Supplementary Information for

"Demographic response of cutlassfish (*Trichiurus japonicus and T. nanhaiensis*) to fluctuating palaeo-climate and regional oceanographic conditions in the China seas"

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Supplementary Information S1: Molecular clock variation and calibration

Sequence substitution rates of the mitochondrial Cyt b gene of fish have been shown to vary greatly between species. For example, molecular rates of 0.34%/myr (*Cobitis*) (Doadrio & Perdices, 2005), 0.53-0.66%/myr (Plagopterini and *Barbus*) (Dowling *et al*., 2002; Tsigenopoulos *et al*., 2003), and 0.9-1.2%/myr (cichlid and schizothoracine fishes) (Martin & Bermingham, 1998; He *et al*., 2004) have all recently been reported. However, molecular rate calibrations, such as these, based on interspecific phylogenetic divergence, geologic and/or fossils evidence have been shown to be unreliable and often underestimate actual divergence due to purifying selection or mutational hot spots (Ho *et al*., 2005; Burridge *et al*., 2008). Furthermore, recent studies have shown that short-term mtDNA evolutionary rates are elevated relative to long-term (deeper phylogenetic level) rates (Santos *et al*., 2005; Kemp *et al*., 2007; Crandall *et al*., 2012). The present study indeed presents an elevated molecular rate estimation of 2.03 (1.35-2.7)%/myr for *Trichiurus* calibrated to the earliest inundation on the newly formed wide East China Sea shelf (150 kya) by rising sea level of the last interglacial period (70~140 kya).

Supplementary Information S2: Geological history of the China seas

The last uplift of the Tibetan Plateau, occurring around 150 kya (Sun *et al*., 2003), accompanied by the costal subsidence of East China is thought to have created wide and flat continental shelves in the East China Sea and northern South China Sea (Wang *et al*., 2004). However, the absence of marine deposits during the early and middle Pleistocene suggest that these continental shelves were much narrower and steeper prior to this event (Wang *et al*., 1981; 1985).

Supplementary Information S3: Primary production difference between the East China Sea and South China Sea influenced by the rivers and monsoon

The large differences in the influx of freshwater and terrigenous sediment between the East China Sea and northern South China Sea likely resulted in different primary productivities of these two seas. For example, the Changjang (Yangtze River) introduces nearly 9.54×10^{11} m^3 of freshwater and 5×10^8 tons of sediment into the East China Sea per year (Wang *et al.*, 1988); whereas as the second largest river in China, the Pearl River, only provides 3.03×10^{11} m^3 of freshwater and 0.89×10^8 tons of sediment into the South China Sea per year (Wei & Wu, 2011; Yang *et al.*, 2011). Furthermore, the primary production of the present day northern South China Sea in summer is much lower than that in winter due to nutrient advection constraint by summer shallow thermoclines and weak vertical mixing (Tang *et al*., 2003; Chen *et al*., 2006), which suggest that coastal river discharge plays a less important role relative to winter monsoons in influencing the primary production of the northern South China Sea.

Supplementary Information S4: Geological history of the Changjiang

Historically, the Changjiang is thought to have drained into the East China Sea since the late Pleistocene (Zhu *et al*., 1984; Li & Zhang, 1995). However, given the absence of Changjiang derived sediments on the ECS shelf prior to the Holocene and the decrease in salinity of the Japan Sea during the LGM, some believe the palaeo-Changjiang historically drained into the Japan Sea or did not enter the East China Sea until the Holocene (Zhao *et al*., 1983; Zhong *et al*., 1983; Zhao, 1984; Yang, 1991).

Supplementary Information S5: Interspecific competition between *T. japonicus and T. nanhaiensis*

The continuous population growth of *T. japonicus* compared to the population contraction of *T. nanhaiensis* prior to 37.5 kya observed in the northern South China Sea (Fig. 5) might be attributed to limited niche space and/or inter-specific competition. In terms of dietary needs, habitat space and resource partitioning, *T. japonicus* and *T. nanhaiensis* have similar niche requirements (Lin *et al*., 2005; Yan *et al*., 2010). In this context, the larger population size of *T. japonicus* over the last 165 kya may have allowed it to successfully occupy much of the available niche space of the northern South China Sea and outcompete species of lower abundance like *T. nanhaiensis* (Fig. 5). With the continued population expansion of *T. japonicus* and increased interspecific competition this brought, the population size of *T. nanhaiensis* steadily declined from 165 to 37.5 kya (Fig. 5).

Supplementary Information S6: Palao-productivity influenced by winter monsoon in the northern Southern China Sea

Primary production in the northern South China Sea was mainly influenced by the winter monssons. For example, present or palaeo-productivity increased due to high nutrient input from upwelling and terrestrial deposits caused by the intense winter monsoons in the northern South China Sea during winter or periods of glaciations (Fig. 5) and decreased due to low nutrient input by shallow mixing layers during summer or weaker winter monsoons during interglacial periods (Li *et al*., 2002; Tang *et al*., 2003; Li & Wang, 2004; Chen & Chen, 2006; Wang *et al*., 2007).

Supplementary Information S7: Link between East Asian monsoons and population dynamics in the China seas

In the East China Sea, a general link between interglacial intensified summer monsoons, increased precipitation followed by high nutrient input from the Changjiang, high primary production and population expansions was revealed. Furthermore, the abrupt postglacial population growth experienced by the East China Sea population of *T. japonicus* provides insight into the Changjiang Delta's postglacial development since 22.5 [15-30] kya. However, contrary to conditions in the East China Sea, glacial increases and interglacial decreases of primary productivity induced by winter monsoons can explain the LGM expansion and postglacial genetic bottleneck of *T. japonicus* and *T. nanhaiensis* in the northern South China Sea.

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