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## The biomass yields and management challenges for the Yellow sea large marine ecosystem



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### ABSTRACT

This paper summarizes the changing biomass yields in the Yellow Sea large marine ecosystem (YSLME) in recent years and discusses the causes of such changes, including overfishing and climate changes. Meanwhile, two kinds of adaptive management strategies are recommended to support the biomass yields in YSLME, including resource-conservation-based capture fisheries (e.g. closed season/areas, stock enhancement etc.) and environmentally friendly aquaculture (e.g. integrated multi-trophic aquaculture, IMTA).

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## 1. Introduction

The World's Large Marine Ecosystems (LMEs) are defined by ecological criteria including (1) bathymetry, (2) hydrography, (3) productivity, and (4) trophically linked populations (Sherman et al., 1993; Duda and Sherman, 2002; Sherman, 2014). The LMEs, especially the coastal ecosystems, play important roles in food supply, and about 80% of global sea foods has been supplied from the coastal ecosystems every year (Sherman, 2014; Tang, 2014). However, the LMEs continue to be degraded by unsustainable fishing practices, habitat degradation including loss of sea grasses, mangroves and corals, eutrophication, toxic pollution, aerosol contamination, ocean acidification, and emerging diseases. The scale and severity of risks to LMEs goods and services associated with depletion and degradation of coastal oceans is well documented (Sherman et al., 2005). The coastal waters of LMEs contribute an estimated \$12.6 trillion annually to the global economy (Costanza, 1997). Therefore, improving of sustainable management and conservation strategies for the ecosystem is becoming an important and urgent issue that needs to be undertaken in LMEs.

The Yellow Sea is located between continental North China and Korean Peninsula. It is separated from the West Pacific Ocean by the East China Sea in the south, and is linked with the Bohai Sea. It covers an area of about 400,000 km<sup>2</sup>, with a mean depth of 44 m. As a semi-enclosed slope and warm water sea, Yellow Sea shows typical characteristics of large marine ecosystem, shallow but rich in nutrients and resources. The Yellow Sea LME (YSLME) has productive and varied coastal, offshore, and transboundary fisheries. Over the past several decades, the fishery populations in the Yellow Sea have changed greatly. Many commercial species are threatened by unsustainable exploitation and by natural perturbations (Tang, 2009).

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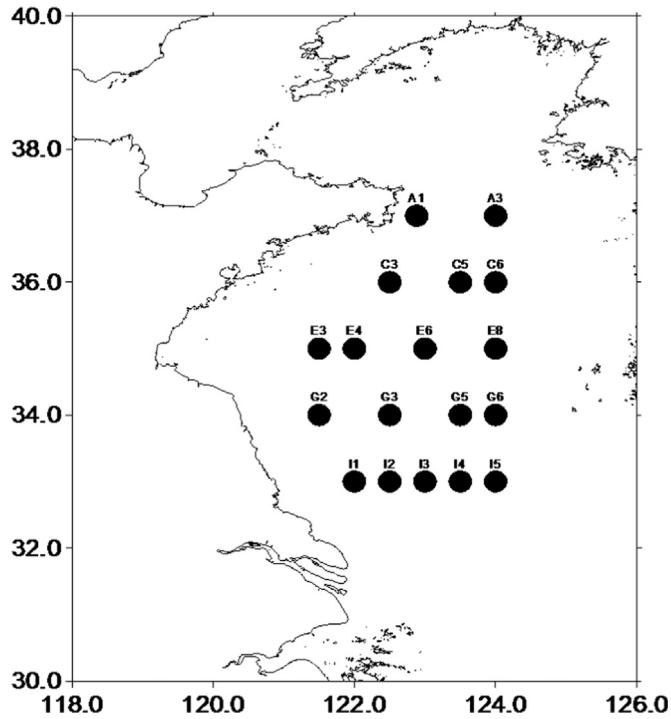


Fig. 1. The survey area and sampling sites of the YSLME.

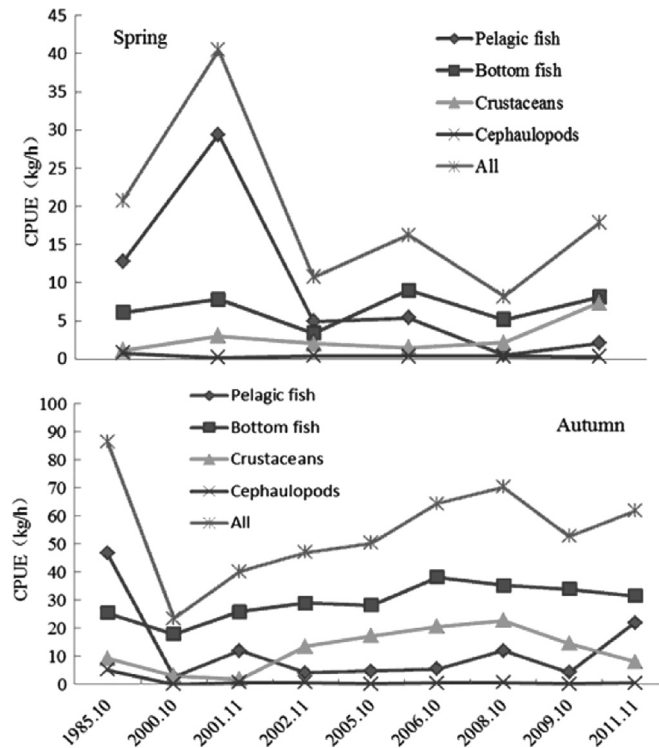


Fig. 2. The variations in CPUE of fishery species in the YSLME in spring and autumn.

Hence, it is crucial and timely to promote sustainable exploitation of the LMEs and implement effective management strategies like ecosystem approach and ecosystem based management at LMEs. In this study, the changing states of biomass yields and management strategies of marine food resources under multiple stressors were discussed by using the case of YSLME.

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