*The following supplement accompanies the article*

# Relative importance of predatory versus non-predatory mortality for dominant copepod species in the northern Chilean (23°S) Humboldt Current System

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Table S1: Formulations and Parameters for estimates Stage durations, predatory and non-predatory mortality rates.

| **Parameter** | **Symbol** | **Unit** | **Note** |
|---|---|---|---|
| Stage duration | $D$ | Days | Stage-specific $D_i$ is indicated by subscript $i$; $i+1$ for consecutive stages |
| Development time | $a_i$ | Days | Stage-specific $a_i$ is indicated by subscript $i$ |
| Temperature | $T$ | °C | Estimated from field conditions |
| Alpha | $\alpha$ | °C | Solved by nonlineal least square regression (*nls* function in R) |
| Beta | $b$ | Dimensionless | |
| Molting rates | $MR$ | $d^{-1}$ | Stage-specific MR is indicated by subscript $i$ |
| Number of individuals in molting rate experiment | $N$ | Dimensionless | Consecutive stages are indicated by subscripts $i$ and $i+1$ |
| Time | $t$ | h | |
| Abundances | $A$ | $ind.m^{-3}$ | Used for Abundances ratio in Predatory mortality rates. Consecutive stages are indicated by subscripts $i$ and $i+1$ and adults ($A_q$) |
| Predatory mortality rates | $\delta$ | $d^{-1}$ | Solved for iteratively |
| Proportions of individuals | $\pi$ | | $\pi_1$ y $\pi_2$ are proportions live and dead, respectively in stage $i$ ; $\pi_3$ y $\pi_4$ are proportions live and dead, respectively in stage $i+1$ |
| Carcasses turnover time | $\tau$ | days | |

| | | | |
|---|---|---|---|
| Total mortality | *mt* | $d^{-1}$ | |
| Non-predatory mortality rates | *m* | $d^{-1}$ | |

**Calculations of stage durations:**

Stage duration from Bèlehràdek equation (1935)

$Di = a_i (T - \alpha)^b$ (1)

MR method (Runge et al. 1985; Kimmerer & McKinnon 1987)

$MR = (\frac{N_i + N_{i+1}}{N_i}) \times t$ (2)

$ai=1/MR$ (3)

**Calculations from non-predatory mortality**

Carcasses turnover time (Elliott et al., 2010)

$$\tau = e^{(\frac{3,83}{4,166(1-e^{-0,008T})+0,046DO}-1,39)} \quad (4)$$

Predatory mortality rates (from VLT equations; Elliott and Tang, 2011)

$$\frac{Ai}{Ai+1} = \frac{1-\pi_1 e^{(-\delta i Di)} - \pi_2 e^{(-\delta i \tau)}}{\pi_1 e^{(-\delta i Di)}[1-\pi_3 e^{(-\delta i Di+1)} - \pi_4 e^{(-\delta i \tau)}]} \quad (5)$$

$$\frac{Ai}{Aq} = \frac{1-\pi_1 e^{(-\delta i Di)} - \pi_2 e^{(-\delta i \tau)}}{\pi_1 e^{(-\delta i Di)}[1-\pi_4 e^{(-\delta i \tau)}]} \quad (6)$$

Total mortality rates (from VLT equations; Elliott and Tang, 2011)

$$Total\ mortality\ (mt, d^{-1}) = \mathrm{Ai} + 1\ (\frac{e^{(\delta i Di)} - 1}{1 - e^{(\delta i Di+1)}}) \quad (7)$$

Non-predatory mortality rates (Elliott and Tang, 2011; Tang and Elliott, 2014)

Once predatory and total mortality rates had been calculated, non-predatory mortality rate is then calculated as the difference between total and predatory mortality rate:

$$m = mt - \delta \quad (8)$$

Table S2: Oceanographic variables in Mejillones Bay during 2010−2011.

| **Variable** | **2010** | | | | **2011** | | | |
|---|---|---|---|---|---|---|---|---|
| | Mean | Max. | Min. | SD | Mean | Max. | Min. | SD |
| Temperature at 10 m (°C) | 13.39 | 14.37 | 12.62 | 0.72 | 13.19 | 14.10 | 12.63 | 0.38 |
| Temperature at 50 m (°C) | 14.55 | 15.52 | 13.09 | 0.78 | 14.55 | 15.52 | 13.31 | 0.77 |
| Salinity at 10 m | 34.75 | 34.83 | 34.62 | 0.07 | 34.78 | 34.83 | 34.77 | 0.02 |
| Salinity at 50 m | 34.80 | 34.85 | 34.75 | 0.03 | 34.80 | 34.83 | 34.75 | 0.03 |
| Dissolved oxygen at 10 m (mL $L^{-1}$) | 2.86 | 5.42 | 1.22 | 1.30 | 0.98 | 3.02 | 0.00 | 0.99 |
| Dissolved oxygen at 50 m (mL $L^{-1}$) | 0.47 | 3.02 | 0.00 | 0.98 | 3.37 | 1.24 | 5.42 | 1.22 |
| Chlorophyll *a* at 10 m [mg $m^{-3}$] | 24.03 | 102.0 | 0.60 | 31.22 | 4.19 | 10.08 | 0.93 | 2.85 |
| Chlorophyll *a* at 50 m [mg $m^{-3}$] | 25.20 | 116.8 | 0.02 | 36.21 | 1.56 | 9.98 | 0.04 | 2.74 |

Table S3: Results of two-factor General Linear Model (GLM) for stage durations as functions of months and developmental stages. * indicates significant difference at $p < 0.05$.

