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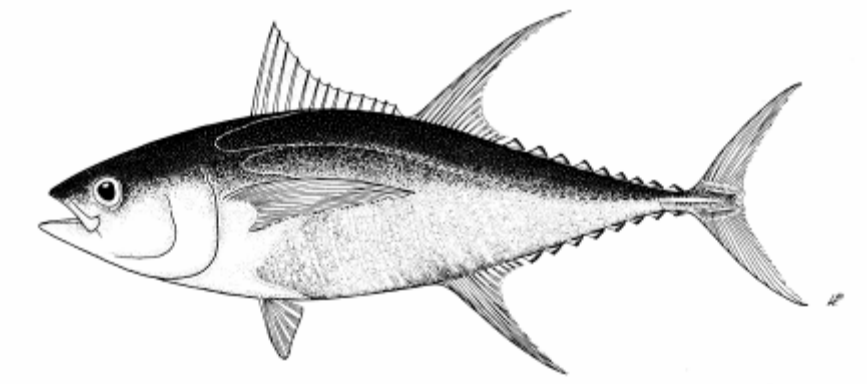
Ecosystem Boundaries and Indicators: Getting started with the ecosystem approach



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Ecosystem Boundaries and Indicators:
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Abstract

The ecosystem approach to fisheries is a place-based approach to resource management. The first step is implementing EAF is to identify the "place" to be managed. This paper summarizes definitions of places frequently seen in the deliberations of the Commission for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean. Means of refining the notion of of place in the context of applying EAF to the WCPFC are discussed.

1 Introduction

The ecosystem approach to fisheries (EAF) is a geographically specified mode of fishery management that takes account of ecosystem knowledge and uncertainties, considers multiple external influences, and strives to balance diverse societal objectives (NOAA, 2004). In other words, EAF is place-based rather than species-based.

Identification of the boundaries of the place to be managed is an obvious prerequisite for implementing EAF. The 2000 Convention on the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean explicitly defines the area over which the WCPFC has authority. The status of stocks, and also presumably, the "ecosystem" will be monitored within the convention area.

The convention area is quite large and far from homogeneous. Current approaches to monitoring the status of stocks recognize the geographic inhomogeneity of fish stocks in the convention area by using spatially structured stock assessments. Application of EAF carries the imperative to go beyond monitoring the status of stocks. Variables in the ecosystem should be monitored to assess the impacts of fishing on the ecosystem as well as the effects of ocean variability of fisheries productivity. A recent symposium on ecosystem indicators (Daan, *at al.*, 2005) demonstrated the difficulty of identifying indicators that are generally applicable across ecosystems. Variables and processes in the ocean each have their own unique space and time scale (Figure 1). Therefore ecosystem indicators will certainly have different natural scales of variability; Thus ecosystem boundaries established for one purpose (e. g. stock assessment) may not be suitable for other purposes (e. g. monitoring primary productivity).

