Fecundity of *Limanda limanda* in Oxwich Bay, South Wales, U.K.

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**ABSTRACT.** *Limanda limanda* is one of the important fish of U.K. and European market. It is a bottom feeder and usually caught together with plaice and flounders.

In the present study, fecundity of *Limanda limanda* was determined. A regression line has been drawn between fecundity and fish length. A curvilinear relationship was obtained and it was found to be 0.0046 L^{5.27}. A logarithmic relationship between fecundity and weight of the fish is also plotted.

**Introduction**

Fecundity is the number of ripe eggs produced by a female during one spawning. Many expressions have been used to describe the relationship of fecundity with other biological parameters of the female, such as, length, weight, or age (Bagenal, 1957, 1958, 1960).

Fulton (1891) obtained dab fecundity but derived his data from only three specimens so that his results have limited value. Bohl (1957) produced a regression line between length and fecundity in North Sea *Limanda limanda*. Lee (1972) obtained the relationship between total fish weight and fecundity in *L. limanda* in the North Sea. Simpson (1959) estimated the fecundity of plaice, *Pleuronectes platessa* on the southern Bight spawning grounds in the North Sea and on the Flamborough spawning ground. Bagenal (1957) worked on the Long Rough dab *Hippoglossoides platessoides* and Bagenal (1958) worked on plaice, *P. platessa* from the English Channel and the South and West coasts of Ireland. Abdul-Jabbar (1978) recorded the fecun-
Fecundity of *Limanda limanda*.

Fecundity = \( \frac{\text{Mean number of eggs in the sub-sample} \times \text{weight of whole ovary}}{\text{Mean weight of the sub-sample}} \)

**Observations**

Fecundity of the dab *L. limanda*, was estimated for fish with total length between 15 cm and 33 cm. The results are presented in Table 1. Values vary from 33,000 to 943,500 eggs. The fecundity was estimated in three ways:

<table>
<thead>
<tr>
<th>Observations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fecundity of the dab <em>L. limanda</em>, was estimated for fish with total length between 15 cm and 33 cm. The results are presented in Table 1. Values vary from 33,000 to 943,500 eggs. The fecundity was estimated in three ways:</td>
</tr>
</tbody>
</table>

**Table** Fecundity estimates of the examined fish length, weight, gonad weight, and the number of eggs in five sub-samples with their mean and standard deviations.

