CITY UNIVERSITY
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Risk-sharing Relationships between Shipowners and Insurers

by

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Thesis submitted for the degree of
DOCTOR OF PHILOSOPHY

Athens, August 2004

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DECLARATION

I grant powers of discretion to the University Librarian to allow this thesis to be copied either in whole or in part without further reference to me. This permission covers only single copies made for study purposes, subject to normal conditions of acknowledgement.

To the Memory of my Father George

ACKNOWLEDGMENTS

I would like to thank Professor George Provopoulos of the University of Athens for kindly accepting to provide me with a reference letter.

I would also like to thank Professor Gerry Dickinson, who served as my tutor at the commencement of this thesis. The title of the thesis was among his suggestions.

I am especially indebted to Dr. Michael N. Tamvakis, for his timely suggestions and ideas, as well as for his support throughout this thesis. He has been and continues to be a trusted friend.

I feel grateful towards Professor Richard J. Verrall, who took over the tutorship from Professor G. Dickinson and helped me during the most part of this thesis.

I must thank my uncle Mr. John N. Kouroutis, because indirectly he created my interest in marine insurance. His great experience as a marine insurance agent not only educated me in my initial steps in this business, but also made me realize how fascinating marine insurance is.

Finally, I must thank Professor Costas Th. Grammenos for his enthusiastic support. throughout this thesis.

ABSTRACT

The primary purpose of this thesis is to examine the way fishing vessels are treated by the marine insurance market. The insurance of fishing vessels is a very specialized sector and there have not been any similar attempts in the past. We used data from a fleet of Greek owned / managed fishing vessels to examine the claims occurred during the last 29 years of the 20th century (1970 – 1998). We also considered the deductible analysis for these vessels and made various suggestions as to the level of the optimum deductible. We then built models that explain the way the number and amount of claims is affected by various parameters.

A simulation analysis is performed assuming the number of claims follows the Poisson distribution and the amount of claims the Gamma distribution (based on our findings). The conclusions of our models are confirmed by the simulation data.

The results raise questions on the level of premium as well as whether or not reinsurance is necessary for such a portfolio. Both imply the extension of this work allowing for further steps in the future.

CHAPTER 1 - FOREWORD

The oldest line of business insurance is marine insurance. In Roman Law bottomer loans (*foenus nauticum*) played an important part. These loans made it possible for a merchant to borrow money to buy and equip a ship for an expedition. Under a loan of this kind the owner of the ship repaid the loan, with interest only if the vessel returned safely from its voyage. If the ship was lost, the loan was not repaid. Under this arrangement the lender carried a considerable risk, and he naturally charged an appropriate rate of interest. Some historians maintain that the origin of marine insurance is the Catholic Church's ban on usury. Be this as it may, but the bottomer disappeared, and these loans with interest adjusted to the risk involved, were replaced by lending at the "risk-free" rate, and insurance, that is by pure risk-bearing with a high expected reward.

The market for fishing vessels has traditionally been very important in countries like Norway, U.K., Spain, U.S.A., Portugal, Iceland, Japan, Italy and Greece. For several years the cost of insurance premium for fishing vessels has been relatively stable, which was characterized by a growing fleet and a trend towards larger and more sophisticated trawlers.

That positive environment came under pressure a few years ago mainly because of the considerable number of losses and the Insurance market's negative results, which are known to all participants. Some fish boat owners then complained over the increase in their insurance rates and deductibles, which did not follow the rather stable prices of catch.

Since the insurance of fishing vessels is a very specialized sector there have been no attempts in the past to form a model for calculating the optimum premium level for Greek owned fishing vessels. We intend to use the existing models which are being applied to other insurance branches e.g. life, motor etc. Ideally we shall try to form a new model, which will assist all interested parties in their negotiations and above all the Market, because it will inevitably show the trend for rating of this business.

Data for approximately 2,500 vessels throughout a period of 29 years (1970 - 1998) was obtained from the archives of our firm in Greece, "Insurance Agencies J.Kouroutis & Co.Ltd.", a Company which presently represents The Miller Insurance Group, Lloyd's Brokers, in Greece.

Over the years we have developed a strong link with the Greek Fishing Community and as a result we have insured, through our London Brokers a considerable number of trawlers in the London Market. We therefore have an easy access to the data for these vessels and we reckon the data of 2,500 vessels is sufficient to lead to satisfactory results. The data consists of the following:

- Vessel's name
- Year built and / or rebuilt
- Material of construction
- Dimensions
- Tonnage
- Ownership
- Engine (type, BHP, age)

- Classification
- Value
- Trading area
- Conditions of insurance
- Level of deductible
- Rate applied
- Claims situation and analysis (date, cause and amount)

The introduction to this thesis in chapter 2 describes the London Insurance Market and its origins and we consider this chapter useful for those who have no or very little knowledge of the international insurance markets.

The third chapter examines the claims situation in the Greek fishing fleet during the past 29 years. The analysis consists of types of vessels, amounts, types of claims, causes and looks with more details into the most common types of claims. We also deal with the analysis of the distribution of claims for their number and amounts.

The analysis of deductibles in chapter 4 is detailed and we particularly focus on the methods used for estimating the optimum deductible level. Our findings are also used to examine whether the data is consistent with the von Neumann-Morgenstern expected utility hypothesis to determine the optimal deductible.

The fifth chapter deals with modelling both frequency and severity of fishing vessel claims for the 29 years from 1970 onwards.

The sixth chapter deals with simulation of the models described in chapter 5.

The conclusion chapter compares the results obtained with the insurance market practice and makes certain considerations based on the fishing market conditions.

1.1 Literature Review

In this section we shall briefly review the literature primarily used throughout this thesis.

1.1.1 Introduction

In the **"Zephyr"** case (1983) we saw how the practice of "signing down" a slip is followed in the London Market.

In the series of papers published by **Henri Louberge** (1990) in memory of Karl H. Borch, chapter 12 dealt with the microstructure of the London insurance market. It provided a brief description of the organization, regulation and competitive nature of the London insurance market. The paper included an explanation as to how the market handles the more unusual and high-risk insurances and it concluded with a summary of the role of major players in the market.

Shailesh A. Malde, Angus Ball, Brian Gedalla, Constantinos Miranthis, Hugh Rice, Alastair C. Shore, Philip Archer-Lock, Catherine Cresswell, Graham E. Lyons, Kathryn A. Morgan, David E. A. Sanders and Kathryn Willis (1994) provided background that assists in understanding the principal features of Marine Underwriting. They examined each class of marine underwriting, i.e. Hull, Cargo & Specie, Liability and Energy.

1.1.2 Optimum Deductible Analysis

B. Peter Pashigian, Lawrence L. Schkade and George H. Menefee (1966) were concerned with the selection of the optimum deductible. Their analysis for automobile collision was based on the expected utility hypothesis in the von Neumann-Morgenstern sense. The paper was concerned with the problem that, if an individual plans to purchase collision insurance, what is the optimum value for the deductible.

Lawrence L. Schkade and George H. Menefee (1967) expanded the previous paper in selecting the criteria that would apply to determine the amount of deductible chosen by an individual for vehicle collisions.

Tom C. Allen and Richard M. Duvall (1971) demonstrated that normal capital budgeting techniques may be used in order determine the optimum deductible for a firm. They showed that the best deductible limit per policy can be demonstrated by ascertaining the marginal savings produced by each.

Jürgen Strauss (1975) was concerned with the subject of deductibles in Industrial Fire insurance. His analysis dealt with the calculation of the loss elimination ratio, its dependence on the absolute amount of the deductible as well as on the individual branches of the industry and on the PML[1]. This was a theoretical paper with no practical examples that would substantiate the areas that the loss elimination ratio calculation could be applied for identifying the optimum deductible level.

Michael L. Smith (1976) proposed a method for applying risk-return analysis to deductible selection. Although the proposed method was applied by the author to actual data doubts are expressed as to whether it can apply in calculating the optimum deductible level.

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[1] Probable Maximum Loss

Michael L. Smith and George L. Head (1978) provided, as the title of their paper states, some guidelines to casualty insurers to price deductibles correctly. The analysis of this paper is quite thorough and it provided the basis for the methodology we followed in Chapter 4.

Hans-Peter Sterk (1980) looked into deductibles from the theoretical point of view. After discussing generally the dangerousness of risks Sterk explains the dangerousness of deductibles with respect to the coefficient of variation. The paper concludes with the deductible rebates as a function of the claims model and of the premium principles employed.

Harris Schlesinger (1981) analyzed from a theoretical point of view that the choice of optimal deductible is directly related to the insured's degree of risk aversion. It was shown that "*ceteris paribus* an individual with a higher loss probability, a higher degree of risk aversion, or a lower level of initial wealth will purchase more insurance".

Neil A. Doherty & Harris Schlesinger (1983) extended some results on deductible insurance purchases with random initial wealth.

Mogens Muff (1984) presented a model to be applied in setting franchise deductibles in Danish Motor insurance market. As franchise deductibles are no longer applied we concluded that this paper is out of date.

Finally, **Brian Z. Brown and Melodee J. Saunders** (1996) provided an analysis to the then recent trends in workers compensation coverage for the U.S. Market with examples from various states.

Generally speaking, in none of the above papers we saw reference to deductibles applicable to Marine Insurance. The most common examples used by the respective authors were taken by the motor (collision in particular) and personal accident branches, while we did not find any paper whatsoever dealing with the subject of analyzing the optimum deductible for a specific fleet of vessels similar to what this thesis deals with in Chapter 4. Needless to say that we found in none of the above papers reference to any analysis of deductibles, of either hypothetical or actual data, for Marine Insurance.

1.1.3 Rates and Models

Paul H. Jackson (1953) presented some of the theory underlying the experience rating process. The paper dealt with the problems involved in experience rating and of the general methods of approach which may be adopted. The remainder of the paper dealt with the mathematical formulas, which may be used to evaluate several experience rating functions and the connection between these functions and practical distribution functions. The author presented illustrative values of the functions for group life insurance, therefore it was not related at all with marine insurance. The only relevance of the above paper we found with our thesis was the presentation of the general theory in experience rating.

David B. Houston (1964) developed a concept of risk, which is appropriate to the insurance mechanism. The paper reviewed briefly the meanings of risk and uncertainty in economics. Classification of exposure units can be explained in terms of a random sampling model. Credibility procedures may be viewed as an example of Bayesian inference.

