## EOSC 112 Nov 26 Lecture by Prof Daniel Pauly – Fishing Down Marine Foodwebs

Marine fish harvest is not increasing any more

- main components of the harvest are: 1) bottom (demersal) fish such as cod,
- 2) anchovie and sardines (small fish), and 3 ) by-catch (catch the wrong species)

Early fisheries was centered on large species, but their numbers have decreased and so the fishing fleets are catching smaller and smaller species that are at lower trophic levels in the food web (hence the title of the lecture).

Recall:

- 1) a food web is composed of various species that eat other species. Primary producers (phytoplankton) are at the first trophic level and animals that eat plants (herbivores) are at the second trophic level and animals that eat animals (carivores) are at the third trophic level. In some food webs, some animals are at the fourth or fifth trophic level. For example tuna is at the fifth trophic level.
- 2) The trophic level of an animal defines how far it is removed from the base of the food chain (the phytoplankton).
- 3) Ecological Efficiency or trophic level transfer 10% of the biomass of the lower trophic level is transferred on to the next higher trophic level. So if you fish down one trophic level and catch smaller fish this is more efficient in terms of the food web since it did not take as much primary production to produce the fish at the lower trophic level.

The mean trophic level of the global fisheries was near 4, but now it has decreased to about 3.2 (i.e. fishing down the food web). The estimate is for a decline of about 0.1 trophic level per decade.

For example, when the cod fishery collapsed in eastern Canada, the invertebrate fishery increased (e.g. snow crab) since the cod and crab compete for similar food.

BC fisheries – ling cod, sturgeon, and humpback whales are either gone or almost gone. Now hake (a bottom fish) is more abundant. Our goal is to have a sustainable fishery.

Historically primitive fishers started with large high trophic level fish/animals that were close to shore and easy to catch (e.g. sea cows that ate kelp).

Big animals often have a slow growth rate and therefore they cannot compensate for the high harvest rate.

When big animals/fish are gone, then fishers harvest smaller ones (the prey of the big ones)

New technology makes catching fish easy. Large bottom trawlers wipe out the bottom (benthic) animals.

Final result of fishing down the foodweb is that we may be catching zooplankton and jellyfish in the future. We will have to make new products out of these less desirable animals.

China – has been reporting very high catches (like the upwelling area off Peru – the world's largest fishery). But there is no upwelling off China, so how could this be true. The large anchovie fishery off Peru is due to the upwelling of nutrients which results in very high primary productivity. Pauly estimated what the fish catch should be as a function of the known primary productivity off the coast of China. He concluded that China was over reporting!! (for political purposes).