**Table S1.** **Measured (blue shading) and predicted development time (days) for *Graneledone boreopacifica* using published models.** Hatching mass used in some models comes from Voight and Drazen, 2004. Egg length (15 mm) and temperature (3°C) were measured in situ.

|  |  |  |  |
| --- | --- | --- | --- |
| **Reference** | **Model****Duration (D, days), Temperature (T,°C)** | **Duration (in days, at 3°C)** | **Notes** |
| **This manuscript** | **In situ measurement** | **1590** | **Based on in situ observations with MBARI remotely operated vehicles.** |
| This manuscript | D=10794T-1.79 | 1510 | Octopodidae only, each species represented by one point. Where more than one measurement was available, the measurement at the lowest temperature was used. Temperature range = 5-29°C.**Data in Table S2**. |
| …including *Graneledone boreopacifica* | D=10087T-1.76 | 1458 | As above, but including the present data for *G. boreopacifica* at 3°C. |
| Temperature coefficient, Q10 = 2 - 3 | R2 = R1\*Q10(T2-T1/10)Rate (R) = 1/D | 552, 650 | Calculated using a starting development time of 419 days (R1 = 1/419) at 7°C from *Bathypolypus arcticus* (Wood, 1998). |
| Laptikhovsky, 1991 | D=277.6\**d*0.0291T+0.263e-0.22T d = (L + W/2) x 10 = 100L = 15, W = 5 | 743 | For Octopodidae. Nesis (1999) used this formula to estimate *G. boreopacifica* embryonic development at 826 days (2.2°C, L = 16, W = 7). An error in Nesis’ formula resulted in 798 days. The formula presented here is correct. |
| Laptikhovsky, 1999 | D=(3163.1T-1.62)L0.499 | 2057 | For Octopodidae. The author uses “ripe egg length”, which is 35 mm in *G. boreopacifica*. This results in over-estimated embryonic development duration. |
| Seibel et al., 2000 | D=70.67L-0.86 | 725 (5-7°C) | Data from varied squids and octopods measured between 5-7°C (n=7). |
| Katsanevakis and Verriopoulos, 2006 | D=532.2/(T-8.76), re-plotted with power function to extrapolate <9°C, D=22391T-2.023 | 2425 | Effect of temperature on *Octopus vulgaris,* range 11-31°C |
| Hamasaki and Morioka, 2002 | D=62798T-2.477 | 4131 | Effect of temperature on *Octopus vulgaris*, range 16.5-25.5°C- |
| Kubodera, 1991 | 2300 - 2700 deg-days | 760 - 900 | Effect of temperature on *Octopus dofleini,* range 7-16°C |
| Gillooly et al., 2002 | Loge D/m0.25=-0.12{T/(1+T/273)}+6.06 | 362 | Based on Metabolic Theory of Ecology, using data for “aquatic ectotherms”. Prediction using 2.5 g, hatchling mass. |
| Hirst and Lopez-Urrutia, 2006 | Loge D/m0.25=-0.11{T/(1+T/273)}+6.49 | 572 | Based on Metabolic Theory of Ecology as above, using data for Teuthoidea (squids), 2.5 g hatchling mass. |

**Table S2.** **Egg development and morphometric data for species of the family Octopodidae.**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Species** | **Egg length (mm)** | **T (°C)** | **Development Duration (days)** | **Reference** |
| *Graneledone boreopacifica* | 15 | 3 | 1590 | This study |
| *Octopus dofleini* | 7 | 5 | 547 | Kubodera, 1991 |
| *Octopus bimaculoides* | 2 | 18 | 82 | Forsythe and Hanlon, 1988 |
| *Octopus joubini* | 3.3 | 22 | 42 | Forsythe and Toll, 1991 |
| *Octopus tetricus* | 2 | 17.3 | 53 | Joll, 1978 |
| *Octopus aegina* | 3.18 | 28 | 19 | Ignatius and Srinivasan, 2005 |
| *Octopus laqueus* | 2.6 | 24 | 25 | Kaneko et al., 2006 |
| *Octopus digueti* | 6 | 15 | 60 | Hochberg (in Mangold et al., 1971) |
| *Octopus rubescens* | 3.0 | 14.5 | 91 | Osborn, 1995 |
| *Octopus maorum* | 6 | 15 | 80 | Anderson, 1999 |
| *Octopus micropyrsus* | 9 | 15 | 75 | Hochberg (in Mangold et al. 1971) |
| *Octopus briareus* | 12 | 23 | 65 | Hanlon, 1977 |
| *Octopus vulgaris* | 2 | 17 | 83 | Caveriviere et al., 1999 |
| *Octopus tehuelchus* | 11 | 19 | 112 | Iribarne, 2009 |
| *Hapalochlaena lunulata* | 3.5 | 23.5 | 35 | Overath and Boletzky, 1974 |
| *Hapalochlaena maculosa* | 6.5 | 22 | 60 | Overath and Boletzky, 1974 |
| *Robsonella fontanianus* | 4.77 | 14 | 93 | Gonzalez et al., 2008 |
| *Robsonella australis* | 2.9 | 13 | 81 | Brought, 1965 (in Mangold et al., 1971) |
| *Eledone cirrhosa* | 7.55 | 16 | 105 | Mangold et al., 1971 |
| *Bathypolypus arcticus* | 11 | 7 | 419 | Wood, 1998 |
| *Enteroctopus megalocyathus* | 10.05 | 11 | 168 | Uriarte et al., 2014 |
| *Paroctopus conispadiceus* | 15 | 6.5 | 307 | Ito, 1983 |
| *Megaledone setebos* | 18.5 | 0 |  | Collins and Rodhouse, 2006 |
| *Pareledone harissoni* | 13.5 | 0 |  | Collins and Rodhouse, 2006 |

**Supporting Table References**

Anderson TJ (1999) Morphology and biology of *Octopus maorum* Hutton 1880 in Northern New Zealand. Bull Mar Sci 65: 657-676.

