**Larval English sole chapter:**

*Question: How do environmental conditions influence the growth of larval English sole in the Northern California Current?*

H1A: English sole collected in regions of local retention or consistent frontal activity will experience higher rates of early daily growth compared to those collected in more dispersive regions

H1B: Larval English sole with warmer temps, lower wind stress, and higher stratification will exhibit higher feeding success and faster growth

H1C: Higher growth will be associated with higher abundances of prey

H1D: Larval prey selectivity will be reduced in instances of reduced appendicularian abundance, such that a greater variety of prey items in the guts will be lower and overall gut fullness will be lower.

**Things to do:**

1. Larval inventory:
   1. By station per MOC1/ MOC4 **DONE**
   2. **Go through inventory sheet and make sure the \*picked\* lines are labeled as such**
   3. Pick out fish vials from SPECTRA and make sure all are accounted for
2. **Size distributions for 2018 + 2019**
   1. **Finish measuring the sizes for MEZCAL**
   2. See document under /Data/Measurements
3. **Start Measuring SPECTRA fish**
   1. Must all be measured
4. With the measurements:
   1. Make MOC1 and MOC4 distributions
   2. Distributions between years
   3. Distributions within years
   4. Distributions with nets as different colors? (Histograms)
   5. Stations?
   6. For SPECTRA: look at the distributions between the different stations too
   7. If there are differences in the distributions or a non-unimodal distribution, may be able to do some kind of selective mortality study- double up the sample sizes for the interannual comparison at NH
5. Calculate MOCNESS volumes + calculate larval concentrations
   1. Get MEZCAL net volumes and calculate per station volumes for concentrations
   2. Figure out SPECTRA net volumes
      1. Compare the computed volumes with the “measured” ones- look for outliers
      2. Do we trust the flowmeter?
      3. Output file right now has the volume – should we just use that?
         1. Make a demonstration of the \*measured\* volume vs. the estimate from MEZCAL methods
6. MEZCAL temperature and salinity information:
   1. Do I have to go back through the raw data files for the MEZCAL MOCNESS and extract the temperature data? Or is there anywhere where the temperature data exist?
7. Map the concentrations by *station* for the four years, including the zeroes
   1. Potentially could also plot the concentration through the water column for each station (might look messy on a map though)
8. Dissecting otoliths:
   1. 50 PRACTICE
      1. These do not necessarily need to be “thrown away”- just the read will be thrown away.
      2. When reading otoliths, **the readings will change over time – need to make sure that there is consistency in the reading**
   2. Selecting fish:
      1. Must be random (or random within a size distribution)
   3. Dissect and read otoliths **first** before doing gut contents analysis
      1. Make sure that fish have individual vials and are labeled and numbered
   4. Start with the interannual comparison –
      1. **2018- 30**
      2. **2019- 30**
      3. **2022- 30**
      4. **2023- 30**
   5. Then within year spatial comparison
      1. 2022: HH- 25, CR- 25, GH-25
      2. 2023: HH-25, CR-25, GH-25

Look into external data for wind, mixing, etc.

**Measuring larvae:**

**Sample size estimates for otoliths:**

Between year:

NH 2018- 30

NH 2019- 30

NH 2022- 30

NH 2023- 30

TOTAL- 120

Within Year:

2022 + 2023

GH- 25 x2

CR- 25 x2

HH – 25 x2

(additional 150 fish)

**Life history traits:**

Larval English sole do not deposit first increment until 5d after hatching -- +5 to age estimates

