Marine Liability Insurance Pricing Report

1. Executive Summary

- This report assesses the pricing for Marine Liability Insurance using claims data from 2018 to 2023. Individual policies run from 1/1 – 31/12 for each year. The analysis focuses on key pricing elements, including loss frequency and severity every year, and key considerations such as inflation adjustments, large loss handling, and premium calculations. Recommendations are provided to adjust premiums based on observed trends (if any), exposure, and assumptions about future claims, including handling for large loss events.

2. Data Overview

- The dataset comprises 100 Marine Liability claims reported between 2018 and 2023. The key variables analysed include:
    - **Claim Types**: Collision, Cargo Liability, Damage to Other Vessels, Environmental Pollution, and Injury to Third Parties.
    - **Amount Gross Inflation Adjusted Claimed**: Ranges from $114,000 to $5,300,000.
    - **Policy Limits**: Vary from $500,000 to $10,000,000.
    - **Deductibles**: Range from $10,000 to $50,000.
    - **Claim Status**: 65 claims are closed, with the remainder either open or in litigation.

3. Exploratory Data Analysis (EDA)

- The claims data shows that:
    - Collision and Environmental Pollution Liability claims are the most frequent, accounting for over 43% of all claims.
    - The highest severity claims are in Environmental Pollution, with one large loss event exceeding $5 million.
    - Claims Frequency: Steady growth over the years, with a noticeable increase in 2020 due to cargo liability claims.
    - Outliers: The large loss claim in 2021 is significantly higher than other claims and will require special handling in the premium calculation.

4. Risk Assessment

- Based on the historical claims data:
    - **Loss Severity by claim type** (adjusted for inflation):
        - Collision Liability: $575,994
        - Cargo Liability: $590,583
        - Damage to other vessels: $632,910
        - Environmental Pollution: $857,386
        - Injury to third parties: $469,272
    - **Claim count by claim type** (adjusted for inflation):
        - Collision Liability: 21
        - Cargo Liability: 19
        - Damage to other vessels: 20
        - Environmental Pollution: 22

    - Injury to third parties: 18
- **Key Findings**: Environmental Pollution poses the highest risk due to its potential for catastrophic losses, and is also the most frequent claim type observed. Collision Liability, Cargo Liability, though frequent, have lower severities.
- **Summary by cause of loss:**
    - The most frequent cause of loss is Technical failure, followed by human error. While both of these are high-frequency events, they have the lowest severity compared to the other causes of loss.
- **Summary by loss location:**
    - The most common loss location is in the Atlantic Ocean, accounting for 23% of claims. This is also the highest severity loss location, partly due to a $5m loss in this location.
- **Assumptions**:
    - Commission is set to 0%.
    - No adjustments are required for claims development patterns.
    - The policy period runs from 1/1 – 31/12 each year.

5. Premium Calculation by Year

- Claim frequency is calculated by dividing the number of claims by the exposure at risk for each year, and claim severity is calculated as the sum of net incurred claims divided by the number of claims in that period. In this case, our exposure is gross tonnage. Loss frequency gives us an understanding of how often claims occur, while loss severity gives insight into the financial impact of each claim. These metrics are adjusted for inflation to provide a more accurate reflection of the cost of claims in the upcoming policy period that is being priced.
- The expected loss per unit of gross tonnage was calculated for each year using historical loss frequency and severity, adjusted for inflation:

Claim Year	Loss Frequency	Loss Severity	Expected Loss per Unit of Gross Tonnage
2018	0.000000222	$642,823	$0.14
2019	0.000000347	$609,717	$0.21
2020	0.000000479	$603,662	$0.29
2021	0.000000482	$598,316	$0.29
2022	0.000000367	$609,484	$0.22
2023	0.000000358	$465,367	$0.17

- Average Frequency: 0.000000376
- Average Severity per Claim: $588,228
- 2024 Expected Gross Tonnage: 40,000,000
- Total Risk Premium excl. large loss loading: $8,841,969.38

- Total Risk Premium incl. large loss loading: $9,104,666.75
- **Adjustments:**
    - Expense Loading: 30%
    - Profit Margin: 10%
- **Commission:** Nil
- **Large Loss Loading:** A loading was applied to account for the environmental pollution event that occurred. This has been removed from the data and added as a large loss loading to adjust for the longer expected return period of such events.
- **Final Premium:**

Final Premium = Pure Premium × (1 + Expense Loading) × (1 + Profit Margin)
= $9,104,666.75 × 1.30 × 1.10 = $13,019,673.45

6. Sensitivity Analysis on a claim type

- **Scenario**: A 6% increase in the severity of **all** claims.
- A sensitivity analysis was conducted to evaluate the impact of increasing claims cost on the risk premium, specifically testing how a 6% increase in severity affects the pricing. This analysis highlights how sensitive the overall premium can be to increases in claim severity. It can help us understand how material any assumptions made are as well as the potential impact of future trends e.g. if an increase in claim severity is expected due to court inflation or changes in legal rulings.
- **New Loss Severity for claims**: $623,521.95
- **New Pure Premium**:
  0.000000376 × 623,521.954 × 40,000,000 + 262,697.37 = $9,635,184.91
- **New Office Premium:** $9,635,184.91 × 1.30 × 1.10 = $13,778,314.42
- **Key Assumptions**
- **Inflation Adjustments**
    - **Assumption**: Claims amounts from 2018 to 2023 were adjusted for inflation using industry-standard indices.
    - **Rationale**: Inflation adjustments ensure that historical claims are compared on a like-for-like basis with claims from recent years.
    - **Impact**: By adjusting for inflation, the premium calculation reflects the true cost of covering risks in today's economic conditions.
- **Exposure (Gross tonnage)**
    - **Assumption**: 2024 gross tonnage is expected to be 40m as provided by the client.
    - **Rationale**: Exposure is critical for adjusting the pure premium calculation, as it reflects the volume of risk the insurer covers.
    - **Impact**: The gross tonnage directly affects the overall premium. All else equal, higher gross tonnage would lead to a higher premium as there is greater exposure to risk.
- **Large loss Event and Return Period**
    - **Assumption**: A large loss event related to environmental pollution occurred in the dataset, with a claim cost of $5.1 million. We assumed that large loss events of this size occur once every 20 years.
    - **Rationale**: Large loss events are rare but can have a significant financial impact, so the return period allows for the financial impact to be spread across several years, and adjust the premium to allow for the expected

likelihood of such events reoccurring. This prevents clients from facing significant premium increases following such events.
    - **Impact**: A large loss loading was calculated and added to the premium to account for the likelihood of large loss events.
- **Expense and Profit Margin Loading**
    - **Assumption**: An expense loading of 30% was applied to account for administrative costs, claims handling, and other operational expenses, and a profit margin of 10% was added to ensure profitability. A 0% commission was applied as there is no commission payable to the broker who is acting as an intermediary between the client and insurer.
    - **Rationale**: These loadings are standard practices in insurance pricing to ensure the insurer can cover its costs and remain profitable.
    - **Impact**: These loadings were added on top of the pure premium to calculate the final premium charged to the policyholder.
- **Commission:** Nil commission applied in the calculation of the office premium.
- **Claim development patterns:** No adjustment is required for claims development patterns, i.e., it is assumed all policy years are 100% developed.
- **Deductibles:** Deductibles in the upcoming policy period will be the same as deductibles in prior policy periods.
- **Policy Period:** Individual policies run from 1/1 - 31/12 each year