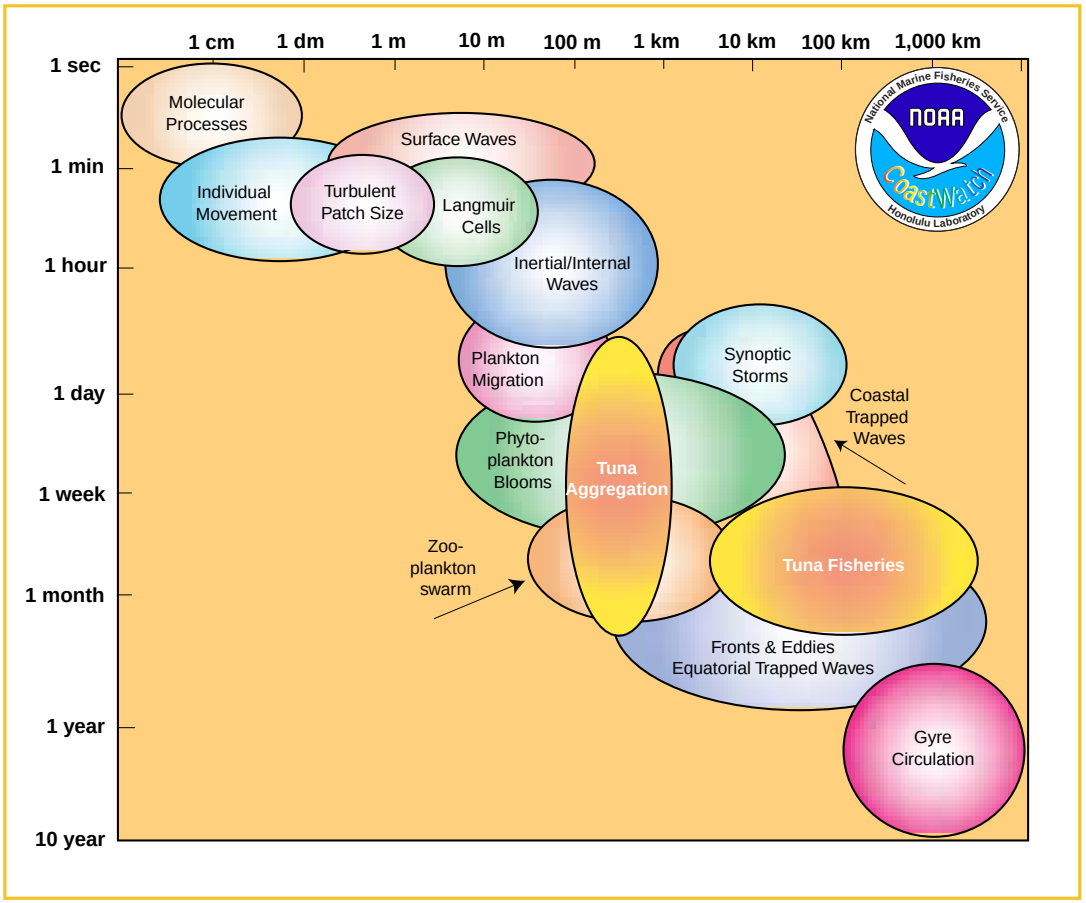
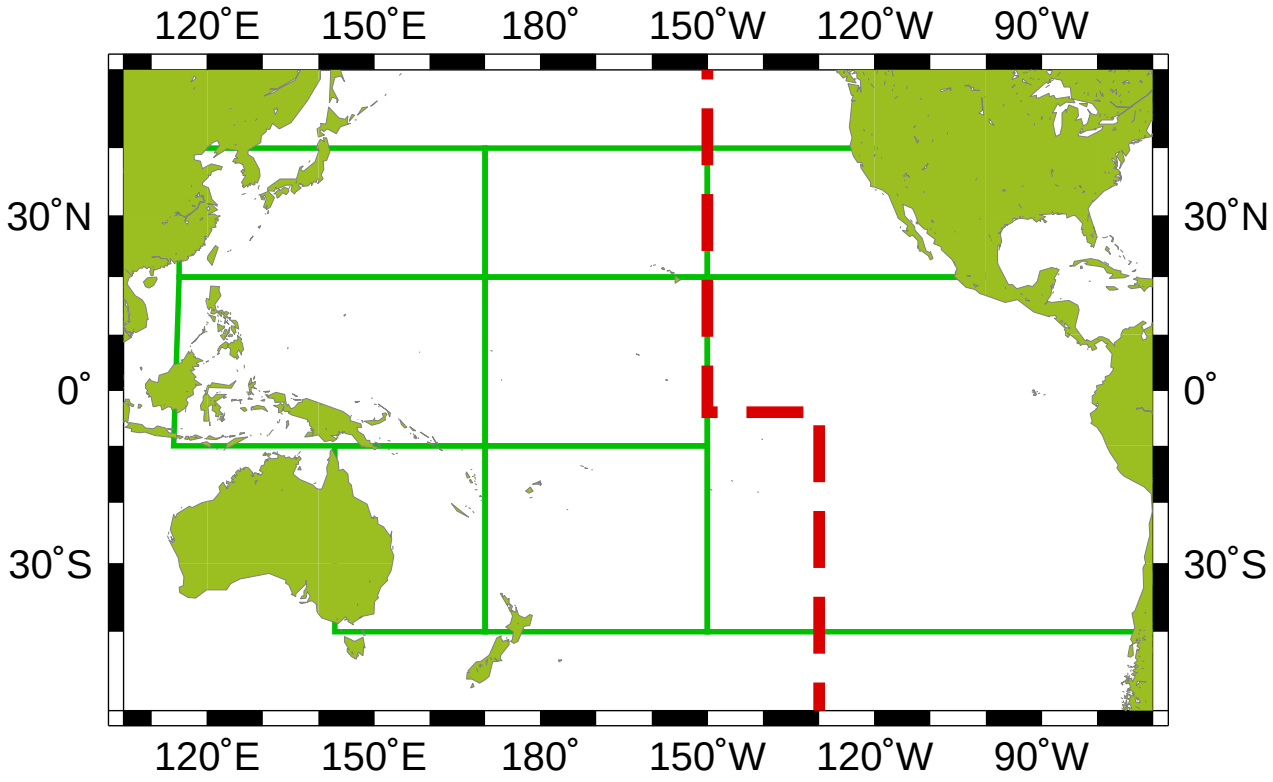


Figure 1: Spatial and temporal scales of some oceanic phenomena; after Dickey (1991).