<table>
<thead>
<tr>
<th>Length cm</th>
<th>Age years</th>
<th>Weight g</th>
<th>Gonad weight g</th>
<th>N1 w1</th>
<th>N2 w2</th>
<th>N3 w3</th>
<th>N4 w4</th>
<th>N5 w5</th>
<th>Mean sub weight</th>
<th>Mean no. eggs in sub sample</th>
<th>S.D.</th>
<th>Mean no. eggs in the ovary (Fecundity)</th>
<th>Estimated total no. of eggs in the ovary (Fecundity)</th>
<th>S.D.</th>
</tr>
</thead>
<tbody>
<tr>
<td>19.5</td>
<td>3(4)</td>
<td>74.5</td>
<td>2.27</td>
<td>833</td>
<td>622</td>
<td>898</td>
<td>770</td>
<td>-</td>
<td>0.028</td>
<td>791</td>
<td>87</td>
<td>64,128</td>
<td>7,053</td>
<td></td>
</tr>
<tr>
<td>22.0</td>
<td>4</td>
<td>99.9</td>
<td>2.95</td>
<td>1038</td>
<td>735</td>
<td>651</td>
<td>533</td>
<td>4</td>
<td>0.04</td>
<td>708</td>
<td>181.5</td>
<td>52,215</td>
<td>13,385</td>
<td></td>
</tr>
<tr>
<td>22.0</td>
<td>3(4)</td>
<td>101.8</td>
<td>2.14</td>
<td>1578</td>
<td>1155</td>
<td>1465</td>
<td>944</td>
<td>894</td>
<td>0.026</td>
<td>1207</td>
<td>273</td>
<td>99,345</td>
<td>27,136</td>
<td></td>
</tr>
<tr>
<td>24.0</td>
<td>3(4)</td>
<td>144.0</td>
<td>3.16</td>
<td>855</td>
<td>800</td>
<td>980</td>
<td>1050</td>
<td>-</td>
<td>0.083</td>
<td>920</td>
<td>99</td>
<td>35,027</td>
<td>3,807</td>
<td></td>
</tr>
<tr>
<td>24.0</td>
<td>3(4)</td>
<td>161.48</td>
<td>8.28</td>
<td>666</td>
<td>860</td>
<td>1000</td>
<td>1240</td>
<td>720</td>
<td>0.086</td>
<td>897</td>
<td>207</td>
<td>86,362</td>
<td>20,000</td>
<td></td>
</tr>
<tr>
<td>25.0</td>
<td>6(7)</td>
<td>163.1</td>
<td>5.68</td>
<td>1360</td>
<td>1500</td>
<td>800</td>
<td>1300</td>
<td>950</td>
<td>0.026</td>
<td>1182</td>
<td>263</td>
<td>260,000</td>
<td>57,500</td>
<td></td>
</tr>
<tr>
<td>27.0</td>
<td>5(6)</td>
<td>209.2</td>
<td>12.15</td>
<td>1006</td>
<td>1340</td>
<td>1260</td>
<td>1400</td>
<td>1470</td>
<td>0.052</td>
<td>1295</td>
<td>160</td>
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<tr>
<td>29.0</td>
<td>4</td>
<td>262.1</td>
<td>6.68</td>
<td>1150</td>
<td>1130</td>
<td>1014</td>
<td>940</td>
<td>1029</td>
<td>0.034</td>
<td>1053</td>
<td>78</td>
<td>206,880</td>
<td>15,500</td>
<td></td>
</tr>
<tr>
<td>29.5</td>
<td>6(7)</td>
<td>312.8</td>
<td>13.01</td>
<td>875</td>
<td>1120</td>
<td>800</td>
<td>1002</td>
<td>830</td>
<td>0.033</td>
<td>925</td>
<td>120</td>
<td>365,000</td>
<td>47,300</td>
<td></td>
</tr>
<tr>
<td>29.5</td>
<td>8(9)</td>
<td>277.7</td>
<td>13.78</td>
<td>1008</td>
<td>1190</td>
<td>900</td>
<td>920</td>
<td>1180</td>
<td>0.054</td>
<td>1040</td>
<td>124</td>
<td>265,400</td>
<td>31,640</td>
<td></td>
</tr>
<tr>
<td>30.5</td>
<td>5</td>
<td>394.0</td>
<td>32.11</td>
<td>2568</td>
<td>1571</td>
<td>1207</td>
<td>908</td>
<td>800</td>
<td>0.056</td>
<td>1411</td>
<td>637</td>
<td>809,000</td>
<td>365,250</td>
<td></td>
</tr>
<tr>
<td>31</td>
<td>5(6)</td>
<td>332.4</td>
<td>22.95</td>
<td>887</td>
<td>728</td>
<td>875</td>
<td>723</td>
<td>1025</td>
<td>0.054</td>
<td>848</td>
<td>114</td>
<td>350,000</td>
<td>47,750</td>
<td></td>
</tr>
<tr>
<td>33</td>
<td>5(6)</td>
<td>478.5</td>
<td>39.93</td>
<td>1910</td>
<td>870</td>
<td>1696</td>
<td>2142</td>
<td></td>
<td>0.062</td>
<td>1465</td>
<td>573</td>
<td>943,500</td>
<td>369,030</td>
<td></td>
</tr>
</tbody>
</table>

A. Fecundity Related to Length

The data is shown in Table 1, both varieties, fecundity and length of dab are shown in the scatter diagram (Fig. 2). Curvilinear relationship was obtained from applying the following equation:

\[
F = aL^b
\]

a logarithmic transformation gives

\[
\log F = \log a + b \log L
\]

From data given in Table 1

\[
\log F = 5.274 \log L - 2.195
\]

\[
F = 0.0046 L^{5.27}
\]

where F = Fecundity, a, b = constant, and the coefficient of correlation is

\[
(r = 0.8652, \ P = 0.001).
\]
weights yield more eggs. Regression lines have been fitted to this data on the graphs and a straight line provides an adequate fit as

\[ F(\text{Fecundity}) = a + bx \]
Fecundity of *Limanda limanda*.

\[ F(\text{Fecundity}) = a + bx \] (where \( a \) and \( b \) are constants)

In the study, \( F = 28773.9 \text{ov}^{0.913} \) (where \( \text{ov} = \text{ovary weight} \)). The coefficient of correlation \((r = 0.8822, P = 0.001)\) is slightly higher than that obtained from the fecundity-length \((r = 0.8652)\) and from fecundity-weight \((r = 0.8652)\). Also, there was a significant relationship between fecundity and length, weight or ovary weight.