Paul Markham Kahn (1964) made some interesting comments about mathematical models in insurance. The paper looked at the earliest important life insurance model, the Rodson in 1762, as well as some recent studies, such as the collective risk theory suggested by Filip Lundberg in 1903 and models later discussed by Harald Cramér, H. Ammeter and others.

Robert B. Miller (1968) analyzed a series of problems concerned with purchasing of insurance coverage from the point of view of an individual facing certain risks. Both the concept of utility and subjective probability were used to deal with the quantification of an insurance company's preferences.

Robert Eric Beard, Teivo Pentikainen and Erkki Pesonen (1969) reviewed classical results of the theory of risk and looked at applications of risk theory to business planning.

James C. Hickman and Robert B. Miller (1970) reviewed recent criticisms of the principles and procedures, by which insurance premiums have been determined. Examples were developed that illustrate the application of the methods of decision analysis to the determination of insurance premiums.

Charles C. Hewitt Jr. (1970) used the previous works of Arthur L. Bailey and Allen L. Mayerson to show that credibility was greatest when severity was ignored entirely.

Hans Bühlmann (1970) created a synthesis of modern scientific publications in actuarial mathematics.

Kenneth J. Arrow (1971) presented a selection of essays on risk-bearing. Although the book is quite extensive in the presentation it did not include any practice examples for the implication of these essays.

Mark V. Pauly (1974) showed that in the absence of perfect information the competitive outcome in markets for insurance may be non-optimal, not only as compared to the infeasible optimum that would have occurred if information were perfect, but also compared to optima that are feasible.

Michael Rothschild and Joseph Stiglitz (1976) used a simple model of a competitive insurance market, to discuss the situation in other markets, where information was not perfect.

Leonard R. Freifelder (1976) contended that even the standard deviation of variance-based risk adjustments were unsatisfactory in many respects. He proposed, as an alternative, the use of utility theory as a basis for premium computation. More specifically, he argued that if insurance rates were to satisfy certain fundamental axioms, insurance companies should use one particular utility function – the exponential. While the suggested use of utility theory was not new, the advocacy of the exponential utility function as the ratemaking standard represented a significant departure from past analysis.

C.I.I. Tuition Service (1976) dealt among other things with the factors that determine the rate per cent per annum, fleet statistics, market agreements and details of the individual Marine Policies.

Karl Heinrik Borch (1979) discussed some essential elements in marine insurance. From all papers studied that was the only one directly related with Hull & Machinery insurance from an actuarial angle, although the author very modestly admitted that his model could be applicable to other insurance fields. Nevertheless, this paper only captured some of the basic elements in marine insurance and did not provide an evaluation of the model based on either actual or hypothetical data.

Artur Raviv (1979) showed that the Pareto optimal insurance contract involved a deductible and co-insurance of losses above the deductible. The deductible feature was shown to depend on the insurance costs. The co-insurance was due to either risk or cost sharing between the two parties. The upper limits on insurance were shown to be Pareto sub-optimal.

Steven Shavell (1979) presented a model on moral hazard and determined exactly when an insurance policy represented a compromise between no coverage and full coverage. The paper also analyzed the choice concerning the timing of observation of care and proved that imperfect information about care is valuable.

Syed M. Ahsan, Ali A. G. Ali and John N. Kurian (1982) developed a theory of crop insurance. The authors presented a model of public insurance as a decentralized plan, where the farmer determines factor utilization taking the insurance contract as given. In turn, the insurance agency, taking factor utilization as determined by the farmer, chooses the optimal contract so as to maximize the value of aggregate output in the economy.

Gur Huberman, David Mayers and Clifford W. Smith Jr. (1983) showed that absent moral hazard, economies of scale in the administrative cost technology imply that optimal contracts between risk-averse policyholders and risk-neutral insurers cannot obtain a deductible.

Neil A. Doherty and Harris Schlessinger (1983) examined the theory of optimal insurance purchasing in the presence of uninsurable background risk. More specifically, the paper demonstrated that optimal insurance-purchasing strategies depend on the correlation between risks in an individual's portfolio.

Joseph E. Stiglitz (1983) explored the relationship between risk, insurance, incentives and imperfect information.

Christian Gollier (1987) generalized previous results on optimal insurance.

Michael Beenstock, Gerry Dickinson and Sajay Khajuria (1988) carried out an international analysis in order to investigate the relationship between economic development (as measured by per capita GNP) and property-liability insurance premiums.

Robert G. Chambers (1989) studied Pareto-optimal and constrained Pareto-optimal insurance contracts. The paper also examined the effect of moral hazard on all-risk agricultural insurance indemnity schedules. Results for indemnity schedules under moral hazard and constant absolute risk aversion showed that providing farmers with the incentives to take appropriate actions may imply lower deductibles in the presence of moral hazard than in the absence of moral hazard.

Marcel Boyer and Georges Dionne (1989) reduced the gap between empirical studies on moral hazard and experience rating. By designing a set of variables depicting individual characteristics and a set of variables to be interpreted as proxies for the individual's self-protection behavior and by estimating a Probit model of the individual probability of an accident led to a very significant result: taking explicitly into account individual characteristics, the authors found that the variables used as proxies of the individual's self-protection behavior are significant in explaining the probability of an accident.

Henri Louberge (Ed.) (1990) included a paper from **Roland Eisen**, which demonstrated that there exist competitive equilibria even with asymmetric information.

Michael J. Brockman and Thomas S. Wright (1992) used the Generalized Linear Model technique to estimate risk and premiums from past claims data in U.K. motor insurance.

H. R. Dumas (1993) gave a lecture on the ageing of the world fleet and its effect for Reinsurers. The speaker used data from his Syndicate's results in an extensive period of time, i.e. fourteen (14) years from 1979 to 1993. His analysis was based on correlation between his Syndicate's loss ratio over that period of time as opposed to both dry cargo and tanker earnings. The speaker admitted that the lack of sufficient data in particular average claims fails to "*produce a reliable scale*". Nevertheless, the conclusion of this presentation is a fair comment for our thesis as the speaker invites all involved in the business to "*do the research, for if the reinsurance Market correctly assesses the risk that it is being asked to take and it reacts accordingly, then some of what I feel may happen to marine hull and other areas of marine business in the mid 1990's can yet be avoided*".

Anita Khiani (1998) analysed the insurance of "sundry hulls" in India. "Sundry Hulls" is a term used by Insurers to differentiate certain types of small craft from ocean going ships. Although the analysis was quite comprehensive it failed to provide underwriting solutions for each type of vessel and did not take into account the individual deductible levels for these vessels. Besides, the data was based only on five (5) years, i.e. from 1992 to 1997, while things might have changed if the author had access to underwriting results over a longer period. In addition to the above the author did not propose a model for rating this type of vessels, but she only suggested that with the collection of the necessary data insurers and provided "*computerisation is made comprehensive for sundry hulls*" loss prevention techniques could be developed. Finally, the author did not explain the reason for poor underwriting results in 1992-3 and we, therefore, consider the whole analysis to be quite narrow.

Finally, the most recent paper was published in May 2004 by **Brian Gedalla, P. Jackson & David E. A. Sanders**. The authors indicated how the Generalized Linear

Modelling technique can be used to rate Marine Liability business. Although the analysis has both a common area with our thesis, i.e. the Marine Insurance Market and the fact that it also used the Poisson error structure with a log link for the frequency model, we found the above paper to be quite general. The reason is that it only provided a broad analysis as to how the P. & I. Market operates and it suggested the GLM modeling for the derivation of statistically valid premium for each vessel. The authors did not give specific examples for each type of vessel, they did not proceed with suggested call levels that the various types of vessels should be rated and they did not show how the deductible factor can be taken into consideration for the above modeling technique.

Concluding this section we would comment that from all papers studied we discovered only one actuarial paper with a flavor for Hull & Machinery insurance. We also noticed one recent paper on the P. & I. Market and one with a rather statistical and not actuarial analysis of vessels similar to those analysed in our thesis. It therefore appears to be a lack of similar research in the actuarial library, since the data we have included in the thesis is unique, quite extensive, original, reliable and unpublished. Our analysis of the data is also unique, since we did not find, despite our extensive research, any similar paper dealing with either the marine insurance market in general or with the more specialised area of fishing vessels insurance.

CHAPTER 2 - INTRODUCTION

The term "London market"[2] is used to distinguish that part of the British insurance market that provides insurance and reinsurance services mainly for overseas, as distinct from UK domestic, risks. Overwhelmingly the business transacted is marine and other non-life classes of insurance. An important feature of the market is that the insurers (or their underwriting agents) and the brokers, who serve the market, are grouped in a small geographical area at or near Lloyd's of London. This enables the market to spread the fixed costs of trading in the manner of many securities markets. The London Market consists of a number of components:

- the majority of the 171 Marine & Aviation, and the 145 Non-Marine (excluding motor) underwriting syndicates at Lloyd's;
- the Institute of London Underwriters (which has 112 members from the United Kingdom and overseas);
- many of the 500 or so British and foreign companies incorporated in the United Kingdom and authorized to write non-life insurance business;
- most of the 140 branch offices or foreign insurers located in the United Kingdom;
- the underwriting agencies writing business on behalf of UK-authorized British and foreign insurers and re-insurers; and
- the insurance broking firms that place business on the market.

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[2] Louberge, Henri (ed.), (1990), *Risk, Information and Insurance: Essays in the Memory of Karl H. Borch*, University of Geneva, Carouge / Geneva.

Lloyd's is an insurance market of a kind to be found nowhere else in the world. Almost anything can be insured there: fleets of ships and aircraft, supertankers and giant airliners, civil engineering projects, factories, oil rigs and refineries, to name but a few of the thousand-and-one risks which are placed at Lloyd's each year. This business flows in all parts of the world and represents an income of over £8 million in premium each working day.

Lloyd's is not a company. It has no shareholders and accepts no corporate liability for risks insured there. Lloyd's is a society of underwriters, all of whom accept insurance risks for their personal profit or loss and are liable to the full extent of their private fortunes to meet their insurance commitments.

A proper understanding of the present day Lloyd's, how it works, why it exists even, is impossible without a brief glimpse at the past.

The origins of marine insurance are barely discernible in the mists of time. The practice was introduced in England by the Lombards in the sixteenth century. The growing importance of London as a centre of trade after the English Civil War led to a steady increase in the demand for the insurance of ships and cargoes.

