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TITLE: Ocean warming has a greater effect than acidification on the early life history development and swimming performance of a large circumglobal pelagic fish

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ABSTRACT:

Abstract Ocean warming and acidification are serious threats to marine life; however, their individual and combined effects on large pelagic and predatory fishes are poorly understood. We determined the effects of projected future temperature and carbon dioxide (CO 2) levels on survival, growth, morphological development and swimming performance on the early life stages of a large circumglobal pelagic fish, the yellowtail kingfish Seriola lalandi . Eggs, larvae and juveniles were reared in cross?factored treatments of temperature (21 and 25°C) and p CO 2 (500 and 985 ?atm) from fertilisation to 25 days post hatching (dph). Temperature had the greatest effect on survival, growth and development. Survivorship was lower, but growth and morphological development were faster at 25°C, with surviving fish larger and more developed at 1, 11 and 21 dph. Elevated p CO 2 affected size at 1 dph, but not at 11 or 21 dph, and did not affect survival or morphological development. Elevated temperature and p CO 2 had opposing effects on swimming performance at 21 dph. Critical swimming speed (U crit) was increased by elevated temperature but reduced by elevated p CO 2 . Additionally, elevated temperature increased the proportion of individuals that responded to a startle stimulus, reduced latency to respond and increased maximum escape speed, potentially due to the more advanced developmental stage of juveniles at 25°C. By contrast, elevated p CO 2 reduced the distance moved and average speed in response to a startle stimulus. Our results show that higher temperature is likely to be the primary driver of global change impacts on kingfish early life history; however, elevated p CO 2 could affect critical aspects of swimming performance in this pelagic species. Our findings will help parameterise and structure fisheries population dynamics models and improve projections of impacts to large pelagic fishes under climate change scenarios to better inform adaptation and mitigation responses.

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