Winter 2018

NH

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Transect** | **Station** | **Net No** | **Number Larvae** | **Sum Station** | |
| MaD | 5 | 1-oblique | 1 | MOC1: 1 | |
| MaD | 1 | 1-oblique | 2 | MOC1: 3 | MOC4: 9 |
| MaD | 1 | 1-oblique | 1 |
| MaD | 1 | 4-0 | 1 |
| MaD | 1 | 4-3 | 8 |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Transect** | **Station** | **Net No** | **Number Larvae** | **Sum Station** | |
| MbD | 3 | 1-0\* | 1 | 1 | |
| MbD | 2 | 1-oblique | 6 | MOC1:  7 | MOC4:  14 |
| MbD | 2 | 1-4\* | 1 |
| MbD | 2 | 4-oblique | 14 |
| MbD | 1 | 1-0 | 173 | MOC1:  312 | MOC4:  198 |
| MbD | 1 | 1-0\* | 94 |
| MbD | 1 | 1-3 | 6 |
| MbD | 1 | 1-4 | 17 |
| MbD | 1 | 1-4\* | 22 |
| MbD | 1 | 4-0 | 197 |
| MbD | 1 | 4-3 | 1 |

Winter 2019

NH

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Transect** | **Station** | **Net No** | **Number Larvae** | **Sum Station** | |
| MaD | 4 | 1-4 | 5 | MOC1: 5 | MOC4:  8 |
| MaD | 4 | 4-0 | 2 |
| MaD | 4 | 4-4 | 6 |
| MaD | 3 | 1-3 | 1 | MOC1:  9 | MOC4:  15 |
| MaD | 3 | 1-4 | 7 |
| MaD | 3 | 1-4\* | 1 |
| MaD | 3 | 4-0 | 2 |
| MaD | 3 | 4-2 | 1 |
| MaD | 3 | 4-3 | 3 |
| MaD | 3 | 4-4 | 9 |
| MaD | 2 | 1-0 | 4 | MOC1:  17 | MOC4:  42 |
| MaD | 2 | 1-2 | 1 |
| MaD | 2 | 1-3 | 3 |
| MaD | 2 | 1-4 | 9 |
| MaD | 2 | 4-0 | 9 |
| MaD | 2 | 4-3 | 13 |
| MaD | 2 | 4-4 | 20 |
| MaD | 1 | 1-0 | 2 | MOC1:  19 | MOC4:  143 |
| MaD | 1 | 1-3 | 3 |
| MaD | 1 | 1-4 | 14 |
| MaD | 1 | 4-0 | 15 |
| MaD | 1 | 4-3 | 11 |
| MaD | 1 | 4-4 | 117 |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Transect | Station | Net No | Number Larvae | Sum Station | | |
| MbD | 5 | 4-3 | 1 | MOC4: 1 | | |
| MbD | 4 | 1-0 | 3 | MOC1: 8 (+4 picked) | | MOC4:  3 |
| MbD | 4 | 1-1 | 1 |
| MbD | 4 | 1-3 | 1 |
| MbD | 4 | 1-4 | 3 |
| MbD | 4 | 1-4\* | 4 |
| MbD | 4 | 4-0 | 1 |
| MbD | 4 | 4-3 | 2 |
| MbD | 3 | 1-0 | 4 | MOC1:  8 | MOC4:  23 | |
| MbD | 3 | 1-2 | 2 |
| MbD | 3 | 1-4 | 2 |
| MbD | 3 | 4-0 | 16 |
| MbD | 3 | 4-1 | 1 |
| MbD | 3 | 4-2 | 2 |
| MbD | 3 | 4-3 | 1 |
| MbD | 3 | 4-4 | 3 |
| MbD | 2 | 1-0 | 61 | MOC1:  163 (+9 picked) | MOC4:  368 | |
| MbD | 2 | 1-2 | 18 |
| MbD | 2 | 1-3 | 51 |
| MbD | 2 | 1-4 | 33 |
| MbD | 2 | 1-4\* | 9 |
| MbD | 2 | 4-0 | 72 |
| MbD | 2 | 4-2 | 34 |
| MbD | 2 | 4-3 | 20 |
| MbD | 2 | 4-4 | 242 |
| MbD | 1 | 1-0 | 9 | MOC1:  55 (+ 16 picked) | MOC4:  136 | |
| MbD | 1 | 1-3 | 14 |
| MbD | 1 | 1-4 | 32 |
| MbD | 1 | 1-4\* | 17 |
| MbD | 1 | 4-0 | 7 |
| MbD | 1 | 4-3 | 6 |
| MbD | 1 | 4-4 | 123 |