This coincided with the rise in popularity of coffee drinking in England, a custom which had far-reaching effects upon the nation's social and commercial life. The first London coffeehouse opened in 1652. From the time of King Charles's restoration to the throne in 1660, coffeehouses proliferated until by the end of the century they were numbered in hundreds. In contrast to the inns and taverns, which had always existed in profusion, coffeehouses provided congenial meeting places for serious and clear-headed discussion. In the City, their popularity as places for the transaction of business was quickly established. The Royal Exchange, the traditional meeting-place of merchants, offered little in the way of comfort and convenience and must have been frequently deserted in favour of the coffeehouse.

Business in those days was conducted very informally and the insurance of ships and cargoes was a fairly simple matter of hawking a policy around the City for subscription by anyone with the private means to take a share of the risk in return for a portion of the premium. A merchant with a ship to insure would request an "insurance office" to obtain cover. There were no marine insurance companies in the seventeenth century and the proprietor of the insurance office acted as a broker, taking the policy from one wealthy merchant to another until the risk was fully covered. The broker's skill lay chiefly in ensuring that policies were underwritten only by men of sufficient financial integrity to meet their share of a claim - to the full extent, if need be, of their personal fortunes.

It was against this background that Lloyd's Coffee House made its appearance in Tower Street sometime in 1688, the year that the "bloodless" revolution brought William and Mary to the throne of England. Unfortunately, very little is known either about Edward Lloyd or his coffeehouse. It was one of many similar establishments and, apart from occasional references in contemporary newspapers, the record is blank. The first mention of Lloyd's appears in a London Gazette of the late 1680s where an advertisement offers a guinea reward for information about stolen watches, claimable from "Mr. Edward Lloyd's Coffee House in Tower Street".

It seems very likely that, from the first, Edward Lloyd encouraged a clientele of ships' captains, merchants, shipowners and the like. Coffee houses in general (and Lloyd's was surely no exception) were centres of discussion where, in the days before newspapers, the latest gossip could be heard. More than this, at a time when communications were laborious and unreliable, Edward Lloyd gained an enviable reputation for trustworthy shipping news. This was one of the basic ingredients for successful underwriting and perhaps more than any other factor, ensured that Lloyd's Coffeehouse, over and above its rivals, became the recognized place for obtaining marine insurance.

As far as is known, Edward Lloyd took no part in underwriting. He contented himself with providing congenial surroundings and the facilities for his patrons to do business, remaining a "coffee-man" until his death in 1713. Lloyd's chief bequest to posterity was his name and the coffeehouse, which bore it.

Up to 1720 there is nothing to suggest that underwriting carried on exclusively in any one place. But in that year a piece of legislation was enacted by Parliament, which profoundly influenced the future of Lloyd's Coffeehouse as a centre of marine insurance.

For some years previously there had been intermittent attempts to set up a securely based insurance corporation (or chartered company) which it was hoped would bring some regularity to the disorderly commercial world of the early Georgian period. At this time, too much wealth and too little employment for it had given rise to wild investment speculation, which swept London and culminated in the collapse of the South Sea Company in 1720, ruining thousands of investors.

The "South Sea Bubble" was the most spectacular of many frauds and failures of corporate enterprises at a time when disreputable companies ballooned and burst overnight.

The "Bubble Act" (so-called because it was passed as the drama of the South Sea Company reached its climax) granted charters to the Royal Exchange Assurance and the London Assurance Companies, prohibiting marine insurance by any other corporation or business partnership. The legislators had no intention, however, of curbing the underwriting activities of private individuals, those respectable merchants who had traditionally subscribed their names to insurance policies.

Unlike the companies and partnership groups, private underwriters on accepting a risk bound themselves "each for his own part not for one another" and, by long-standing custom, the whole of their private estate was pledged as security to meet a claim. For these reasons the Act deliberately excluded "private and particular persons" from its scope and Lloyd's can be fairly said to owe its future existence to this omission.

As it happened, the threat presented by the two unenterprising insurance corporations did not prove to be serious, though it probably caused the merchant underwriters to concentrate in a community of interest at the place most frequented by them - Lloyd's Coffee House in Lombard Street.

As the eighteenth century drew on, the informal gathering of merchants at Lloyd's gradually assumed a more cohesive identity. But there was little or no restriction of the activities of the patrons and we can assume that a very mixed bag gathered under its roof. In those times a thin line divided respectable marine underwriting from the sort of insurance that would now be regarded even beyond the scope of a bookmaker. Gambling was still the outlet for excess wealth as it had been in the years before the South Sea Bubble burst. Side by side with the insurer of ships and cargoes there were men who would make a book on any eventuality - against an ailing monarch, for example, dying within a certain time, or a highwayman being caught and hanged. In 1769, however, a number of Lloyd's more reputable customers decided to break away and set up a rival establishment in nearby Pope's Head Alley devoted strictly to marine insurance. This step was one of the first signs of any community of interest among underwriters at the coffee-house. It led rapidly to the establishment of a properly constituted society out of which evolved the business institution of today.

"New Lloyd's Coffee House", as it was called, soon proved to be too small. In 1771 a Committee was elected to find new premises and seventy-nine merchants, underwriters and brokers each paid £100 into the Bank of England for the purpose.

Three years later, rooms were leased by the Committee in the Royal Exchange and "New Lloyd's" left the coffee-house for good. Although everyone still referred to "Lloyd's Coffee House" for many years to come there is no doubt that it immediately took on the appearance of a place of business rather than one of refreshment. The modern Lloyd's had been born.

Old times: the coffee house at Lloyd's by an unknown artist, published in 1798

For the next century the society of underwriters at Lloyd's evolved step by step, gradually assuming its present-day form. Membership was regulated and the elected Committee given increased authority. This period of evolution culminated in 1871 with the incorporation of Lloyd's by Act of Parliament. Up to then, Lloyd's constitution had been based on the "Trust Deed", a legal document drawn up in 1811 and signed voluntarily by all subscribers to Lloyd's - or "members" as they were called after 1843. Lloyd's Act gave the Society a formal legal basis enabling it to acquire property and to make bye-laws which had the full authority of Parliament behind them. If the Trust Deed marked the end of the coffeehouse era, Lloyd's Act confirmed the existence of the modern business institution seen at Lloyd's today.

The hundred years from the election of the first Committee was a testing and formative period for Lloyd's during which it survived the strain of both the American War of Independence, and a twenty-year war with France. From 1824 onwards it also faced competition from the newly emancipated insurance companies. Rather than being weakened, Lloyd's emerged with its character forged, its reliability tested and with greater resilience than ever.

Lloyd's 1871 Act of Parliament created the Corporation of Lloyd's. Incorporation does not imply any acceptance of corporate liability by Lloyd's for the insurance business transacted by its members. The principle of individual and unlimited liability remains as valid today as it was three centuries ago. The Corporation, through the Committee of Lloyd's nevertheless lays down stringent regulations governing the financial requirements both for Lloyd's membership and the audit of underwriting accounts. The Corporation of Lloyd's, as befits the true successor to Edward Lloyd, also provides its members with their premises and a variety of centralized supporting services.

Lloyd's Act of 1871 has been followed by five further Acts to meet the Society's changing needs. The most recent of these, Lloyd's Act 1982, resulted from an enquiry into the Society's constitution and the effectiveness of its powers of self-regulation. The enquiry, established by Lloyd's in 1978 and chaired by a former High Court Judge, Sir Henry Fisher, recommended the formation of a new Council of Lloyd's to assume the rule-making and disciplinary functions hitherto vested in Lloyd's membership as a whole.

As it was three centuries ago, a policy is subscribed at Lloyd's today by private individuals with unlimited liability. Now that Lloyd's members are numbered in thousands, however, the method of underwriting is the same only in principle. The merchant of the past, signing policies in a coffee house as a side-line to his main business, gave way long ago to the professional underwriter employed by others to accept business at Lloyd's on their behalf. Today, over 20,000 members of Lloyd's are grouped into various syndicates varying in size from a few to more than a thousand names. The affairs of each syndicate are managed by an underwriting agent who is responsible for appointing a professional underwriter for each main class of business.

The syndicate system developed from a practice which was common enough in former times whereby an underwriter would "write a line" on a policy on behalf of one or two acquaintances who might have lacked the time or skill to sit in person at Lloyd's. With the development of marine insurance as a profession came an increase in the number of those employing an underwriter to act for them. In the 1840s, the Committee insisted that all whose names appeared on a Lloyd's policy, whether underwriting in person or through an agent, should first be elected members of the Society. This was one of the first of many steps taken to strengthen Lloyd's policies whose security today is unparalleled.

Early syndicates were small and reflected the relatively modest amount of business available to the market in those days. The big underwriting syndicates of today are a direct result of Lloyd's great expansion in the last ninety years. In spite of dire predictions to the contrary, the new non-marine risks of the 1880s proved very profitable and one or two enterprising men at Lloyd's found themselves underwriting for larger syndicates than had ever been seen before. The non-marine market rapidly expanded and, with premiums flowing from all parts of the world, Lloyd's underwriters were able to cover the increasing volume of business only by accepting an ever-growing number of names into their syndicates.

Underwriting membership is open to men and women of any nationality provided that they meet the stringent financial requirements of the Committee of Lloyd's.

Lloyd's membership today is drawn from many sources. Industry, commerce and the professions are strongly represented while many members are actively engaged at Lloyd's either on the broking or the underwriting side.

Until recently, Lloyd's capital base was entirely provided by its Names, the individuals whose personal wealth underpinned the market's underwriting. When Lloyd's hit large losses in 1989-92, the number of traditional Names continuing to underwrite decreased. In response, Lloyd's, with the consent of the Names, allowed corporate members to enter the market. The first 25 corporate members joined in 1994. Almost all were spread vehicles, which invested on portfolios of syndicates, in some respects not dissimilar to Names investing through Members' Agents Pooling Arrangements, or MAPAs.

Some of the spread vehicles were investment trusts with a stock market listing. There were others formed by Names and others who were owned by major international insurers.

The Underwriting Room at Lloyd's is essentially a market for insurance where the placing of risks is a matter of negotiation between broker and underwriter.

The insurance broker is a key figure in the Lloyd's market. Lloyd's underwriters have no other contact with the insuring public and their premium income is entirely dependent on the initiative and enterprises of Lloyd's brokers in obtaining business throughout the world. The Committee of Lloyd's demands the highest professional standards from the several hundred accredited brokerage firms permitted to place risks in the Room.

The Lloyd's broker's prime duty is to negotiate the best available terms for his clients. To this end he is free to place risks wherever he thinks fit whether at Lloyd's, with the insurance companies or both.

