Implications of Harmful Microalgae and Heterotrophic Dinoflagellates in Management of Sustainable Marine Fisheries

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Abstract

Worldwide increases in the frequency and spatial extent of blooms of harmful marine microalgae and heterotrophic dinoflagellates suggest that these species are becoming an increasingly important influence on year class strength of marine fishes through both direct and indirect mechanisms. Impacts on fish populations from harmful marine microalgae and heterotrophic dinoflagellates have been considered primarily from the limited view of acute or lethal influences. Accumulating evidence indicates that insidious sublethal and chronic impacts to both fish and human health from these organisms, such as long-term behavior alteration, increased susceptibility to cancers and other diseases, depressed feeding, and impaired reproduction, may be substantial and pervasive. For some harmful species, significant indirect impacts that promote critical habitat loss or disrupt the microbial food web balance also have been documented. Because successful models to predict the behavior and growth of most of these species have not yet been developed, and because toxins for many are poorly characterized, a clear anthropocentric focus has guided management strategies for confronting their outbreaks. The extent to which management takes the fundamental step of acknowledging scientifically demonstrated linkages among harmful microalgae, shellfish contamination, fish kills, and human health impacts has also been seriously constrained by political dictates stemming

from economic considerations. Without federal involvement, and without catastrophe of human death or widescale serious human illness, little progress historically has been realized in the development of effective management strategies to mitigate lethal impacts to fish or other organisms. Many long-known taxa such as certain "red tide" dinoflagellates apparently can increase independently of human influences other than physical transport. However, some newly discovered toxic or otherwise harmful taxa have been correlated with cultural eutrophication in poorly flushed fish nursery grounds such as estuaries and coastal waters. Outbreaks of certain warm-optimal species have coincided with El Nino events, suggesting that warming trends in global climate change may stimulate their growth and extend or shift their range. The available information points to a critical need for a more proactive, concerted effort to determine the full range of chronic/sublethal effects, as well as acute impacts, on marine fish populations by harmful marine microalgae and heterotrophic dinoflagellates, so that their increasingly important influence can be factored into reliable plans for sustainable fisheries management.