Winter 2022 (NOT ALL NETS DONE)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Transect | Station | Net No | Number Larvae | Sum Station | | |
| GH | 2 | 1-0 | 3 | MOC1:  7 | | MOC4:  18 |
| GH | 2 | 1-3 | 3 |
| GH | 2 | 1-3 | 1 |
| GH | 2 | 4-0 | 6 |
| GH | 2 | 4-3 | 12 |
| GH | 1 | 4-0 | 1 | MOC4: 2 | | |
| GH | 1 | 4-4 | 1 |
| CR | 4 | 4-0 | 1 | MOC4: 1 | | |
| CR | 3 | 4-4 | 1 | MOC4:1 | | |
| CR | 1 | 1-0 | 2 | MOC1: 29 | | MOC4:  10 |
| CR | 1 | 1-3 | 3 |
| CR | 1 | 1-4 | 24 |
| CR | 1 | 4-4 | 10 |
| CR | 2 | 1-0 | 6 | MOC1:  15 (+11 picked) | | MOC4:  31 |
| CR | 2 | 1-2 | 2 |
| CR | 2 | 1-4 | 7 |
| CR | 2 | 1-4\* | 11 |
| CR | 2 | 4-0 | 4 |
| CR | 2 | 4-2 | 1 |
| CR | 2 | 4-3 | 1 |
| CR | 2 | 4-4 | 25 |
| CM | 3 | 1-4 | 2 | MOC1:  2 | MOC4:  1 | |
| CM | 3 | 4-0 | 1 |
| CM | 2 | 1-3 | 1 | MOC1:  1 | MOC4:  9 | |
| CM | 2 | 4-2 | 4 |
| CM | 2 | 4-3 | 5 |
| CM | 1 | 1-0 | 8 | MOC1:  10 | MOC4:  4 | |
| CM | 1 | 1-4 | 2 |
| CM | 1 | 4-0 | 2 |
| CM | 1 | 4-4 | 2 |
| NH | 6 | 1-1 | 2 | MOC1: 2 | MOC4: 1 | |
| NH | 6 | 4-4 | 1 |
| NH | 5 | 1-4 | 1 | MOC1:  1 | MOC4:  1 | |
| NH | 5 | 4-0 | 1 |
| NH | 4 | 1-2 | 1 | MOC1:  1 | MOC4:  1 | |
| NH | 4 | 4-0 | 1 |
| NH | 1 | 1-0 | 1 | MOC1:  5 | MOC4:  27 | |
| NH | 1 | 1-3 | 1 |
| NH | 1 | 1-4 | 3 |
| NH | 1 | 4-0 | 16 |
| NH | 1 | 4-3 | 9 |
| NH | 1 | 4-4 | 22 |
| HH | 2 | 1-0 | 1 | MOC1:  4 (+1 picked) | MOC4:  7 | |
| HH | 2 | 1-3 | 1 |
| HH | 2 | 1-4 | 2 |
| HH | 2 | 1-4\* | 1 |
| HH | 2 | 4-0 | 1 |
| HH | 2 | 4-1 | 2 |
| HH | 2 | 4-2 | 3 |
| HH | 2 | 4-4 | 1 |
| HH | 1 | 1-0 | 7 | MOC1:  12 (+1 picked) | MOC4L  8 | |
| HH | 1 | 1-4 | 5 |
| HH | 1 | 1-4\* | 1 |
| HH | 1 | 4-0 | 2 |
| HH | 1 | 4-4 | 6 |
| RR | 1 | 4-0 | 1 | MOC4 :1 | | |
| RR | 2 | 4-0 | 2 | MOC4: 3 | | |
| RR | 2 | 4-4 | 1 |
| RR | 3 | 4-0 | 2 | MOC4:2 | | |
| RR | 4 | 1-3 | 1 | MOC1: 2 | | MPC4: 8 |
| RR | 4 | 1-4 | 1 |
| RR | 4 | 4-0 | 2 |
| RR | 4 | 4-3 | 6 |

