Improving Fishery Management: Melding Science and Governance

Summary Proceedings

Warren S. Wooster, Editor

Jessica M. Quinn, Assistant Editor

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Session I: Interactions of Fisheries in Ecosystems Over Time

The first session was designed to explore how fished ecosystems change over time and the status of four regional Pacific fisheries ecosystems. Many of the key concepts in this regard, i.e., "fishing down food webs", "shifting baselines", "regime shifts", and "trophic cascades" are being incorporated into fisheries management. To what extent do they apply in the four regions? What can we learn from these regions about the use of ecosystem metrics? Bruce Leaman, Executive Director of the International Pacific Halibut Commission (IPHC), convened the session.

Daniel Pauly, Director of the University of British Columbia Fisheries Center, was the lead speaker. He discussed the decline in global fisheries catches since the late 1980s. The fisheries are mainly on continental shelves and within Exclusive Economic Zones (EEZs), although they have recently been extending into greater depths. Expansion in the southern hemisphere has met increasing demand in the north.

In 1998, worldwide occurrences of "fishing down the food web" were demonstrated. This effect was particularly strong in the North Atlantic despite a long series of detailed catch data and an equally long history of fisheries management (Figure 1). However, United Nations Food and Agriculture Organization (FAO) staff members have suggested that the following issues were overlooked: (1) the composition of landings did not necessarily reflect relative abundance on the underlying ecosystem; (2) trophic levels change with size or age; (3) over-aggregated catch statistics may bias results; (4) bottom-up effects were not accounted for.

There are counter-arguments to the first point. (1) Fish are currently exploited everywhere they are abundant, but landings may not reflect actual catches; (2) all trawl survey data so far tested (e.g., Gulf of Thailand, Cantabrian Shelf, Guinean Shelf, etc.) show trophic level trends similar to those of landings; (3) work in the Celtic Sea has shown that the decline of trophic level in landings is less pronounced than in survey data, because skippers try to maintain catches of high-trophic level fishes.

On the second point, trophic levels tend to increase with size/age, so with high fishing activity, trophic level decline is faster when ontogenic changes in level are considered. As for over-aggregated catch statistics, this has the effect of masking the fishing down effect. Hence the global trend of declining trophic levels is in fact stronger than previously thought because much of the world catch is reported in very coarse categories (Figure 2). An example from the West Central Atlantic supported the point.

Members of the Convention on Biological Diversity have endorsed the Marine Trophic Index (MTI), the mean trophic level, as a marine biodiversity indicator. It is now one of eight indicators that will be monitored globally.

As the MTI decreases, jellyfish increase and are now a resource exploited and exported from some parts of the world. In areas that are significantly fished down, dead zones begin to appear in various parts of the world. The annual occurrence of dead zones in the Gulf of Mexico is well known, while that in the Adriatic Sea is more of a surprise. Some of the organisms that bloom in such areas, e.g., *Pfisteria* in the Chesapeake Bay, are particularly unwelcome. The eastern seaboard of the United States is more and more resembling Chesapeake Bay in this respect (Figure 3).

Reversing the fishing down trend will be difficult without large marine reserves. At present, less than 1% of the ocean

disallows fishing. There is a 5% annual increase in area included in marine reserves. An emerging issue may impose a solution to this - we are running out of cheap energy, and it will become increasingly expensive to fish, especially in deep waters.

Data required to assess these results ca found at *www.seaaroundus.org*

In the discussion, the question was raised regarding disease being the caus oyster decline in Chesapeake Bay. In Pauly's view, sick oysters are an effect c changed conditions, not the cause. Overfishing of oysters and loss of their beneficial filtering abilities on the ecosys have transformed the nature of the bay.

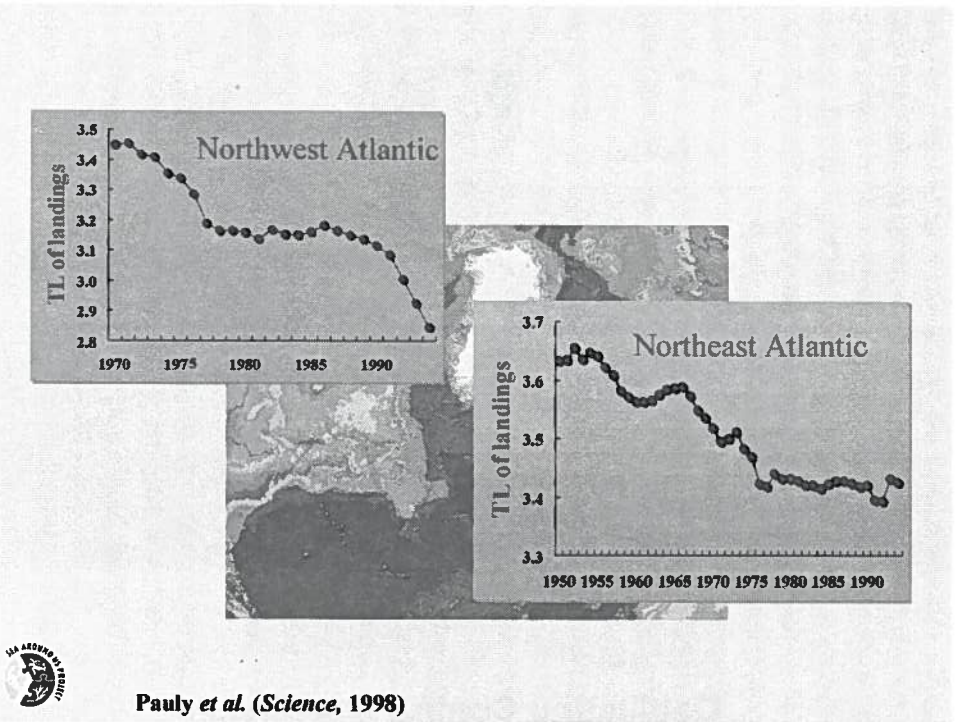
The mean trophic level of most syste is 4-4.5 when fishing begins, then tends toward 2 (e.g., sea cucumbers). The decline is global and varies among count and areas as to how quickly it is reducec Sustainability is not possible with declinir trophic level.

