**Problem A MCM Moving North**

Global ocean temperatures affect the quality of **habitats** for certain ocean-dwelling species. When temperature changes are too great for their continued thriving, these **species move to seek other habitats better suited to their present and future living and reproductive success**. One example of this is seen in the lobster population of Maine, USA that is slowly migrating north to Canada where the lower ocean temperatures provide a more suitable habitat. This geographic population shift can significantly disrupt the livelihood of companies who depend on the stability of ocean-dwelling species. Your team has been hired as consultants by a Scottish North Atlantic **fishery** management consortium.

The consortium wants to gain a better understanding of issues related to the potential migration of **Scottish herring** and **mackerel** from their current habitats near Scotland if and when global ocean temperatures increase. These two fish species represent a significant **economic contribution** to the Scottish fishing industry. Changes in population **locations** of herring and mackerel could make it economically impractical for smaller Scotland-based fishing companies, who use fishing vessels without on-board refrigeration, to harvest and deliver fresh fish to markets in Scotland fishing ports.

**Requirements**

1. Build a mathematical model to identify the most likely **locations** for these two fish species over the next 50 years, assuming that water temperatures are going to change enough to cause the populations to move.

鱼在哪儿

2. Based upon how rapidly the ocean water temperature change occurs, use your model to **predict** best case, worst case, and most likely **elapsed time(s)** until these populations will be too far away for **small fishing companies** to harvest if the small fishing companies continue to operate out of their current locations.

预测鱼会逗留多长时间

3. In light of your predictive analysis, should these small fishing companies **make changes** to their operations?

根据预测数据，看看捕鱼公司是否需要行动

a. If **yes**, use your model to identify and assess practical and economically attractive **strategies** for small fishing companies. Your strategies should consider, but not be limited to, realistic options that include:

- **Relocating som**e or all of a fishing company’s assets from a current location in a Scottish port to closer to where both fish populations are moving;

- Using some proportion of small fishing vessels capable of operating without landbased support for a period of time while still ensuring the freshness and high quality of the catch.

- Other options that your team may identify and model.

b. If your team rejects the need for any changes, justify reasons for your rejection based on your modeling results as they relate to the assumptions your team has made. *Hook Line and Sinker*

4. Use your model to address how your proposal is affected if some proportion of the fishery moves into the **territorial waters (sea)** of another country.

鱼群移动到别的国家对建议的影响

5. In addition to your technical report, prepare a one- to two-page article for magazine to help fishermen understand the **seriousness of the problem** and how your proposed solution(s) will improve their future business prospects.

文学建模：阐述问题严重性&方法有效性