2 Current Regions

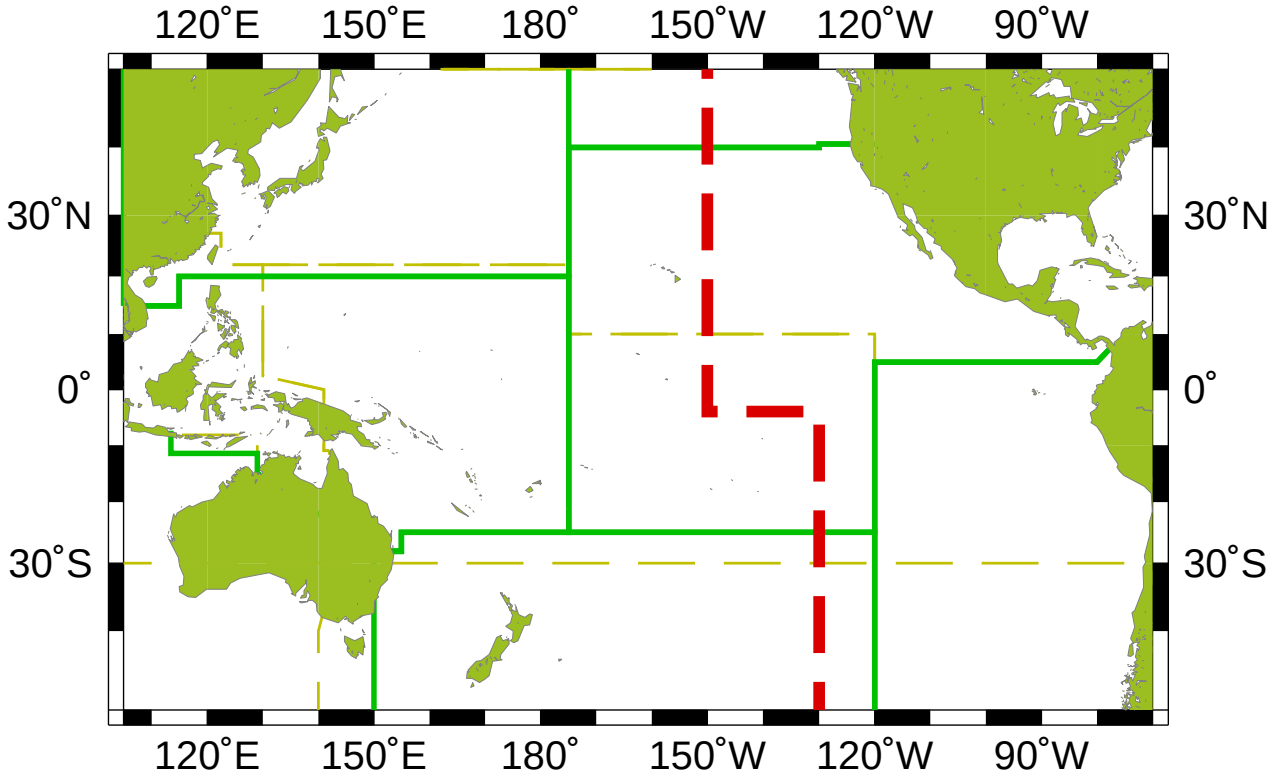
Several different delineation systems are routinely used in the Pacific. Exclusive Economic Zone (EEZ) boundaries and the Convention area are two examples. In the maps that follow, the eastern boundary of the WCPFC Convention Area is shown as the heavy dashed (red) line and the featured region as medium (green) lines.