On receiving a request for insurance cover, a Lloyd's broker first makes out the "slip" - a sheet of folded paper with details of the risk. The next step is to negotiate a rate of premium with underwriters, expert in that particular type of business. Lloyd's thrives on competition and the broker may obtain several quotes before deciding on the best one - bearing in mind what his client will be prepared to pay and what level of premium is required to get the risk adequately covered in the market. The leading underwriter, having set the rate, takes a proportion of the risk on behalf of the syndicate.

Armed with this "lead" the broker approaches as many other syndicates as are needed to get the slip fully subscribed. Large risks are usually spread over the whole London market, cover being shared by Lloyd's underwriters and the insurance companies.

Only the 262 firms of Lloyd's registered brokers have access to Lloyd's underwriters, but many Lloyd's brokers form part of larger broking groups which themselves may be wholly or partly owned by, or have operating agreements with, foreign brokers. The large scale of operation of the main brokers serving the London market enables them to take advantage of the economies of scale, which are not available to many insurers (because of their generally small size). In the 1970s major American brokers took over or acquired shareholdings in Lloyd's brokering firms to give them direct access to the Lloyd's market.

Unlike many national markets, market concentration in London is low (and in fact, the market's modus operandi depends on the absence of any dominating groups). For example, although over half of the reinsurances written in London are placed at Lloyd's, the syndicates are separately managed, operate wholly independently of, and compete against each other. Likewise, no one company dominates the company sector of the market. The premium income of the largest British specialist reinsurance company (the Mercantile and General Re.) is less than one-quarter that of the world's largest reinsurers (the Munich Re. and the Swiss Re.). With very few exceptions, all of the world's major reinsurance companies are authorized to transact business in Britain.

All companies, whether British or foreign-owned, that wish to undertake insurance or reinsurance business in Britain must obtain authorization from the Department of Trade and Industry (DTI). Lloyd's syndicates are regulated by both the Council and the Committee of Lloyd's, under the provisions of the Lloyd's Acts 1870-1982. A breakdown of the number of companies and Lloyd's syndicates authorized to write general insurance business in the United Kingdom is given in Table 2.1:

Table 2.1 – The number of Companies Authorized to Write General Insurance Business in the United Kingdom

Year	U.K. Companies	Foreign Companies	Total	Lloyd's Syndicates	Grand Total
1970	458	115	573	254	827
1972	447	129	576	258	834
1974	460	126	586	278	864
1976	436	115	551	328	879
1978	444	96	540	354	894
1980	468	100	568	430	998
1982	480	148	628	425	1,053
1984	490	139	629	391	1,020
1986	482	137	619	366	985
1998			880	156	1,036

Source: Department of Trade and Industry, U.K.

Although the DTI strictly regulates the financial standing of authorized insurance companies, it exercises no control over premium rates or contract terms, leaving decisions on such matters to the commercial judgment of the parties concerned.

Spreading a risk as widely as possible is one of the cardinal principles of insurance, which enables Lloyd's and the London market to withstand the pressure of heavy claims, which might otherwise be ruinous. The famous preamble to an insurance Act of Parliament passed during the reign of Elizabeth I puts it succinctly "...it cometh to pass that on loss or perishing of any ship there followeth not the undoing of any man, but the loss lighteth rather easily upon many than heavilie upon fewe...".

Probably nowhere in the world there is so much collective underwriting expertise under one roof as at Lloyd's. Although syndicates compete with each other there is a wealth of shared experience within the market. This subtle blend of competition and co-operation combines with an unshakeable belief in the old insurance dictum of "utmost good faith" to give Lloyd's its unique quality.

Good faith undoubtedly characterizes the relationship between broker and underwriters, who each place considerable trust in one another. An underwriter's signature on a slip is absolutely binding - in honour if not in law - and the broker can be confident that a valid claim would be settled even if it were presented before a policy had been issued. For his part, the underwriter knows that the broker will have disclosed all material facts accurately and fairly. Without such mutual trust, Lloyd's would not long survive.

Modern marine insurance covers not only the traditional areas of hull and cargoes but the whole field of transport insurance - the carriage of goods of every description by land, sea and air - as well as structures such as oil production rigs deep-sea exploration platforms.

The competitive character of the London market is influenced by four main factors: the number of competitors, entry and exit from the market, the exposure to external competition, and market practice.

The large number of competing insurers operating in the London market, combined with the low level of market concentration, creates the conditions for a highly competitive market. Table 2.1 shows that the number of competing insurers has increased since 1970; furthermore, this has been accompanied by a fall in market concentration as the smaller companies have managed to increase their market share in recent years. However, the risks insured in the market are generally too large for any one underwriter to provide all of the capacity required.

Therefore underwriters usually share risks among themselves (on a coinsurance basis) by means of the "slip" system.

There is relatively free movement of insurers into and out of the London market. The provisions of the *Insurance Companies Act 1982* do not represent a significant entry barrier to any financial sound, well-managed company (be it British or foreign owned). Over the ten years before 1985, 147 companies (of which two-thirds were foreign-incorporated or owned) were newly authorized in the United Kingdom to write one or more classes of non-life insurance.

London-based insurers are also exposed to competition from insurers based in other countries. Generally the types of insurance and reinsurance offered in London are also widely available in the United States, Europe, Japan, and elsewhere. Furthermore the numbers of professional insurers world-wide has increased substantially over the last ten years.

The unique feature of the London market is the presence of Lloyd's; the Lloyd's brokers who bring the business to the syndicates also serve the company sector of the market. Since most of the insurances that come to the market are beyond the capacity of any one insurer or reinsurer to handle, risks are shared among a number of syndicates and/or companies using a coinsurance slip.

The skill of a lead underwriter on the slip (and of the insurance broker who first approached that underwriter), is to give a premium quotation that a sufficient number of other underwriters (we use the term "followers") will be prepared to follow in all respects, so as to enable the broker to complete the slip. However, by initialling an original slip unconditionally and applying the stamp that bears his syndicate's number, the Lloyd's underwriter completes a binding contract for that share of it that he indicates on the slip. In those instances where the broker has presented slips for the same risk to more than one lead underwriter, the leads are essentially competing against each other with the broker acting as referee.

We identify two main categories of follower: first there are a number of insurers, both Lloyd's syndicates and companies, who, while participating mainly as followers, do make their own underwriting assessments of the risks offered to them - these we call the "active" followers. Secondly, a substantial number of insurers are content to provide a "following market" and do not attempt to make any detailed underwriting assessment of the risks they are called upon to consider, relying principally on the reputation of the leader - we term these "passive" followers.

Normally a lead underwriter will gain his position on the basis of his market reputation for rating the type of risk concerned. One might expect such a reputation to be based on the underwriter's past track record in terms of his ability to set premium rates that generated (at least normal) profits for himself and/or followers. However the nature of the risks placed on the London market make it difficult to assess the appropriateness of a given premium rate (although attempts to validate premium rates scientifically are now more common). In practice, the lead underwriter is more likely to signal a leading position by having the ability to attract followers even at a low price.

In neither the UK domestic insurance market nor the London market does there exist for any class of non-marine insurance any market agreement requiring insurers to conform to uniform premium rates or policy coverage. Any attempt to negotiate and enforce such an agreement would probably be deemed to be contrary to UK anti-competition law. Likewise there are no market agreements governing any class or type of reinsurances. In any event, the nature of the business placed on the London market does not lend itself to rating manuals, let alone to standard premium rates and terms applied across the whole market. Instead, the premium rates for the insurance of large risks are subject to individual negotiation.

Although scientific techniques are often employed to assess claims potentials, it is inevitable that some measure of judgment enters into an underwriter's rating decisions. The coinsurance system employed in the London market enables the lead underwriter to test out his estimation of the risk premium on the rest of the market (particularly the active followers). In instances where the characteristics of the loss are not known or agreed, the test of whether or not the premium is considered adequate is in the broker's ability to complete the slip. If the slip cannot be completed at the established rate, this indicates that other underwriters do not consider the rate to be high enough. In cases where a slip is under-subscribed, legal opinion appears to be divided on whether it is binding on the underwriters. However the most accepted view is that once a syndicate places its signature on an original slip, it gives its word that it will honour that agreement.

It is unclear whether or not an oversubscribed slip implies that following underwriters consider the premium rate to be too high. In practice, it is common for slips to be oversubscribed even for those risks where there ought to be a measure of agreement on the appropriate rate (for example, in *General Accident v. Tanter* [1984],[3] a slip covering all marine perils was oversubscribed by 182.5%). In such instances, the slip is then "signed down" so that the cover offered by each underwriter is proportionately reduced. There are a number of commercial reasons why a slip may be oversubscribed: it looks good for the broker, large lines by leading underwriters encourage further participation by others, it enables the slip to be filled quickly, and it makes any extension of cover easier to obtain in the future. However *General Accident*

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[3] General Accident Fire and Life Assurance Corporation and others vs. Peter William Tanter and others (*"The Zephyr"*), (1984), QB (Comm. Ct.), 1983, Lloyd's Law Reports, 58, Volume 1, pp. 58-101.

v. Tanter [1984] demonstrated that, before deciding on the optimal amount of cover for which to sign, the lead underwriter needs to consider the likely extent of signing down, so that the signing down procedure does not necessarily imply that underwriters are unable to arrange their optimal levels of cover. Although there are ways in which an underwriter can prevent his cover being signed down, the practice of over-subscription may prevent an individual underwriter from obtaining a substantial share of the risk.

The purpose of this introductory chapter was to explain how the London insurance market works and look at its history. We think it was important especially for the readers who are not so familiar with these details that make the London market the leading insurance market in the world for the past three centuries. Our analysis for the fishing vessels that will follow is based on the vessels insured in the London Market from 1970 until 1998, hence we looked at how this market operates. In the next chapter we shall begin our analysis on the fishing vessels by looking at the claims situation in the Greek fishing fleet during these years.

