APPENDIX A: Upwelling Index

Figure A1. The smoothed daily upwelling index at 36N 122W generated by the Pacific Environmental Fisheries Laboratory, National Oceanic and Atmospheric Administration. Months is on the x-axis (from October 2009 to March 2011) and upwelling index (m$^3$/sec/100 meters of coastline) is on the y-axis. Solid line indicates the daily upwelling index, which has been smoothed with a 3-day, 3rd order, forward-reverse Butterworth filter. The dashed line is a biharmonic fit to the daily upwelling index from 1967-1991. The horizontal bars are the monthly mean upwelling index, and the shaded area denotea one standard error around the biharmonic fit. (Graphic from http://www.pfeg.noaa.gov/products/PFELmodeleled/indices/upwelling/NA/daily_upwell_graphs.html)

APPENDIX B: Data Processing Details


Sampling dates using 3-5 m bin for median calculation of chl a (month/day/year): 6/21/2005

APPENDIX C: Standardized residuals vs. fitted value plots

Year-long data

Univariate regressions

**Non-transformed chl a**

Chl a and temperature

**Transformed chl a**

ln(chl a) and temperature

Chl a and salinity

ln(chl a) and salinity
Multiple regression

Non-transformed chl a

Regression with PCA

Non-transformed chl a

Transformed chl a
On season data

Univariate regressions

*Non-transformed chl a*

- Chl $a$ and temperature
- Chl $a$ and salinity

*Transformed chl a*

- ln(chl $a$) and temperature
- ln(chl $a$) and salinity
Multiple regression

Non-transformed chl a

Transformed chl a

Regression with PCA

Non-transformed chl a

Transformed chl a
Off season data

Univariate regressions

Chl \(a\) and temperature

\[ \text{ln(chl } a) \text{ and temperature} \]

Chl \(a\) and salinity

\[ \text{ln(chl } a) \text{ and salinity} \]
Multiple regression

Non-transformed chl a

Regression with PCA

Non-transformed chl a
APPENDIX D: PCA Details

Table D1. Essential principal components combining temperature, salinity, and DO for all months.

<table>
<thead>
<tr>
<th>Component</th>
<th>Eigenvalue</th>
<th>Proportion</th>
<th>Cumulative</th>
</tr>
</thead>
<tbody>
<tr>
<td>pc1</td>
<td>1.723</td>
<td>0.5745</td>
<td>0.5745</td>
</tr>
<tr>
<td>pc2</td>
<td>0.697</td>
<td>0.2325</td>
<td>0.8069</td>
</tr>
</tbody>
</table>

Equation D1. Eigenvectors for pc1.

\[ pc1 = 0.5470 \times \text{Temperature} + 0.6023 \times \text{Salinity} - 0.5814 \times \text{DO} \]

Equation D2. Eigenvectors for pc2.

\[ pc2 = 0.8143 \times \text{Temperature} - 0.2217 \times \text{Salinity} + 0.5364 \times \text{DO} \]

Table D2. Essential principal components combining temperature, salinity, and DO for upwelling on season.

<table>
<thead>
<tr>
<th>Component</th>
<th>Eigenvalue</th>
<th>Proportion</th>
<th>Cumulative</th>
</tr>
</thead>
<tbody>
<tr>
<td>pc1\text{on}</td>
<td>1.3551</td>
<td>0.4517</td>
<td>0.4517</td>
</tr>
<tr>
<td>pc2\text{on}</td>
<td>1.0447</td>
<td>0.3382</td>
<td>0.7999</td>
</tr>
</tbody>
</table>

Equation D3. Eigenvectors for pc1\text{on}.

\[ pc1\text{on} = 0.7276 \times \text{Temperature} + 0.4358 \times \text{Salinity} + 0.5298 \times \text{DO} \]

Equation D4. Eigenvectors for pc2\text{on}.

\[ pc2\text{on} = 0.0185 \times \text{Temperature} + 0.7596 \times \text{Salinity} - 0.6502 \times \text{DO} \]

Table D3. Essential principal components combining temperature, salinity, and DO for upwelling off season.