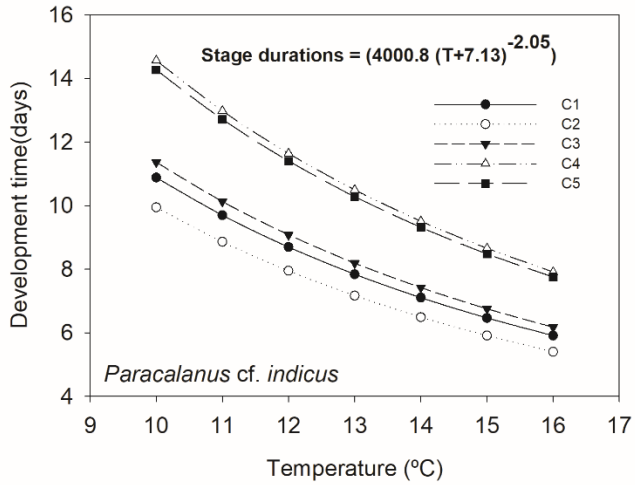
| **Variable** | | **Stage duration** | | |
|---|---|---|---|---|
| | | **df** | **F** | ***p*** |
| *P.* cf. *indicus* | Months | 23 | 2.77 | 0.000* |
| | Stages | 4 | 1.73 | 0.000* |
| *A. tonsa* | Months | 23 | 1.18 | 0.000* |
| | Stages | 4 | 2.41 | 0.000* |
| *C. chilensis* | Months | 23 | 7.45 | 0.000* |
| | Stages | 4 | 5.78 | 0.000* |

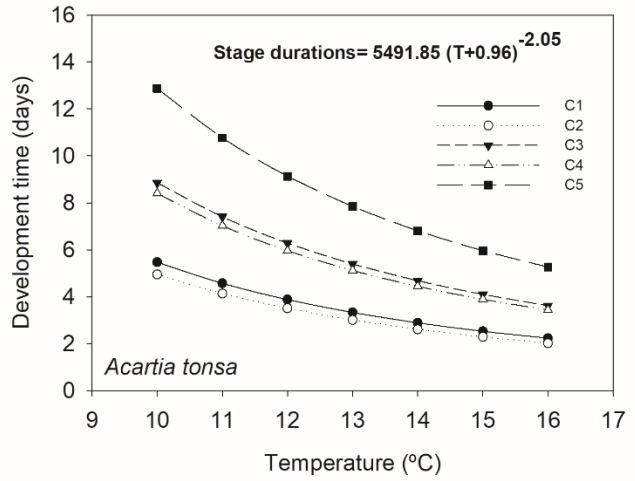
Table S4: Results of General Linear Model (GLM) for oceanographic variables at the coastal upwelling zone of northern Chile during 2010−2011.

| **Variable** | | **F** | ***P*** |
|---|---|---|---|
| Chlorophyll *a* | Seasons | 2.77 | < 0.05 |
| | Years | 2.74 | < 0.05 |
| Ekman transport | Seasons | 4.08 | < 0.05 |
| | Years | 0.28 | 0.626 |
| Salinity | Seasons | 2.36 | 0.055 |
| | Years | 0.24 | 0.626 |
| Dissolved oxygen | Seasons | 6.63 | < 0.05 |
| | Years | 0.82 | 0.374 |

Table S5: Results of two-factor General Linear Model (GLM) for predatory and non-predatory mortality rates ($d^{-1}$) as functions of months and developmental stages. * indicates significant difference at $p < 0.05$. Stations were treated as replicates.

| **Variable** | | **Predatory mortality rates** | | | **Non- predatory mortality rates** | | |
|---|---|---|---|---|---|---|---|
| | | **df** | **F** | ***p*** | **df** | **F** | ***P*** |
| *P.* cf. *indicus* | Months | 23 | 10.35 | 0.001* | 23 | 2.18 | 0.140 |
| | Stages | 4 | 21.68 | 0.000* | 4 | 18.56 | 0.000* |
| *A. tonsa* | Months | 23 | 43.53 | 0.000* | 23 | 5.69 | 0.000* |
| | Stages | 4 | 42.74 | 0.000* | 5 | 12.97 | 0.000* |
| *C. chilensis* | Months | 23 | 11.31 | 0.001* | 23 | 3.30 | 0.070 |
| | Stages | 4 | 9.82 | 0.000* | 4 | 4.21 | 0.002* |



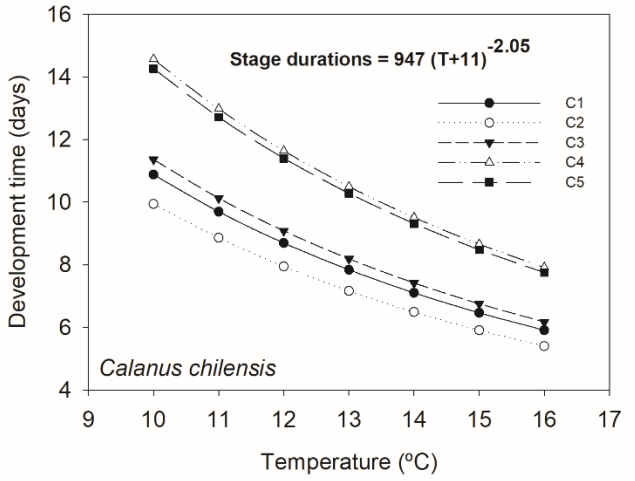




Figure S1. Copepodite stage duration for the three major copepod species as a function of temperature T (from Bèlehràdek equation) at Mejillones Bay.