CHAPTER 3 - ANALYSIS OF CLAIMS

3.1 Introduction

The Greek fishing fleet in 1997 was the largest within the European Union in terms of number of vessels with a total of 20,334 trawlers, approximately 21% of the total European fishing fleet. With the exception of a group of 60 trawlers, which operate off the Mediterranean Sea, the total Greek fleet operates within Greek waters. The main fleet consists of 380 fishing trawlers ("Michanotrata" type) which catch about 22% of the Greek production. It is also worth noting the fleet of 410 "gri-gri" type of vessels, which catch both small and medium-size fish. These vessels operate in various areas within Greek waters and the most important ports are Salonica and Kavala in the North-Eastern coast and Piraeus in the Eastern coast. The average size per vessel has only a gross tonnage (GRT) of 6 and the breakdown of the fleet is shown in Table 3.1:

Table 3.1 – Breakdown of the Greek fishing fleet

Length Overall	Number	Total Power of Engine in BHP	Total Capacity in GRT
< 10 metres	18,724	363,935	42,287
10 - 15 metres	972	103,730	17,149
15 - 24 metres	516	135,755	31,033
> 24 metres	105	51,303	26,113
No details	17	1,571	692

Source: Fishing News Magazine, March 1997

This chapter is in four sections. The first section describes the scope and size of the analysis and sets it in the context of the overall claims experience of the Greek fishing vessels. The relative importance of human error, structural failure and other factors are analyzed in section two, where both total loss and particular average claims are reviewed separately. Section three deals with the analysis of the distribution of claims for their number and amounts. Finally, in section four we analyze both the frequency and the severity of claims for fishing vessels.

Because the data is collected over a period of 29 years during which monetary values have changed, it was considered important to bring the values onto a common basis by means of a suitably chosen index. All claims are shown on a "fleet" year. There is, thus, a distinction between statistics based upon the "underwriting" year, which will include all premiums closed in that year and the settlements applying to those premiums and the "fleet" year by which all business attaching to one year's fleet slip will be aggregated, whether it was actually closed in the current or the subsequent underwriting year[4]. A breakdown of the claims was therefore affected by both labour and spare parts. The amounts were then deflated in accordance to the local inflation of the country where the repairs were carried out. As consumer price indices for certain countries of Africa were not available, such as: Libya (1990-1998), Liberia (1991-1998), Cameroon (1998), Tanzania (1990-1994) and Benin (1976-1991) we used the average Consumer Price Index for the West African countries instead.

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[4] CII Tuition Service, *Marine Underwriting*, Study Course, 190M/073, Chapter 8, pp. 1-7.

The analysis examines the underlying causes of the 251 claims which occurred in Greek owned / managed fishing vessels between 1st January, 1970 and 31st December, 1998 which had been notified to "Insurance Agencies J. Kouroutis & Co. Ltd.". This company has been specializing since 1946 in the insurance of fishing vessels under its current form, but also under its predecessors, "Michalinos Insurance Agency Co." and "Insurance Agencies Company Ltd." through the representation of the London Brokers shown in Table 3.2:

Table 3.2 – List of Lloyd's Brokers represented in Greece by Insurance Agencies Co. Ltd.

Name of London Broker	Period of Representation	Name of appointed representative
Joseph W. Hobbs & Co.	14/8/1946 – 10/2/1947	The Michalinos Coal Trading Co. Ltd. (Managers of Michalinos Insurance Agency Co.)
Hobbs Savill & Co. Ltd.	10/2/1947 – 23/9/1972	The Michalinos Coal Trading Co. Ltd. (Managers of Michalinos Insurance Agency Co.)
Hobbs Savill & Co. Ltd.	23/9/1972 – 27/6/1980	Insurance Agencies Co. Ltd.
Rbt Bradford Hobbs Savill Ltd.	27/6/1980 – 26/7/1982	Insurance Agencies Co. Ltd.
Paul Bradford and Co. Ltd.	26/7/1982 – 23/8/1983	Insurance Agencies J. Kouroutis & Co. Ltd.
Paul Bradford and Co. Ltd.	23/8/1983 – 16/8/1985	Insurance Agencies J. Kouroutis & Co. Ltd.
Clarkson Puckle Limited	16/7/1985 – 18/5/1988	Insurance Agencies J. Kouroutis & Co. Ltd.

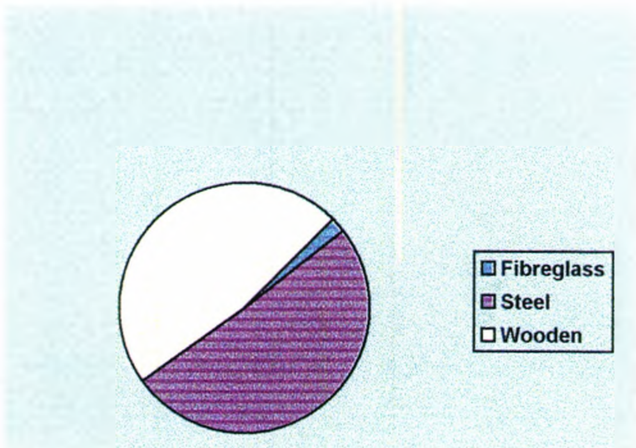
Bain Clarkson Limited	18/5/1988 – 17/3/1995	Insurance Agencies J. Kouroutis & Co. Ltd.
Bain Hogg Limited	17/3/1995 – 21/1/1998	Insurance Agencies J. Kouroutis & Co. Ltd.
Aon Group Limited	21/1/1998 – 2/8/1999	Insurance Agencies J. Kouroutis & Co. Ltd.
The Miller Insurance Group	2/8/1999 – To date	Insurance Agencies J. Kouroutis & Co. Ltd.

3.2 Claims Experience

3.2.1 Types of vessels

We examined 251 claims from the years 1970 - 1998. 5 occurred in fibreglass type (1.99% of total), 129 in steel type (51.39%) and 117 in wooden type (46.61%) vessels. Graph 3.1 shows the breakdown in the number of the various types:

Graph 3.1 – Types of vessels

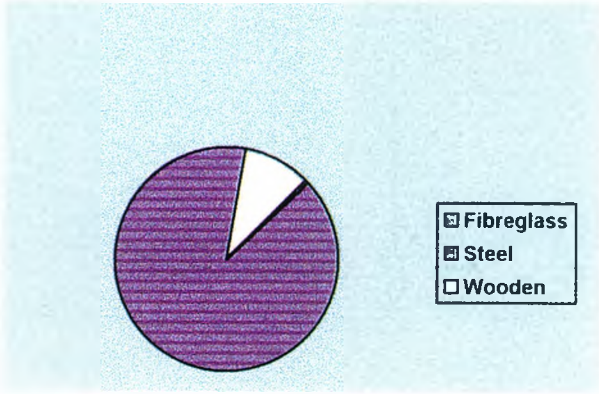


The tonnage that suffered a casualty is split as shown in table 3.3 and in graph 3.2:

Table 3.3 – Types of vessels / tonnage

Fibreglass:	191.72	(0.50%)
Steel:	34,631.62	(89.79%)
Wooden:	3,759.02	(9.75%)

Graph 3.2 – Types of vessels / tonnage



We notice that the majority of vessels that had a casualty were steel. This of course is the result of larger steel trawlers compared to the size of fibreglass and wooden ones.

In terms of comparisons between types of vessels and values of claims we obtained the results shown in table 3.4 and in graph 3.3:

Table 3.4 – Types of vessels / values (in US$)

(a) Submitted Claims:

Fibreglass:	US$	1,340,977.58	(4.33%)
Steel:	US$	26,616,251.00	(86.02%)
Wooden:	US$	2,985,842.08	(9.65%)

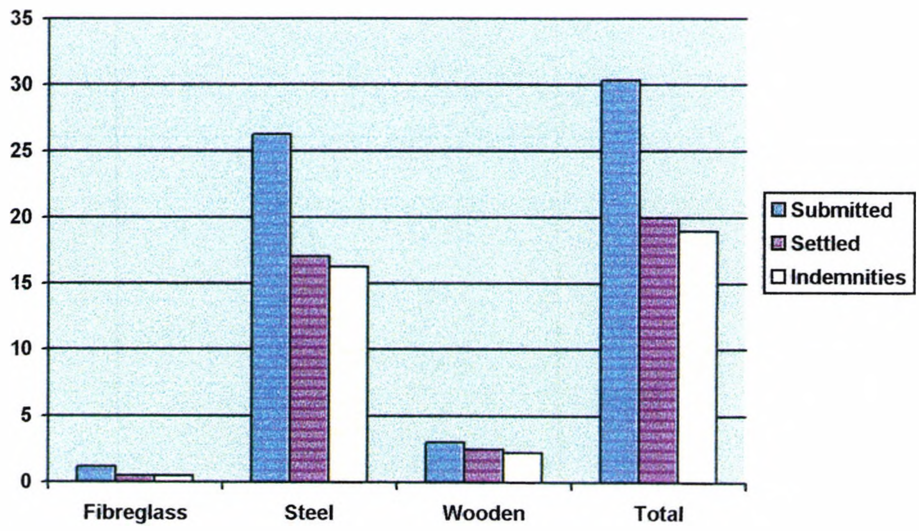
(b) Settled Claims:

Fibreglass:	US$	570,431.96	(2.65%)
Steel:	US$	18,550,239.67	(86.07%)
Wooden:	US$	2,431,579.13	(11.28%)

(c) Indemnities Paid:

Fibreglass:	US$	488,722.06	(2.40%)
Steel:	US$	17,648,100.96	(86.84%)
Wooden:	US$	2,186,640.88	(10.76%)

Graph 3.3 – Types of vessels / values (in US$ m)