Can some of the overfished areas be rehabilitated? The only way they can be rehabilitated is to restore the trophic system, so the effect of a Marine Protect Area (MPA) on the ecosystem is critical. we don't reverse the current trend, we w end up with unmanageable and unpredictable "mud" areas. How big wou the MPAs need to be? Pauly estimates th 20-40% of fishing areas should be MPAs achieve the desired improvement.

Were fishing regulations to protect higher trophic levels factored in the calculations? No, but if a species has bee rehabilitated, it will be fished again. Ther there will be a quota that represents the existing biomass. Unless an area is closec this is a one-way street.

Has any modeling predicted an acceptable reduction in trophic level in a sustainable fishing effort? No, because while big fish have increased in value 3-4 times faster than the Consumer Price Index, the value of small animals has increased 10-20 times faster. Going after the small fish, or jellyfish, always justifies itself. These products will make money for the fishermen; an economy must grow to be sustainable.

Session I Figures



Pauly *et al.* (*Science*, 1998)

Figure 1 (Pauly)

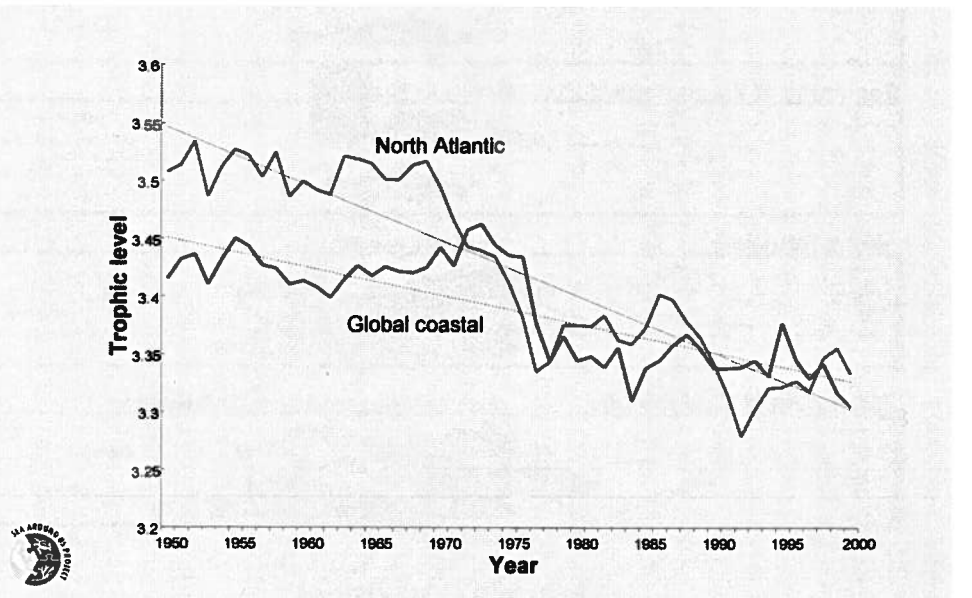


Figure 2 (Pauly)

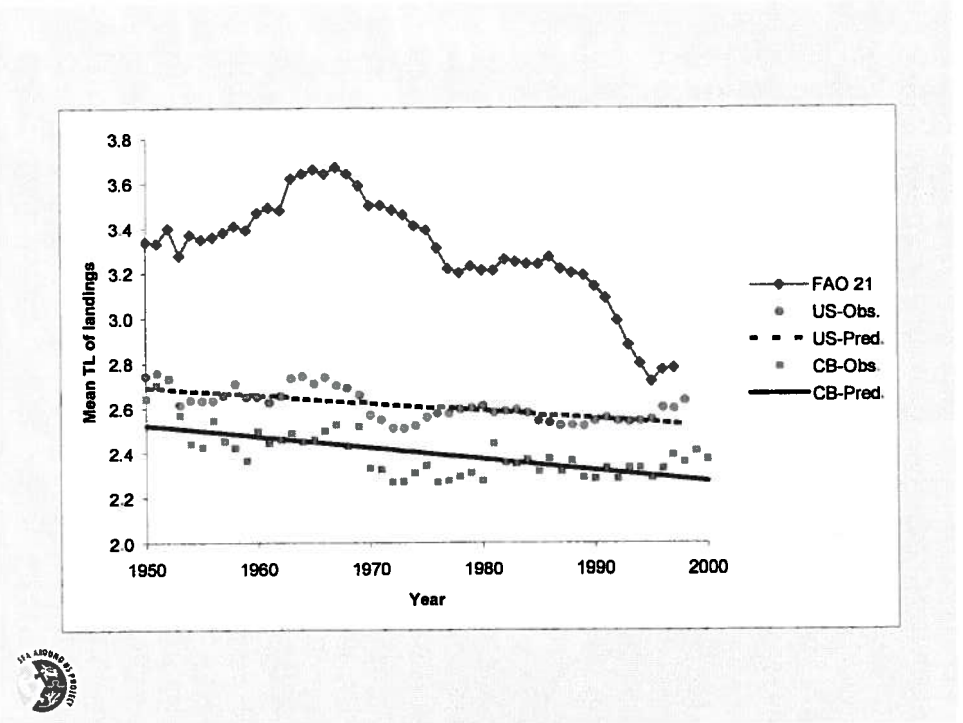


Figure 3 (Pauly)