<table>
<thead>
<tr>
<th>Component</th>
<th>Eigenvalue</th>
<th>Proportion</th>
<th>Cumulative</th>
</tr>
</thead>
<tbody>
<tr>
<td>pc1\text{off}</td>
<td>1.8488</td>
<td>0.6162</td>
<td>0.6162</td>
</tr>
<tr>
<td>pc2\text{off}</td>
<td>0.7313</td>
<td>0.2438</td>
<td>0.8600</td>
</tr>
</tbody>
</table>

Equation D5. Eigenvectors for pc1\text{off}.

\[ pc1\text{off} = 0.4906 \times \text{Temperature} + 0.6135 \times \text{Salinity} - 0.6188 \times \text{DO} \]

Equation D6. Eigenvectors for pc2\text{off}.

\[ pc2\text{off} = 0.8709 \times \text{Temperature} - 0.3684 \times \text{Salinity} + 0.3253 \times \text{DO} \]
### APPENDIX E: Regression Results

Table E1. $R^2$ and p-values for models tested with non-transformed chl a values. * denotes significant p-value ($p<0.05$), ** denotes a very significant p-value ($p<0.01$), *** denotes a highly significant p-value ($p<0.001$)

<table>
<thead>
<tr>
<th>Regression type</th>
<th>Explanatory variable</th>
<th>$R^2$</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Year-long data</strong></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Individual</td>
<td>Temperature</td>
<td>0.014</td>
<td>0.096</td>
</tr>
<tr>
<td></td>
<td>Salinity</td>
<td>0.029</td>
<td>0.016*</td>
</tr>
<tr>
<td></td>
<td>DO</td>
<td>0.042</td>
<td>0.006**</td>
</tr>
<tr>
<td>Multiple</td>
<td>all</td>
<td>0.057</td>
<td>--</td>
</tr>
<tr>
<td></td>
<td>Temperature</td>
<td>--</td>
<td>0.922</td>
</tr>
<tr>
<td></td>
<td>Salinity</td>
<td>--</td>
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<tr>
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<td>DO</td>
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<td>0.084</td>
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<tr>
<td>PCA</td>
<td>All</td>
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<tr>
<td></td>
<td>pc1</td>
<td>--</td>
<td>0.003**</td>
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<tr>
<td></td>
<td>pc2</td>
<td>--</td>
<td>0.257</td>
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<tr>
<td><strong>On season data</strong></td>
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</tr>
<tr>
<td>Individual</td>
<td>Temperature</td>
<td>0.0946</td>
<td>0.013*</td>
</tr>
<tr>
<td></td>
<td>Salinity</td>
<td>0.0535</td>
<td>0.064</td>
</tr>
<tr>
<td></td>
<td>DO</td>
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<td>0.561</td>
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<tr>
<td>Multiple</td>
<td>all</td>
<td>0.221</td>
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</tr>
<tr>
<td></td>
<td>Temperature</td>
<td>--</td>
<td>0.001***</td>
</tr>
<tr>
<td></td>
<td>Salinity</td>
<td>--</td>
<td>0.006**</td>
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<tr>
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<td>DO</td>
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<td>pc1</td>
<td>--</td>
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<tr>
<td></td>
<td>pc2</td>
<td>--</td>
<td>0.088</td>
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</table>

Table E2. $R^2$ and p-values for models tested with ln(chl a) values. ** denotes a very significant p-value ($p<0.01$), *** denotes a highly significant p-value ($p<0.001$)

<table>
<thead>
<tr>
<th>Regression type</th>
<th>Explanatory variable</th>
<th>$R^2$</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Off season data</strong></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Individual</td>
<td>Temperature</td>
<td>0.005</td>
<td>0.551</td>
</tr>
<tr>
<td></td>
<td>Salinity</td>
<td>0.157</td>
<td>0.001**</td>
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<tr>
<td></td>
<td>DO</td>
<td>0.272</td>
<td>&lt;0.0005***</td>
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<tr>
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<td>all</td>
<td>0.333</td>
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<td>Temperature</td>
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<td>0.197</td>
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<tr>
<td></td>
<td>Salinity</td>
<td>--</td>
<td>0.063</td>
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<tr>
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<td>DO</td>
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<td>0.005**</td>
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<td>PCA</td>
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<tr>
<td></td>
<td>pc1</td>
<td>--</td>
<td>&lt;0.0005***</td>
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<tr>
<td></td>
<td>pc2</td>
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<td>0.007**</td>
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