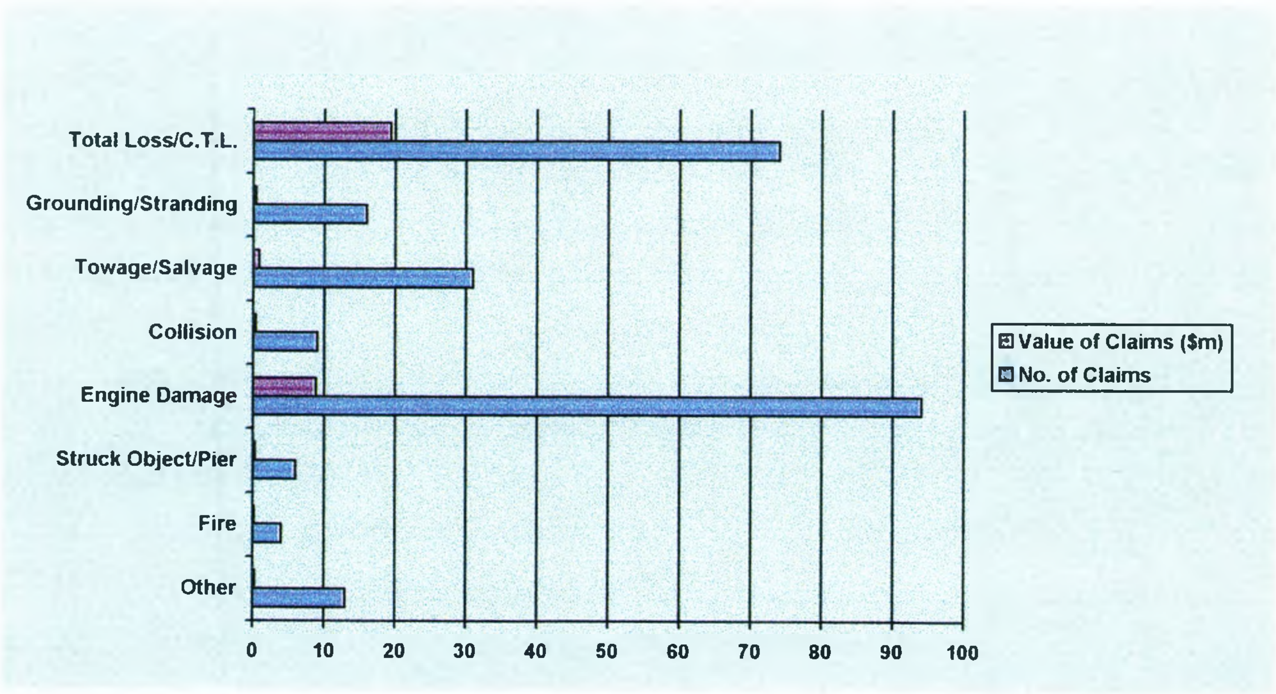
3.2.2 Types of claims

The review takes account of all claims reported within the risk period. There were 251 such claims with a gross submitted value of US$30,943,070.66. Almost 63 per cent of the amount of these claims are in respect of either Total Loss or Constructive Total Loss. The remaining claims refer to Engine Damage (27.71%), Salvage / Towage (6.12%), Collision, Grounding / Stranding, Struck Object / Pier, and Fire. The pattern of all claims analyzed by reference to the type of risk concerned is as shown in table 3.5 and in graphs 3.4 & 3.5:

Table 3.5 – Types of Claims

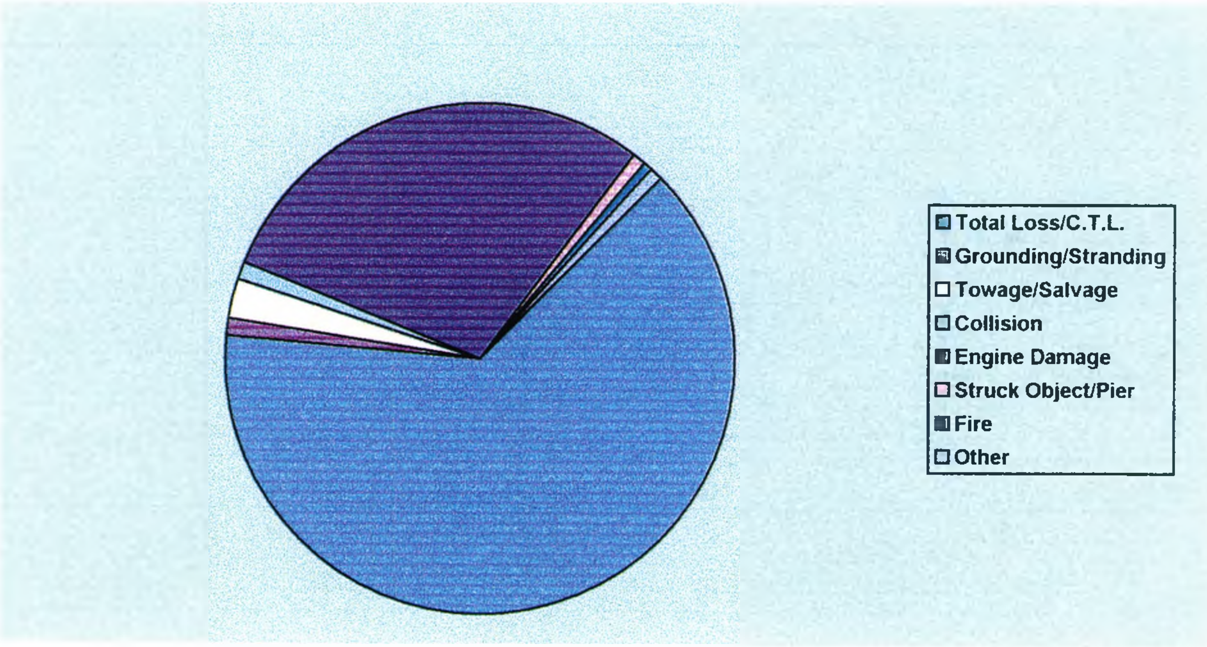
	No.	Submitted claims	Settled claims	Indemnities
Total Loss/ C.T.L. [5]	75	19,439,056.21	13,860,732.07	13,084,180.26
Grounding/Stranding	15	290,207.95	209,496.96	171,666.58
Towage/Salvage	70	1,895,326.93	1,242,528.31	1,183,807.65
Collision	9	350,378.17	241,002.37	241,002.37
Engine Damage	73	8,574,741.07	5,735,970.06	5,393,876.95
Struck Object/Pier	6	234,443.50	172,119.59	158,528.69
Fire	3	158,916.83	90,401.40	90,401.40

Graph 3.4 – Types of Claims



[5] C.T.L.: Constructive Total Loss

Graph 3.5 – Breakdown of Submitted Claims



3.2.3 Frequency

Because the number of claims is directly related to the number of exposures the claims incidence is expressed in terms of frequency per exposure unit.

$$Fk = \frac{kC}{E}$$

where:

F*k* = frequency per *k* exposure units

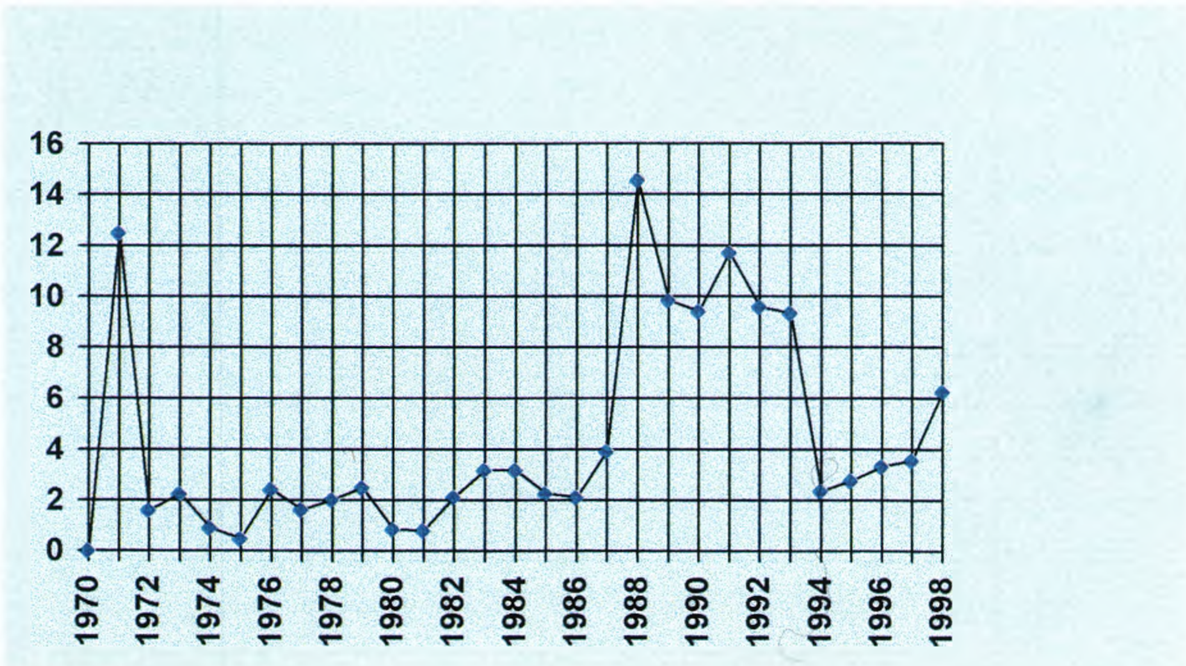
k = scale factor

C = claim count

E = exposure units

In our case we assume ***k*** = 100 and **E** is obtained by the number of policies written every year. Graph 3.6 shows the exposure of fishing vessels in the years 1970 - 1998:

Graph 3.6 – Frequency of Claims



The peak years, i.e. 1971, 1988 and 1991 are explained by the increase in the number of claims for these years. During the years 1988 – 1993 the number of individuals involved with owning fishing vessels was increased as a result of certain incentives encouraged by the E.E.C. This lead to a big number of Owners who had very little knowledge of fishing, a very specialized sector indeed, which increased the frequency of claims. The peak of 1971 is due to the cyclical effect faced by the fishing industry. We also notice that the trend has been relatively stable over the years from 1972 until 1987, whilst there is a rising trend from 1994 onwards.

