ID: W2891762463

TITLE: Assessing bottom trawling impacts based on the longevity of benthic invertebrates

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ABSTRACT:

Abstract Bottom trawling is the most widespread human activity directly affecting seabed habitats. Assessment and effective management of the effects of bottom trawling at the scale of fisheries requires an understanding of differences in sensitivity of biota to trawling. Responses to disturbance are expected to depend on the intrinsic rate of increase in populations (r), which is expected to be linearly related to the reciprocal of longevity. We examine the relationship between the longevity of benthic invertebrates and their response to bottom trawling; both in terms of the immediate mortality following a trawl pass and their subsequent rates of recovery. We collate all available data from experimental and comparative trawling studies, and test how longevity influences these aspects of sensitivity. The shortest lived organisms (<1 year) increased in abundance shortly after experimental trawling but showed no response to trawling in long?term comparative studies. Conversely, the abundance of biota with a life span >1 year decreased by ~9% immediately following a trawl pass. The effect of bottom trawling in comparative studies increased with longevity, with a 2?3× larger effect on biota living >10 years than on biota living 1?3 years. We attribute this difference to the slower recovery rates of the long?lived biota. The observed relationship between the intrinsic rate of population increase (r , our metric of recovery rate) and the reciprocal of longevity matches theoretical expectation and predicts that the sensitivity of habitats to bottom trawling is higher in habitats with higher proportions of long?lived organisms. Synthesis and applications . Where the longevity of a species or the longevity distribution of a community is known or can be inferred, our estimates of depletion and intrinsic rate of increase can be combined with high?resolution maps of trawling intensity to assess trawling impacts at the scale of the fishery or other defined unit of assessment. Our estimates of r may also be used to estimate recovery times following other forms of seabed disturbance.

SOURCE: Journal of applied ecology

PDF URL: None

CITED BY COUNT: 65

PUBLICATION YEAR: 2018

TYPE: article

CONCEPTS: ['Trawling', 'Longevity', 'Biota', 'Bottom trawling', 'Invertebrate', 'Benthic zone', 'Ecology', 'Habitat', 'Fishery', 'Benthos', 'Biology', 'Fishing', 'Environmental science', 'Genetics']