	None
2004/05	5, 868.6 m ²	29 F0 (341)	Area 474 east
2005/06	2,578.8 m ²	29 F0 (340)	None
2006/07	2,142.06 m ²	29 F0 (280)	Area 461, Area 475 (partial)
2007/08	3,456.85 m ²	29 E9 (249)	None

Table 3.1 (b) Maximum number of 9-12mm larvae recorded within 1:9 rectangles for each spawning season. Dredging areas that are located within the stated 1:9 rectangle are also listed.

(partial *) - Only part of the dredging licence area lies within the 1:9 rectangle in which the maximum density of larvae were recorded

The new data acquired for this updated assessment indicated that the maximum density of 5-8mm larvae recorded in 2006/07 (3,555m²) was the third highest mean density from the 12 survey seasons assessed. This value was recorded within grid square 280 (ICES square 29F0), within which all of Area 461 and part of Area 475 is located. Dredging was undertaken in these areas over the period of these surveys which appears to indicate that spawning continued even whilst dredging was occurring.

3.2. SPECIFIC DREDGING AREAS

3.2.1. Overview

Based upon the scoring system described in Table 3.3 (but excluding the score for fishing activity due to this being removed – see 2008 report), the maximum “score” that could be attributed to an individual hi-resolution (1:54) grid square was 51. Over the specific dredging areas, this “score” was comprised of values for the following:

- larval density (5-8mm and 9-12mm) – data from IHLS;
- broad seabed type – data from EECMHM;
- % gravel (data from ECA Regional Monitoring Baseline); and
- % fines (data from ECA Regional Monitoring Baseline).

Areas were defined as having low, medium, high or very high potential for spawning based on the following scoring bands:

POTENTIAL FOR HERRING SPAWNING	SCORE
Low	0 – 13
Low – Medium	14 – 26
Medium - High	27 – 39
Very High	40– 51

The bands were based on an arithmetical quartile division system, with 26 representing the mid-point of the medium category.

The following sections provide brief descriptions of the data-sets described above for individual dredging areas within the ECR. Figure 3.3 and Table 3.2 illustrates the final rankings for the individual dredging areas, based upon the scoring assessment carried out over the 1:54 rectangle grid developed by RPS.

3.2.2. Overall Analysis of Dredging Area Results

The key conclusions outlined in the 2008 report still hold true following this updated assessment using new larval survey data, i.e. overall, the spawning potential within dredging areas was more strongly associated with the general sediment character and gravel content than any other parameters.

Licence Area	Sediment type	% Fines	% Gravels	5-8mm larvae (m ²)	9-12mm larvae (m ²)	RPS (2008) Final Weighted Score & Potential for spawning	RPS (2009) Final Weighted Score & Potential for spawning	Gardline (2003) rating
				>0 – 1,000 –	>0 – 1,000 –			
				<1,000	<1,000			
				00	<10,000			
477 North	Coarse /Sandy	<20%	21 – 40%	✓	✓	19 (Low – medium)	19 (Low – medium)	Medium
477 South	Coarse	<20%	41 – 60%	✓	✓	27 (Medium – High)	27 (Medium – High)	Medium – high
478	Coarse	<20%	41 – 60%	✓	✓	27 (Medium – High)	27 (Medium – High)	Medium – high
461	Coarse	<20%	41 – 60%	✓	✓	31 (Medium – High)	31 (Medium – High)	Medium – high
475	Coarse	<20%	21 – 40%	✓	✓	28 (Medium – High)	28 (Medium – High)	Medium – high
473 West	Coarse	<20%	41 – 60%	✓	✓	23 (Low - Medium)	23 (Low - Medium)	Medium – high
474 West	Coarse/ Sandy	<20%	21 – 40%	✓	✓	22 (Low – Medium)	22 (Low – Medium)	Medium
473 East	Coarse	<20%	41 – 60%	✓	✓	29 (Medium – High)	29 (Medium – High)	Medium – high
464-2 & 458	Coarse/ Sandy	<20%	21 – 40%	✓	✓	20 (Low – Medium)	20 (Low – Medium)	Medium
474 Central	Coarse	<20%	21 – 40%	✓	✓	28 (Medium – High)	28 (Medium – High)	Medium – high
474 East	Sandy	<20%	21 – 40%	✓	✓	21 (Low – Medium)	20 (Low – Medium)	Medium – high