2.1 MULTIFAN-CL Regions



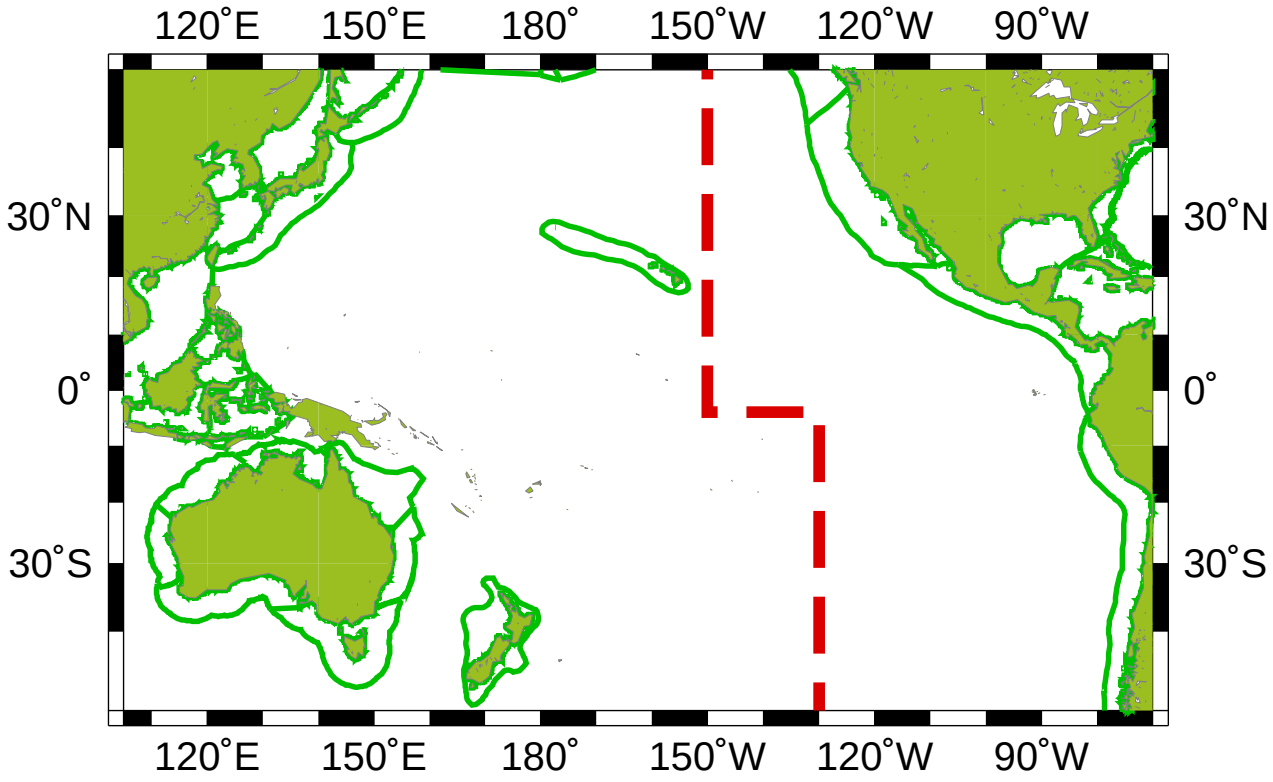
The MFCL regions are used to specify the areas fished by various fleets and the boundaries of the meta-populations used in the analysis. The regions shown here are those used in the Pacific-wide bigeye stock assessment and in the WCPFC assessments. The MFCL regions were modified in 2005 to align more consistently with biophysical features (section 2.4). following of discussions at the seventeenth meeting of the Standing Committee on Tuna and Billfish. These regions represent a practical compromise between the need to aggregate fisheries data and the constraints imposed by ecological structuring of the oceans see section.