Caveriviere A, Domain, F, Diallo A (1999) Observations on the influence of temperature on the length of embryonic development in *Octopus vulgaris* (Senegal). Aquat Living Resources 12: 151-154.

Collins MA, Rodhouse PGK (2006) Southern Ocean Cephalopods. Adv Mar Biol 50: 192-265.

Forsythe JW, Hanlon RT (1988) Effect of temperature on laboratory growth, reproduction and life span of *Octopus bimaculoides*. Mar Biol 98: 369-379.

Forsythe JW, Toll RB (1991) Clarification of the western Atlantic Ocean pygmy octopus complex: the identity and life history of *Octopus joubini* (Cephalopoda: Octopodinae). Bull Mar Sci 49: 88-97.

Gillooly JF, Charnov EL, West GB, Savage VM, Brown JH (2002) Effects of size and temperature on developmental time. Nature 417 :70-73.

Gonzalez ML, Arriagada SE, Lopez DA, Perez MC (2008) Reproductive aspects, eggs and paralarvae of *Robsonella fontanianus* (d’Orbigny, 1834). Aquacult Res 39: 1569-1573.

Hamasaki K, Morioka T (2002) Effects of temperature on egg incubation period, and paralarval survival and growth of common Octopus, *Octopus vulgaris* reared in the laboratory. Suisanzoshoku 50: 407-413.

Hanlon RT (1977) Laboratory rearing of the Atlantic reef octopus, *Octopus briareus* Robson, and its potential for mariculture. Proc World Mariculture Soc 8: 471-482.

Hirst A, Lopez-Urrutia A (2006) Effects of evolution on egg development time. Mar Ecol Prog Ser 326: 29-35.

Ignatius B, Srinivasan M (2005) Embryonic development in *Octopus aegina* Gray, 1849. Current Sci 91: 1089-1092.

Iribarne OO (2009) Life history and distribution of the small south-western Atlantic octopus, *Octopus tehuelchus*. J Zool 223: 549-565.

Ito H (1983) Some observations on the embryonic development of *Paroctopus conispadiceus* (Mollusca: Cephalopoda). Bull Hokkaido Reg Fish Res Lab 48: 93-105.

Joll LM (1978) Observations on the embryonic development of *Octopus tetricus* (Mollusca: Cephalopoda). Aust J Mar Freshwater Res 29: 19-30.

Kaneko N, Oshima O, Ikeda Y (2006) Egg brooding behavior and embryonic development of *Octopus laqueus* (Cephalopoda: Octopodidae). Molluscan Res 26: 113-117.

Katsanevakis S, Verriopoulos G (2006) Modelling the effect of temperature on hatching and settlement patterns of meroplanktonic organisms: the case of the octopus. Scientia Marina 70: 699-708.

Kubodera T (1991) Distribution and abundance of the early life stages of octopus, *Octopus dofleini* Wülker, 1910 in the North Pacific. Bull Mar Sci 49: 235-243.

Laptikhovsky VV (1991) A mathematical model for the study of the duration of embryogenesis in cephalopods. Biol Nauki 3: 37-48.

Laptikhovsky VV (1999) Improved mathematical model to study the duration of embryogenesis in cephalopod mollusks. Ruthenica 9: 141-146.

Mangold K, Boletzky Sv (1973) New data on reproductive biology and growth of *Octopus vulgaris.* Mar Biol 19: 7-12.

Mangold K, Boletzky Sv, Frösch D (1971) Reproductive biology and embryonic development of *Eledone cirrosa* (Cephalopoda: Octopoda). Mar Biol 8: 109-117.

Nesis KN (1999) The duration of egg incubation in high-latitude and deep-sea cephalopods. Biolog Morya Vladivostok25: 499-506.

Osborn SA (1995) Fecundity and embryonic development of *Octopus rubescens* Berry from Monterey Bay, California. MS Thesis. San Jose State University.

Overath H, Boletzky Sv (1974) Laboratory observations on spawning and embryonic development of a blue-ringed Octopus. Mar Biol 27: 333-337.

Seibel BA, Hochberg FG, Carlini DB (2000) Life history of *Gonatus onyx* (Cephalopoda: Teuthoidea): deep-sea spawning and post-spawning egg care. Mar Biol 137: 519-526.

Uriarte I, Espinoza V, Gutierrez R, Zuniga O, Olivares A, Rosas C, Pino S, Farias A (2014) Key aspects of egg incubation in Patagonian red octopus (*Enteroctopus megalocyathus*) for cultivation purposes. Aquaculture 424-425: 158-166.

Voight JR, Drazen JC (2004) Hatchlings of the deep-sea octopus *Graneledone boreopacifica* are the largest and most advanced known. J Moll Stud 70: 406-408.

Wood JB (1998) Reproduction and embryonic development time of *Bathypolypus arcticus*, a deep-sea octopod. Malacologia 39: 11-20.