Table 3.2 Summary of the parameter values and the final rank used to determine the herring spawning potential of the individual dredging areas. For comparative purposes, the Gardline (2003) rating is given in the final column

4. CONCLUSIONS

4.1. KEY FINDINGS OF PRESENT STUDY

For this most recent assessment of herring spawning potential within the ECR, additional IHLS data from two sampling seasons (2006/07 and 2007/08) have been collated and entered into the project-specific GIS developed previously. The objective of this exercise was to try and identify any large-scale changes in herring spawning potential that could be possibly attributed to the on-going marine aggregate extraction activity within the ECR.

The 2008 assessment made the following key conclusions;

- Larval data suggests that the potential for herring spawning could be less within the ECR than in the English Channel as a whole;
- It is likely that herring spawn throughout the ECR and the areas with higher spawning potential are likely to change between seasons;
- Comparison of the dredging areas suggests that six areas have a medium to high potential for herring spawning, which is concluded to be related to their seabed characteristics; and
- Developing larvae spawned within the ECR are likely to move to the west and the north, although a dispersion rate cannot be determined.

The additional data reviewed as part of this most recent assessment has not changed these key conclusions in any way. The additional data from the 2006/07 and 2007/08 spawning events only changed one overall spawning potential rank of the licenced dredging areas, with Area 474 changing from the 2008 rank of 21 to a new rank of 20 (remaining as low-medium).

One of the most noteworthy results of adding in the larval data from 2006/07 and 2007/08 has been that the maximum density of 5-8mm larvae recorded in the 2006/07 spawning survey (3,555m²) was the third highest mean density from the 12 survey seasons assessed.

This value was recorded within grid square 280 (ICES square 29F0), within which all of Area 461 and part of Area 475 is located. Dredging was undertaken in these areas over the period of these surveys which appears to indicate that spawning continued even whilst dredging was occurring. Both Areas 461 and 475 were defined as having Medium-High spawning potential in the 2008 assessment and the data from the 2006/07 survey appears to indicate that these assessments were relatively accurate.

It is recommended that data from the 2008/09 IHLS also be collated for next year's assessment and the analysis re-run with more up-to-date seabed sediment data collected from other elements of the EEC Regional Monitoring Programme.

Appendix A

Final Rankings

English Channel Final Ranks

ICES Square	1:9 reference	5-8mm larvae	9-12mm larvae	Final rank
28 E9	188	3	2	5
28 E9	218	3	2	5
28 E9	248	3	4	7
28 E9	187	3	2	5
28 E9	217	6	8	14
28 E9	247	9	4	13
28 E9	186	3	2	5
28 E9	216	3	4	7
28 E9	246	3	2	5
28 F0	278	6	2	8
28 F0	308	3	2	5
28 F0	338	3	4	7
28 F0	277	3	4	7
28 F0	307	0	0	0
28 F0	337	0	0	0
28 F0	276	0	0	0
28 F0	306	0	0	0
28 F0	336	0	0	0
29 E9	191	0	2	2
29 E9	221	3	2	5
29 E9	251	3	2	5
29 E9	190	3	4	7
29 E9	220	0	4	4
29 E9	250	3	4	7
29 E9	189	3	2	5
29 E9	219	3	2	5
29 E9	249	3	4	7

ICES Square	1:9 reference	5-8mm larvae	9-12mm larvae	Final rank
29 F0	281	3	2	5
29 F0	311	6	2	8
29 F0	341	6	4	10
29 F0	280	3	6	9
29 F0	310	6	6	12
29 F0	340	12	8	20
29 F0	279	3	4	7
29 F0	309	12	6	18
29 F0	339	9	4	13
29 F1	371	3	6	9
29 F1	401	3	2	5
29 F1	431	0	0	0
29 F1	370	6	8	14
29 F1	400	0	0	0
29 F1	430	0	0	0
29 F1	369	6	4	10
29 F1	399	0	0	0
29 F1	429	0	0	0
30 E9	194	0	0	0
30 E9	224	0	0	0
30 E9	254	0	0	0
30 E9	193	0	0	0
30 E9	223	0	0	0
30 E9	253	0	0	0
30 E9	192	0	0	0
30 E9	222	0	0	0
30 E9	252	0	2	2
30 F0	284	0	0	0
30 F0	314	0	0	0
30 F0	344	0	0	0
30 F0	283	0	0	0
30 F0	313	0	0	0
30 F0	343	6	6	12
30 F0	282	3	2	5
30 F0	312	3	2	5