2.2 FAO Statistical Areas



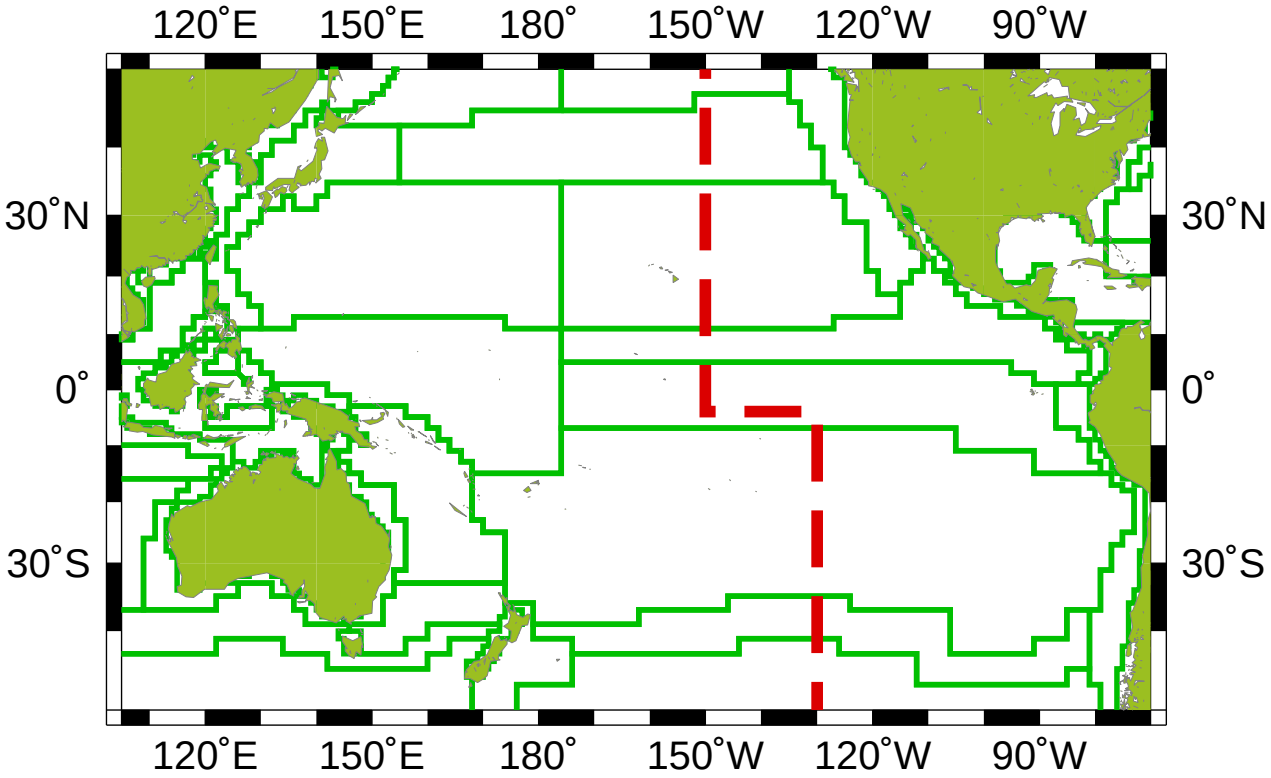
The FAO statistical areas are usually considered to be simply a convenient means to summarize fisheries data. These areas do not conform well either to the WCPFC convention area or to the MULTIFAN-CL regions. (The lighter dashed line in the figure represents a proposed realignment of the statistical areas.)

2.3 Large Marine Ecosystems (LMEs)



The United States National Oceanic and Atmospheric Administration has been engaged in a program to define large marine ecosystems for use in fishery management since 1984. Sixty four LMEs have designated around the world based on geography, productivity, fisheries, pollution, socioeconomic and governance considerations. Since 1993, NOAA has been cooperating with GEF, IUCN, and several UN agencies to assist developing countries implement EAF based on LMEs. LMEs correspond roughly to the margins of the continental shelves (i. e. the 200m isobath) and are thus largely coastal and only moderate in size. From the standpoint for applying the EAF to highly migratory fish stocks in the WCPO, LMEs are neither sufficiently large nor sufficiently marine. See Sherman *et al.* (2004) and numerous other papers and books for more information on LMEs.

2.4 Longhurst Biophysical Provinces



Longhurst (1998) constructs a regional ecology of the oceans based on physical oceanographic characteristics and knowledge of how primary production is influenced by physical processes. On this basis, Longhurst recognizes approximately 80 regions in the global ocean. These regions clearly have some relevance to the WCPFC and are reflected in the aggregation of fisheries used in ithe 2005 stock assessments (section 2.1).

3 Discusssion

Two initial steps are prerequisite to implementing EAF: (1) selection of indicators for monitoring ecosystem status and (2) delineation of regions over which to monitor the selected indicators. Preliminary steps have been taken to attempt to monitor the ecosystem effects of fisheries, and several ecosystem indicators have been proposed for evaluation (Kirby, *et al.*, 2005). The size spectrum of the biota in an ecosystem has been proposed as a measure of the ecosystem effects of fishing, and Hampton (2004) reported on estimated

changes in the ensemble size spectrum of the principle tuna stocks in the WCPO using estimates of the size composition of tuna populations from the MFCL stock assessment.

Use of spatially structured stock assessment tools is an important starting point for implementation of EAF. However the utility of the current MFCL regions for stock assessment needs further verification. Furthermore it is likely that the MFCL regions regions will not be appropriate for reporting other ecosystem indicators. The identification of appropriate regions for reporting ecosystem indicators is an important step.

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4 References

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