4
Choosing and interpreting diversity measures

Given the large number of indices and models it is often difficult to decide which is the best method of measuring diversity. One good way to get a ‘feel’ for diversity measures is to test their performance on a range of data sets. There are two approaches to this. First, by looking at contrived data it is possible to observe how the different measures react to changes in the two major components of diversity, species richness and evenness. However, in the real world it is rare for richness and evenness to vary independently in the way they so often do in artificial data sets. The second, and more realistic, approach therefore is to test the response of diversity measures to species abundances from genuine ecological communities. This chapter begins by comparing the behaviour of a range of diversity measures and models when used to estimate the diversity of two data sets, one contrived and one real. The difficulties of deciding the appropriateness of one species abundance distribution over another have already been mentioned (see Chapter 2) and quickly become apparent when models are fitted to data. Often the problems arise when a goodness of fit test fails to discriminate between different distributions. The value of goodness of fit tests in conjunction with, or instead of, graphical methods is considered in the context of the analysis of data sets.

A rather more scientific method of selecting a diversity index is on the basis of whether it fulfils certain functions or criteria. In the second part of the chapter diversity measures are assessed in relation to four criteria: ability to discriminate between sites, dependence on sample size, what component of diversity is being measured, and whether the index is widely used and understood.

The chapter concludes with a list of guidelines for choosing and using diversity measures.

Richness, evenness and the killer quail

An ecologist investigates the bird diversity of three little known woodlands in a remote European country. In each case the birds visible or audible from...
Choosing and interpreting diversity measures

random positions along transects are counted until the total number of individuals recorded reaches 500. Rank abundance plots are constructed and diversity estimated using nine of the more popular indices. The fit, or otherwise, of the log series, log normal and broken stick models is assessed. All methods are described fully in Chapter 2.

Inspection of the data (Table 4.1) shows immediately that species richness

Table 4.1  Bird species abundance in remote European woodlands. For more details see text.

<table>
<thead>
<tr>
<th></th>
<th>Hidden Glen</th>
<th>Wild Wood</th>
<th>Lonely Pines</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spotted ratcatcher</td>
<td>1</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Killer quail</td>
<td>3</td>
<td>16</td>
<td>354</td>
</tr>
<tr>
<td>Riff raff</td>
<td>2</td>
<td>3</td>
<td>7</td>
</tr>
<tr>
<td>Slyneck</td>
<td>1</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Oat crake</td>
<td>4</td>
<td>10</td>
<td>29</td>
</tr>
<tr>
<td>Cold start</td>
<td>5</td>
<td>13</td>
<td>4</td>
</tr>
<tr>
<td>Big dipper</td>
<td>1</td>
<td>30</td>
<td>3</td>
</tr>
<tr>
<td>Shylark</td>
<td>1</td>
<td>14</td>
<td>12</td>
</tr>
<tr>
<td>Startling</td>
<td>18</td>
<td>22</td>
<td>18</td>
</tr>
<tr>
<td>Deadwing</td>
<td>1</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Crook</td>
<td>2</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>Nightcap</td>
<td>63</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>Golden lover</td>
<td>2</td>
<td>19</td>
<td>1</td>
</tr>
<tr>
<td>Baby bunting</td>
<td>1</td>
<td>18</td>
<td>1</td>
</tr>
<tr>
<td>Mute swain</td>
<td>1</td>
<td>14</td>
<td>2</td>
</tr>
<tr>
<td>Chinese kite</td>
<td>1</td>
<td>15</td>
<td>0</td>
</tr>
<tr>
<td>Brownie owl</td>
<td>16</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Hen hurrier</td>
<td>15</td>
<td>27</td>
<td>1</td>
</tr>
<tr>
<td>Grrrrr falcon</td>
<td>60</td>
<td>36</td>
<td>0</td>
</tr>
<tr>
<td>Gosh hawk</td>
<td>1</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Cough</td>
<td>1</td>
<td>47</td>
<td>0</td>
</tr>
<tr>
<td>Flapwing</td>
<td>8</td>
<td>38</td>
<td>18</td>
</tr>
<tr>
<td>Not</td>
<td>16</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>Bar-tailed nitwit</td>
<td>127</td>
<td>6</td>
<td>0</td>
</tr>
<tr>
<td>Snoop</td>
<td>9</td>
<td>7</td>
<td>0</td>
</tr>
<tr>
<td>Funny tern</td>
<td>18</td>
<td>8</td>
<td>1</td>
</tr>
<tr>
<td>Cut throat</td>
<td>3</td>
<td>16</td>
<td>0</td>
</tr>
<tr>
<td>Throttled dove</td>
<td>4</td>
<td>32</td>
<td>0</td>
</tr>
<tr>
<td>Ribbon</td>
<td>3</td>
<td>19</td>
<td>1</td>
</tr>
<tr>
<td>Backchat</td>
<td>11</td>
<td>6</td>
<td>1</td>
</tr>
<tr>
<td>Missile thrush</td>
<td>6</td>
<td>7</td>
<td>1</td>
</tr>
<tr>
<td>Cold tit</td>
<td>7</td>
<td>8</td>
<td>11</td>
</tr>
<tr>
<td>Twit</td>
<td>8</td>
<td>16</td>
<td>9</td>
</tr>
<tr>
<td>Yellow spanner</td>
<td>63</td>
<td>27</td>
<td>10</td>
</tr>
<tr>
<td>Born howl</td>
<td>17</td>
<td>4</td>
<td>3</td>
</tr>
</tbody>
</table>