Winter 2023 (NOT ALL NETS DONE)

Missing: (CM + RR were not sampled!)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Transect | Station | Net No | Number Larvae | Sum Station | | Nets not finished |
| GH | 3 | 1-2 | 5 | MOC1:  23 | MOC4:  38 | MOC1 Net 0  MOC1 Net 4 picked  MOC4 net 0 |
| GH | 3 | 1-3 | 2 |
| GH | 3 | 1-4 | 14 |
| GH | 3 | 4-3 | 3 |
| GH | 3 | 4-4 | 35 |
| GH | 2 | 1-3 | 4 | MOC1:  31 | MOC4:  88 | MOC1 Net 0  MOC1 Net 4 picked  MOC4 net 0 |
| GH | 2 | 1-4 | 27 |
| GH | 2 | 4-2 | 1 |
| GH | 2 | 4-3 | 32 |
| GH | 2 | 4-4 | 55 |
| GH | 1 | 1-3 | 26 | MOC1:  259 | MOC4:  164 | MOC1 net 0  MOC 1 net 4 picked  MOC4 net 0 |
| GH | 1 | 1-4 | 233 |
| GH | 1 | 4-3 | 4 |
| GH | 1 | 4-4 | 160 |
| CR | 1 | 1-3 | 57 | MOC1: 113 | | MOC1 net 0,  MOC1 net 4 picked  MOC1 net 0 |
| CR | 1 | 1-4 | 56 |
| CR | 2 | 1-3 | 2 | MOC1: 7 | MOC4:  7 | MOC 1 net 0,  MOC 1 net 4 picked  MOC 4 net 0 |
| CR | 2 | 1-4 | 5 |
| CR | 2 | 4-3 | 3 |
| CR | 2 | 4-4 | 4 |
| NH | 5 | 4-3 | 1 | MOC4: 1 | | MOC1 net 0  MOC1 net 4 picked  MOC 4 net 0 |
| NH | 3 | 1-3 | 3 | MOC 1: 3 | | MOC1 net 4 picked |
| NH | 2 | 1-2 | 1 | MOC1:  3 | MOC4:  22 | MOC 1 net 4 picked |
| NH | 2 | 1-4 | 2 |
| NH | 2 | 4-0 | 10 |
| NH | 2 | 4-2 | 1 |
| NH | 2 | 4-3 | 8 |
| NH | 2 | 4-4 | 3 |
| NH | 1 | 1-0 | 65 | MOC1:  672 | MOC4:  376 | MOC 1 net 4 picked |
| NH | 1 | 1-3 | 1 |
| NH | 1 | 1-4 | 606 |
| NH | 1 | 4-0 | 17 |
| NH | 1 | 4-3 | 2 |
| NH | 1 | 4-4 | 367 |
| HH | 3 | 1-1 | 1 | MOC1:  65 | MOC4:  41 | MOC 1 net 0  MOC 1 net 4 picked  MOC4 net0 |
| HH | 3 | 1-2 | 14 |
| HH | 3 | 1-3 | 9 |
| HH | 3 | 1-4 | 41 |
| HH | 3 | 4-2 | 24 |
| HH | 3 | 4-3 | 21 |
| HH | 3 | 4-4 | 15 |
| HH | 2 | 1-1 | 6 | MOC1:  62 | MOC4:  315 | MOC1 net 0  MOC1 net 4 picked  MOC 4net 0 |
| HH | 2 | 1-2 | 1 |
| HH | 2 | 1-4 | 55 |
| HH | 2 | 4-1 | 2 |
| HH | 2 | 4-4 | 313 |
| HH | 1 | 1-3 | 79 | MOC1:  114 | MOC4:  209 | MOC 1 net 0  MOC1 net 4 picked  MOC4 net 0 |
| HH | 1 | 1-4 | 35 |
| HH | 1 | 4-3 | 133 |
| HH | 1 | 4-4 | 76 |