ICES Square	1:9 reference	5-8mm larvae	9-12mm larvae	Final rank
30 F0	342	3	2	5
30 F1	374	3	2	5
30 F1	404	3	2	5
30 F1	434	3	2	5
30 F1	373	6	6	12
30 F1	403	3	2	5
30 F1	433	0	0	0
30 F1	372	3	2	5
30 F1	402	3	4	7
30 F1	432	0	0	0

ECR Survey Area Final Ranks

ICES square	1:54 reference	5-8mm larvae	9-12mm larvae	Sediment character	Final Rank
29 E9	1340	0	4	6	10
29 E9	1341	0	4	6	10
29 E9	1342	3	2	6	11
29 E9	1343	3	2	6	11
30 E9	1344	0	0	4	4
29 E9	1400	0	4	6	10
29 E9	1401	0	4	6	10
29 E9	1402	3	2	6	11
29 E9	1403	3	2	6	11
30 E9	1404	0	0	6	6
29 E9	1461	3	4	8	15
29 E9	1462	3	2	6	11
29 E9	1463	3	2	6	11
30 E9	1464	0	2	4	6
29 E9	1521	3	4	8	15
29 E9	1522	3	2	8	13
29 E9	1523	3	2	4	9
30 E9	1524	0	2	4	6
29 E9	1581	3	4	8	15
29 E9	1582	3	2	8	13
29 E9	1583	3	2	8	13
30 E9	1584	0	2	4	6
29 F0	1641	3	6	8	17
29 F0	1642	3	2	10	15
29 F0	1643	3	2	8	13
30 F0	1644	3	2	4	9
30 F0	1645	3	2	4	9
29 F0	1701	3	6	8	17
29 F0	1702	3	2	10	15
29 F0	1703	3	2	8	13
30 F0	1704	3	2	4	9
30 F0	1705	3	2	4	9
29 F0	1761	3	6	10	19
29 F0	1762	3	2	10	15
29 F0	1763	3	2	8	13

ICES square	1:54 reference	5-8mm larvae	9-12mm larvae	Sediment character	Final Rank
30 F0	1764	3	2	4	9
30 F0	1765	3	2	6	11
29F0	1821	6	6	10	22
29 F0	1822	6	2	10	18
29 F0	1823	6	2	10	18
30 F0	1824	3	2	8	13
30 F0	1825	3	2	4	9
30 F0	1826	0	0	6	6
29 F0	1882	6	2	4	12
29 F0	1883	6	2	4	12
30 F0	1884	3	2	4	9
30 F0	1885	3	2	4	9
30 F0	1886	0	0	4	4
29 F0	1942	6	2	4	12
29 F0	1943	6	2	4	12
30 F0	1944	3	2	4	9
30 F0	1945	3	2	4	9
30 F0	1946	0	0	4	4
29F0	2002	6	4	2	12
29 F0	2003	6	4	2	12
30 F0	2004	3	2	2	7
30 F0	2005	3	2	2	7
30 F0	2006	6	6	4	16
29 F0	2063	6	4	2	12
30 F0	2064	3	2	2	7
30 F0	2065	3	2	2	7
30 F0	2066	6	6	4	16
30 F0	2067	6	6	4	16
30 F0	2124	3	2	2	7
30 F0	2125	3	2	2	7
30 F0	2126	6	6	4	16

Dredging Areas Final Ranks

Dredging area	5-8mm larvae	9-12mm larvae	Sediment character	% Gravels	% Fines	Final Rank
477 North	3	2	4	4	6	19
477 South	3	2	10	6	6	27
478	3	2	10	6	6	27
461	3	6	10	6	6	31
475	4	4	10	4	6	28
473 West	5	2	4	6	6	23
474 West	6	2	4	4	6	22
473 East	5	2	10	6	6	29
464-2 & 458	5	2	4	3	6	20
474 Central	6	2	10	4	6	28
474 East	6	2	2	4	6	20