

Scenario

When too many commercial vessels end up in the same area, navigation becomes dangerous, especially at night or in adverse conditions. The Ministry of Transport flagged a recent incident involving two different commercial-fishery fleets that nearly resulted in the loss of life. The joint investigation with the Ministry of Fisheries determined that each fleet was simply pursuing the species of fish for which they were licensed to catch. For whatever reason, the two species of fish congregated in the same area, creating the dangerous situation.

Your task is to analyze whether this situation was simply bad luck and unlikely to occur again, or whether similar situations can be expected in the future. If it is the latter, the Ministry of Transport has suggested that the season for one of the fisheries be moved to another time in the year.

The Ministry of Fisheries has provided you with the results of the investigation. The local waters consist of three distinct areas: Shipwreck Bay, Kraken Cove, and Davy Jones's Straight. Each species moves at dusk, arriving at its next location by nightfall and remaining there until dusk the next day. The movement of the two species of fish appears to be somewhat random.

Data shows the following patterns in the movements of species 1:

- If species 1 is found in Shipwreck Bay, then there is a 25% chance it will remain there, a 35% chance it will move to Davy Jones's Straight, and a 40% chance it will move to Kraken Cove.
- If species 1 is found in Davy Jones's Straight, then there is a 10% chance it will remain there, a 75% chance it will move to Shipwreck Bay, and a 15% chance it will move to Kraken Cove.
- If species 1 is found in Kraken Cove, then there is a 20% chance it will remain there, a 40% chance it will move to Shipwreck Bay, and a 30% chance it will move to Davy Jones's Straight.

Data also shows the following patterns in the movements of species 2:

- If species 2 is found in Shipwreck Bay, then there is a 35% chance it will remain there, a 55% chance it will move to Davy Jones's Straight, and a 10% chance it will move to Kraken Cove.
- If species 2 is found in Davy Jones's Straight, then there is a 10% chance it will remain there, a 55% chance it will move to Shipwreck Bay, and a 35% chance it will move to Kraken Cove.
- If species 2 is found in Kraken Cove, then there is a 40% chance it will remain there, a 40% chance it will move to Shipwreck Bay, and a 20% chance it will move to Davy Jones's Straight.

Create a model to determine how frequently the two species are found in the same waters. The Ministry of Transport has suggested that the two fishing seasons be separated if the likelihood the two species will congregate is greater than 40%.

Format

Prepare a report for the ministries that details whether the two commercial fisheries should be offset. Your report should include the following sections:

Introduction: Provide a brief introduction to the problem or scenario being modeled. The introduction should include any relevant background information that serves to motivate the study and must include a clear statement of the study's objective.

Model: Provide a clear description of the model and its development, including the following details:

- Problem identification
- Statement of assumptions
- Identification and classification of variables
- Discussion of interrelationships between variables

Analysis: Provide an exposition that details the analysis of your model, including the following points:

- Justification for the type of analyses conducted
- Details of the analyses (e.g., calculations, plots, etc.)
- Statement of key results

Conclusions: Briefly restate the main findings of your analysis as they relate to the objective set out in your introduction.