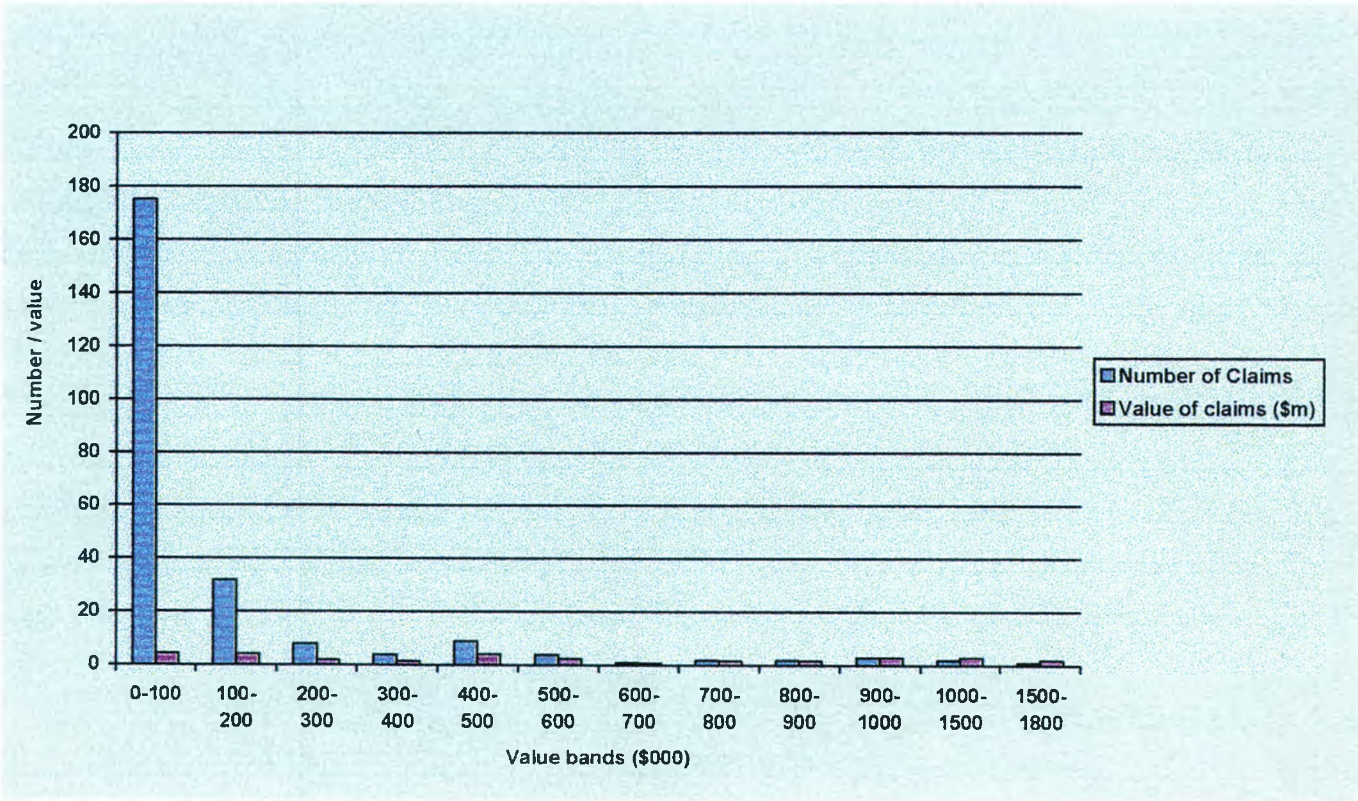
3.2.4 Values of claims

As can be seen from both table 3.6 and graph 3.7 there is a substantial number of claims, which are of amount less than $100,000 – over 72 per cent. A further 12 per cent of claims fall into the next band. The remaining ten value bands have a relatively small number of claims in each, although the value of those claims is significant in the fleet's overall performance.

Table 3.6 – Values of Claims

Bands of values	No. of claims (%)	Values of claims (%)
0 - 100,000	175 (72.31%)	4,511,690.61 (14.58%)
100,000 - 200,000	30 (12.40%)	4,513,927.00 (14.59%)
200,000 - 300,000	9 (3.72%)	2,142,156.56 (6.92%)
300,000 - 400,000	3 (1.24%)	1,065,586.53 (3.44%)
400,000 - 500,000	8 (3.31%)	3,511,432.58 (11.34%)
500,000 - 600,000	3 (1.24%)	1,557,004.21 (5.03%)
600,000 - 700,000	3 (1.24%)	1,881,673.98 (6.08%)
700,000 - 800,000	2 (0.83%)	1,450,000.00 (4.69%)
800,000 - 900,000	2 (0.83%)	1,650,000.00 (5.33%)
900,000 - 1,000,000	2 (0.83%)	1,859,599.19 (6.00%)
1,000,000 - 1,500,000	4 (1.65%)	5,000,000.00 (16.16%)
1,500,000 - 1,800,000	1 (0.41%)	1,800,000.00 (5.82%)

Graph 3.7 – Values of Claims



The *x* axis shows the various bands of values (e.g. 0-100,000, 100,000-200,000 etc.), whilst the *y* axis refers to both number of claims and values of claims (expressed in millions of US$).

3.3 Summary of Analytical Findings

This section deals with the causes of all claims reported by fishing vessel owners during 1970 – 1998. The analysis then carries on with the individual types of claims, i.e. both total and partial losses such as grounding, towage / salvage, collision, engine damage, struck object / pier and fire.

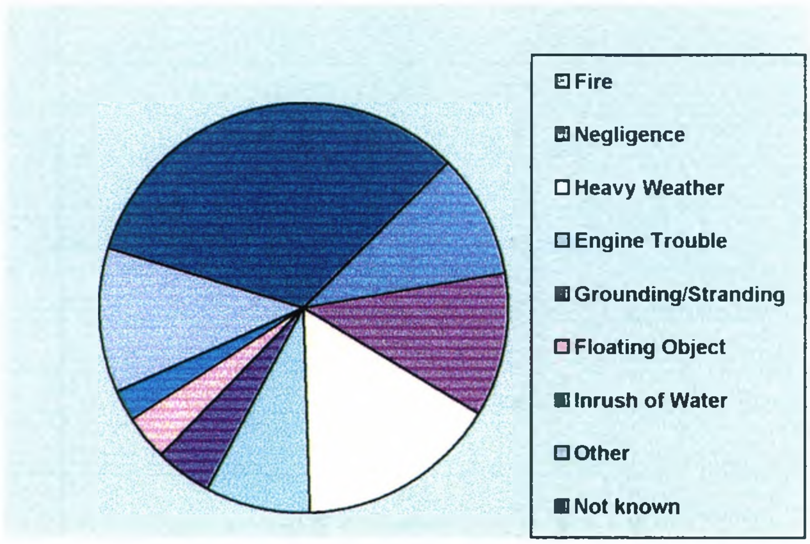
3.3.1 Causes of claims

Analyzing these claims by detailed cause, table 3.7, graphs 3.8 and 3.9 below indicate that heavy weather, engine trouble, negligence and fire predominate.

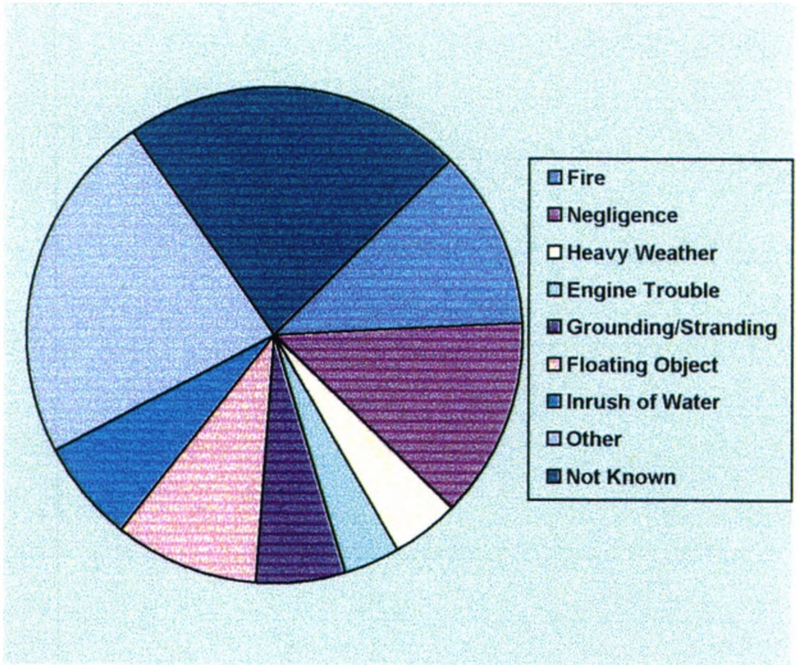
Table 3.7 – Causes of Claims

	No. of Claims	(%)	Submitted Claims	(%)
Fire	29	(11.55%)	4,344,353.74	(14.04%)
Negligence	31	(12.35%)	5,664,653.43	(18.31%)
Heavy Weather	43	(17.13%)	3,138,777.26	(10.14%)
Engine Trouble	47	(18.73%)	3,940,142.45	(12.73%)
Grounding etc.	17	(6.77%)	2,077,249.66	(6.71%)
Floating Object	10	(3.98%)	3,390,065.77	(10.96%)
Inrush of Water	6	(2.39%)	2,221,991.94	(7.18%)
Other	26	(10.36%)	1,784,901.10	(5.77%)
Not known	42	(16.74%)	4,380,937.98	(14.16%)

Graph 3.8 - Causes of Claims (in numbers)



Graph 3.9 - Causes of Claims (in US$ m)



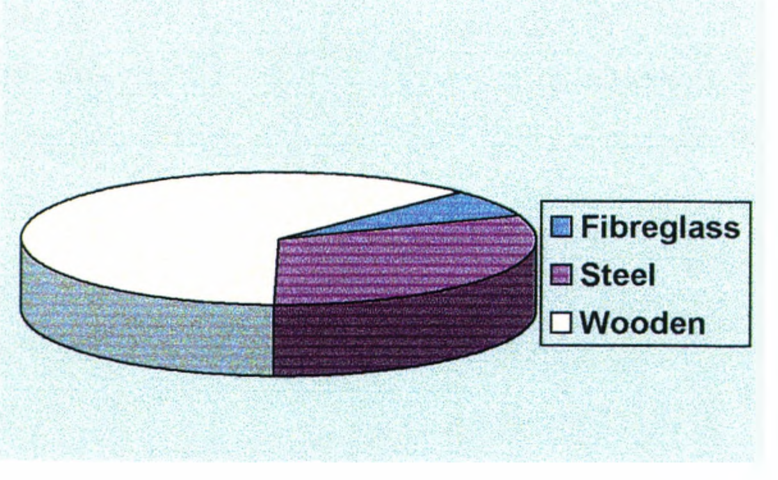
3.3.2 Total Loss / Constructive Total Loss (C.T.L.) claims

The majority of vessels lost (over 60%) as shown in both table 3.8 and graph 3.10 refers to wooden fishing vessels.

Table 3.8 – Analysis of Total Loss claims in terms of types of vessels

Fibreglass	5	(6.67%)
Steel	23	(30.67%)
Wooden	47	(62.67%)

Graph 3.10 - Types of vessels involved in Total Loss / Constructive Total Loss (C.T.L.) claims (in numbers)



The analysis in terms of types of vessels and values is shown in Table 3.9:

Table 3.9 – Analysis of Total Loss / C.T.L. claims in types of vessels and values

		Submitted Claims	Settled Claims	Indemnities
Fibreglass:	5 vessels	1,340,977.58	570,431.96	488,722.06
Steel:	23 vessels	16,192,575.89	11,525,320.89	11,010,633.89
Wooden:	47 vessels	1,905,502.74	1,764,979.22	1,584,824.31

We notice that, despite the fact that the number of wooden fishing vessels (47) lost was greater more than the number of steel vessels (23), the amounts of claims submitted and finally settled were almost ten times more for steel trawlers, in view of the higher values involved.

