

OPTIMAL NUMBER OF SITES IN MULTI-SITE FISHERIES WITH FISH STOCK DEPENDENT MIGRATIONS

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ABSTRACT. We present a stock-effort dynamical model of a fishery subdivided into fishing zones. The stock corresponds to a fish population moving between these zones, on which they are harvested by fishing fleets. We consider a linear chain of identical fishing zones. Fish movements between the zones, as well as vessels displacements, are assumed to take place at a faster time scale than the variation of the stock and the change of the fleet size. The vessels movements between the fishing areas are assumed to be stock dependent, i.e. the larger the stock density is in a zone the more vessels tends to remain in it. We take advantage of these two time scales to derive a reduced model governing the dynamics of the total harvested stock and the total fishing effort. Under some assumption, we obtain either a stable equilibrium or a stable limit cycle which involves large cyclic variations of the total fish stock and fishing effort. We show that there exists an optimal number of fishing zones that maximizes the total catch at equilibrium. We discuss the results in relation to fish aggregating devices (FADs) fisheries.

1. Introduction. This manuscript deals with pelagic multi-site fisheries such as fisheries on fish aggregating devices (FADs) or on artificial habitats (AHs) (Kakimoto, 2004, Lan et al., 2006, Nelson, 2003). In this manuscript, we consider a 1D linear chain of FADs that would be located along the coast or along a reef around an island. It is assumed that fishes of the open sea can visit a FAD where they can stay for a short time (a few days) and then return to the open sea (Girard et

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