Body reserves mediate trade-offs between life history traits: new insights in small pelagic fish reproduction

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Abstract

Limited resources in the environment prevent individuals to simultaneously optimize all life history traits, resulting in trade-offs. In particular, the cost of reproduction is well known to negatively affect energy investment in growth and maintenance. Here, we investigated these trade-offs during contrasted periods of high versus low fish body condition (before/after 2008) in the Gulf of Lions. Female reproductive allocation and performance in anchovy (*Engraulis encrasicolus*) and sardine (*Sardina pilchardus*) were examined based on morphometric historical data from the 70s and from 2003 to 2015. Additionally, potential maternal effects on egg quantity and quality were examined in 2014/2015. After 2008, the gonadosomatic index increased for sardine and remained steady for anchovy, while a strong decline in mean length at first maturity indicated earlier maturation for both species. Regarding maternal effects, for both species egg quantity was positively linked to fish size but not to fish lipid reserves, while the opposite was true for egg quality. Atresia prevalence and intensity were rather low regardless of fish condition and size. Finally, estimations of annual total numbers of eggs spawned indicated a sharp decrease for sardine since 2008 but a slight increase for anchovy during the last 5 years. This study revealed a biased allocation towards reproduction in small pelagic fish when confronted with a really low body condition. This highlights that fish can maintain high reproductive investment potentially at the cost of other traits which might explain the present disappearance of old and large individuals in the Gulf of Lions.