Salmon Aquaculture in Southern Chile: Group Project Problem Statement

Background of Salmon Farming in Chile
The salmon farming industry was first introduced into the Lake District of central Chile in the 1980s, funded in part by development assistance from Japan. Ideal environmental conditions in this area allowed the industry to flourish, and farmed salmon quickly became the second largest Chilean export in an economy historically dominated by copper mining. In its 2007 peak, farmed salmon exports brought in 2.2 billion USD in revenue and created thousands of jobs. During this period, nearly 40% of global salmon production originated from Chile. However, poor management practices and inherent problems associated with the farming of a non-native species in a fragile environment led to abundant environmental degradation, and in 2007 the outbreak of an infectious salmon anemia (ISA) virus caused the industry to collapse, resulting in the loss of thousands of jobs and millions of dollars in revenue.

Due to the importance of the salmon aquaculture industry contrasted with the crisis resulting from the ISA virus, the Chilean government must now decide whether to expand salmon farming into pristine environments of high conservation value in the southern Magallanes Region. There are currently over a thousand salmon farming concessions on standby in this area, however, there is very little reliable information on the costs and benefits of salmon farming in the Magallanes region versus other industries including artisanal fishing and ecotourism, as well as ecosystem services provided by the complex environment of fjords and lakes common to this area.

Question
What are the environmental, economic, and social tradeoffs between different methods of salmon aquaculture in the Magallanes region of Chile?

Methods
We plan to generate a bioeconomic model to address salmon farming industry practices and, potentially, influence regulatory issues affecting salmon aquaculture in Chile. This bioeconomic model will incorporate biological, environmental, social, economic, and other agency/institution variables and will estimate the effects of different salmon farming techniques on outcomes of interest. We will visually display the tradeoffs between management practices for salmon farming techniques on two-dimensional (or possibly multi-dimensional) graphs. Each axis of the graph represents one outcome of interest, for example an environmental variable (e.g. biodiversity) or an economic variable (e.g. local tax revenue). We will plot a point for each farming technique to show, for example, the relative economic benefits and the ecological preservation associated with each farming technique.

Extrapolating from the patterns identified by graphing the effects of the studied farming techniques, we hope to generate an efficiency frontier which will help us identify the optimal - and possibly hypothetical - set of tradeoffs between the social and environmental parameters. This efficiency frontier will be an algorithm describing a curve that is comprised of all of the most efficient trade-offs between our parameter.
effects, such that any farming technique whose effects cause it to lie inside of the curve is inefficient. Developing this algorithm will require data on a number of ecological, social, and economic parameters such as projected revenue from the aquaculture industry, environmental externalities associated with farming, the value of ecosystem services provided by unpolluted environments, and potential losses to the tourism and artisanal fishing industries.

Ultimately, the selection of a specific aquaculture approach will depend on the preferences of our client and of the local people in the Magallanes region. To assess local preferences we will create and administer (over the summer) a survey designed to elicit the trade-off preferences of the community. An indifference curve generated through the identification of these societal values and trade-offs will be matched with our efficiency frontier curve, with the tangent points indicating optimal aquaculture management techniques that integrate social values as well as environmental and economic concerns.