Quantifying Fishing on the US west coast

Outline 5/13/2016

Half draft

**Introduction**

Fishing is a major driver of dynamics in many marine ecosystems. With climate change, distribution and abundance of commercially targeted species are already shifting, and predicted to continue. Previous work predicts that population viability of a shifting species depends on, in part, whether vessels rapidly adjust to harvest their shifting range (Fuller et al. 2015). Determining which vessels will be able to adapt fishing practices in a changing climate will also help managers to identify vulnerable or resilient fishing communities. Because search and fishing strategies of commercial vessels are constrained by technology (vessel length and gear), management (i.e. closed areas, opening dates), markets (processor and market availability) and the ecology of the species, there should be some broad patterns in fishing activity across fisheries, regions, and vessel characteristics. Such patterns may be a useful starting place for generating hypotheses for whether or not vessels, and the fish they target, will tracked climate induced change. Thus understanding how vessel characteristics mediate patterns of fishing in space and time will be important for predicting and evaluating adaptive responses by fishing vessels and accurately forecasting changes in fishing pressure.

Despite the importance of understanding how fishermen are likely to shift fishing effort, there is little empirical work available. This is largely due to the fact that for much of the history of industrial fishing, fisheries data has had low spatial resolution making it difficult to quantify fishing effort across space. Recent increases in the coverage of VMS provide a unique, although hereto unrealized, opportunity to improve our resolution of fishing mortality over large spatial and temporal scales. In this paper we demonstrate these benefits by linking together landings and VMS data to quantify commercial fishing patterns in the California Current System (CCS) in six of the most important commercial fisheries on the US west coast. Specifically, we examine how vessels distribute themselves in space and time, within and across fisheries and vessel lengths. Because not all vessels are equipped with VMS, we also pay special attention to how representative these patterns may be by determining coverage rates at different spatial and temporal scales. We find common spatial strategies of fishing effort that vary broadly with fishery and vessel length and discuss their importance.

Fisheries to profile: pink shrimp, crab, chinook (troll), albacore (troll), sablefish (hook & line), black rockfish long line.

**Quantifying fishing effort – vessel level**

Vessel characteristics

* Vessel Length (will be constant across fisheries)
* Home port (one or many), does it vary with the fishery a vessel participates in?

Space characteristics: for all look at average, variance and whether variance is structured by season

* how far from the coast
* how much area per trip
* how much area fished
* what depth fished
* what habitat fished

**Quantifying coverage**

* each vessel: what proportion of trips covered
* for each fishery: what proportion of trips covered, what proportion of vessels covered

**Quantifying participation – fishery level**

* What size boats tend to participate
* Are boats specialist (only participate in this fishery) or generalist (participating in many fisheries)
* Do all boats go to the same place or different places?
* Is a certain type of habitat targeted?
* Is a certain depth targeted?