**Discussion**

Kandler and Pirwitz (1957) suggested that the relationship between fecundity and length is (cube law), \( F = aL^3 \). Fecundity in the present study was calculated for *L. limanda* in Oxwich Bay, which was found to be rather higher than the cube of length.

The relationship between fecundity (\( F \)) and length (\( L \)) is usually a curve, which has been found by many authors (Bagenal, 1973; Mann, 1976 and Morse, 1981).

Bohl (1957) estimated the fecundity of *L. limanda* using the equation \((F = aL^b)\). He found that the relationship between fecundity and length is a curve where \( F = 7.2783 \text{L}^{3.4525} \) in the North Sea. Compared with the present study in *L. limanda* \( F = 0.0046 \text{L}^{5.27} \). Those differences are not unexpected, since workers using other species have also found that there are wide variations in fecundity between different population (Bagenal, 1973; Mann, 1974). Also, when compared with species of flatfish in other areas, such as *P. platessa* from South and West Ireland, produced values of 140,000 to 153,000 eggs. In contrast Simpson (1959) found the fecundity of plaice in the North Sea was between 136,611 and 171,080 eggs. The fecundity of plaice, *P. platessa* in Carmarthen Bay was between 73,381 eggs for 27.3 cm total length of 153,945 eggs for 35 cm total length (Abdul-Jabbar, 1978). Bagenal (1957), working on the long rough dab *H. platessoides* in the Clyde Sea found that the fecundity varied between 25,000 eggs for 15 cm total length to 250,000 eggs for 30 cm total length and Pitt (1971) found that the fecundity of yellow fail flounder *Limanda ferruginea*, on the Grand Bank, Newfoundland, ranged from 350,000 to 570,000 eggs.

In the present study, the fecundity of *L. limanda* in Oxwich Bay was between 33,051 eggs for 20 cm total length to 280,018 eggs for 30 cm total length, \( F = 0.0046 \text{L}^{5.27} \), which is different than other workers on dabs such as Bohl (1957) and Pitt (1971). This difference may be caused by many factors, such as, food, population density or temperature (Bagenal, 1973). Dahlgren (1979) found that fecundity and fertility decreased by increased population density of adult guppies, *Poecilia reticulata*. Scott (1962) showed that when groups of rainbow trout, *Salmo gairdneri*, were kept on different ration levels shortage of food reduced both the percentage of female spawning, and their fecundity. Hislop et al. (1978), reported that a reduction in available food in haddock, *Melanogrammus aeglefinus*, resulted in a lowering of their fecundity.

When fecundity is related to body weight the data point close to linear line (Fig. 3) and log. \( F = 1.532 \log. W - 1.57 \) or \((W = 57.148 W^{1.532})\) which is less than fecundity that has been obtained from *L. limanda* in the North Sea, log \( F = 3996.17 W - 9214.83 \).
تقييم الخصوبة في أسماك *Limanda limanda*

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كلية علوم البحار، جامعة الملك عبد العزيز
جدة - المملكة العربية السعودية

المستخلص. تعتبر أسماك *Limanda limanda* من الأسماك الفرعية النترذية، وهي هامة من الناحية التسويقية في الأسواق الأوروبية. ويشمل هذا البحث تقدير الخصوبة ومعتدلاتها بالنسبة لطول السمكة وزنها، وكذلك الخصوبة بالنسبة لوزن البيض.

ولقد وجد أن هناك علاقة بين طول السمكة وعدد البيض مُمثل بخط منحني، واستنتجت المعادلة الرياضية التي تُمثل تلك العلاقة 

\[ F = 0.0046 \times L^{5.27} \]

وأيضًا تم توضيح العلاقة اللوغاريتمية بين خط الخصوبة ووزن السمكة.