Graph 3.11 - Types of submitted claims involved in Total Loss / Constructive Total Loss (C.T.L.) claims ($m)

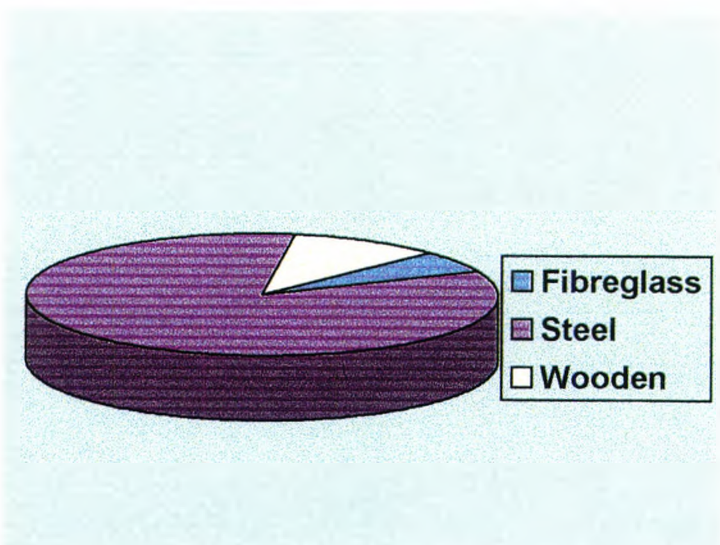


Table 3.10 - Analysis in terms of types of vessels and average age

Fibreglass	4.2 years
Steel	24.4 years
Wooden	18.2 years

The above table 3.10 allows us to compare the effect of age of ship on total losses of different types of fishing vessels. It takes an average for all tonnage lost during the period 1970 to 1998. It is clear that for both wooden and steel types of vessels the majority of total losses are from the oldest age groups.

These 75 total loss / C.T.L. claims (29.88% of the total claims) are valued US$19,439,056.21 (62.62% of the total) submitted claims, US$13,860,732.07 (64.24% of the total) settled claims and US$13,084,180.26 (64.35% of the total) indemnities paid.

The total tonnage lost amounts to 8,978.15 split as shown in Table 3.11:

Table 3.11 – Breakdown of tonnage lost

Fibreglass:	191.72	(2.14% of total vessels lost)
Steel:	7,641.30	(85.11% of total vessels lost)
Wooden:	1,145.13	(12.75% of total vessels lost)

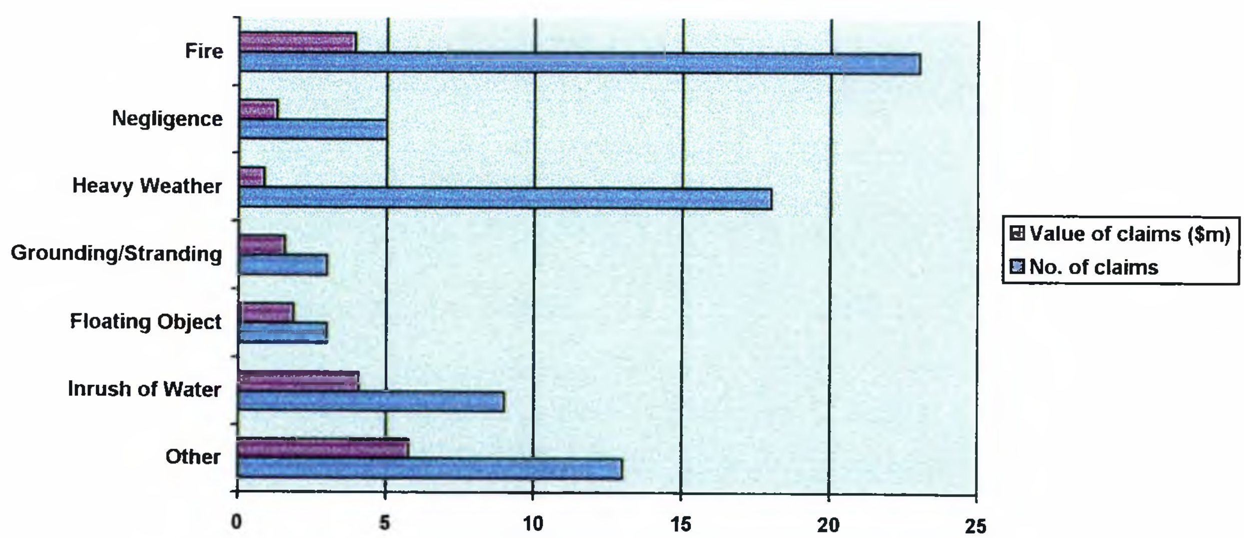
The majority of tonnage lost (85%) applies to steel vessels, which is explained by the difference in size compared with the wooden vessels.

The causes of total loss / C.T.L. claims are shown in both table 3.12 and graph 3.12:

Table 3.12 – Causes of Total Loss / C.T.L. claims

	No.	(%)	Submitted Claims	(%)
Fire	22	(29.33%)	4,051,085.95	(20.84%)
Negligence	5	(6.67%)	1,306,752.22	(6.72%)
Heavy Weather	18	(24.00%)	2,335,447.73	(12.01%)
Grounding/Stranding	5	(6.67%)	1,586,240.38	(8.16%)
Floating Object	3	(4.00%)	2,674,318.63	(13.76%)
Inrush of Water	7	(9.33%)	3,121,991.94	(16.06%)
Other	15	(20.00%)	4,363,219.36	(22.45%)

Graph 3.12 - Causes of Total Loss / C.T.L. claims



The main causes of total losses were, therefore, fire and heavy weather, followed by negligence, inrush of water, grounding and floating objects.

3.3.3 Grounding claims

Only 2 out of 16 grounding claims were caused by steel trawlers with a tonnage of 188.02 (39.87% of total). These two claims were submitted for US$79,459.55 (27.38% of total), settled for US$27,500.00 (13.13% of total) and indemnified for US$27,500.00 (16.02% of total).

Table 3.13 – Causes of grounding claims

Heavy Weather	33.33%
Grounding	26.67%
Other	40.00%

3.3.4 Towage / Salvage claims

33 out of the 70 towage / salvage claims occurred in steel trawlers with average age 12.30 years and submitted for US$1,427,728.39 (75.33% of total). The 37 claims for wooden vessels have average age 15.28 years and were submitted for US$467,598.34 (24.67% of total).

Causes of towage/salvage claims:

Wooden Vessels: Engine Damage (54.05%), Grounding (10.81%), Other (35.14%) being negligence of crew, heavy weather and striking of object.

Steel Vessels: Engine Damage (54.55%), Heavy Weather (18.18%), Other (27.27%).

3.3.5 Collision claims

The 6 out of 9 collision claims were caused by steel vessels (66.67%) which had an average age of 13.7 years and were submitted for US$203,535.00 (58.09% of total). The 3 wooden vessel collision claims were submitted for US$146,843.17 (41.91% of total) and these vessels had an average age of 11.3 years.

3.3.6 Engine damage claims

Table 3.14 below shows a breakdown of all engine damage claims in terms of types of vessels and ages. We notice that the majority of machinery claims occurred in steel fishing vessels. Also that the average age of steel vessels was more than that of the wooden vessels. We shall examine the reasons in Chapter 5.

Table 3.14 – Analysis in terms of types of vessels / age

Wooden:	11 (15.07% of total) with average age 11.6 years
Steel:	62 (84.93% of total) with average age 17.2 years

The engine damage claims of wooden vessels were submitted for US$141,439.42 (1.65% of total) were settled for US$96,665.04 (1.69% of total) and were indemnified for US$94,150.49 (1.67% of total). The engine damage claims of steel vessels were submitted for US$8,433,301.65 (98.35% of total), were settled for US$5,639,305.02 (98.31% of total) and were indemnified for US$5,308,150.63 (98.41% of total).

3.3.7 Struck object / pier claims

2 out of 6 claims, which belong to this type occurred in steel vessels (33.33% of total) with an average age of 23.5 years and were submitted for US$196,888.72 (83.98% of total). The 4 claims of wooden vessels were submitted for US$37,554.78 (16.02% of total) and these vessels had an average age of 16.75 years.

3.3.8 Fire claims

The 2 claims were submitted by wooden vessels (66.67%) for US$76,155.03 (47.92% of total) and had an average age of 18.5 years. The other 1 claim was submitted by steel vessel (33.37%) for US$82,761.80 (52.08%) with an average age 4 years.

3.4 Empirical Distributions

The purpose of this section is to examine which distribution better describes both the number and the size of claims. This will improve our understanding for a variety of issues surrounding insurance of fishing vessels than if we only have information about either total or partial losses.

3.4.1 Number of Claims

The empirical distribution of the number of claims per year is shown on Table 3.15. The table provides information about the variability of the number of claims per year.

Table 3.15 – Data

No. of Claims / Year	Observed No. of Years
0	1
1	6
2	2
3	0
4	3
5	0
6	0
7	2
8	0
9	0
10	4
11	0
12	0
13	3
14	1
15	2
16	2
17	1
18	1
19	0
20	0
21	0
22	0
23	0
24	0
25	1

A Poisson model is fitted to these data [6]. The method of moments and the maximum likelihood method both lead to the estimate of the mean:

$$\hat{\lambda} = \frac{251}{29} = 8.6551724$$

The resulting Poisson model using the parameter value yields the distribution and expected numbers of claims per year as given in Table 3.16.

Table 3.16 – Observed and expected frequencies

No. of Claims / Year	Poisson probability	Expected Number	Observed No.
0 – 6	0.24	6.96	12
7 – 8	0.26	7.59	2
9 – 10	0.24	7.08	4
11 +	0.25	7.37	11
TOTAL	**0.99**	**29.00**	**29**

[6] Klugman, Stuart A., Panjer, Harry H. & Willmot, Gordon E., (1998), *Loss Models: From Data to Decisions*, Wiley Interscience.

The results in Table 3.16 show that the Poisson distribution does not fit the data well. We tested this formally by using a χ^2 test statistic, which gives a large value, in the Table 3.17:

Table 3.17 – χ^2 goodness-of-fit test

No. of Claims / Year	Observed	Expected	χ^2
0 – 6	12	6.96	3.65
7 – 8	2	7.59	4.12
9 – 10	4	7.08	1.34
11 +	11	7.37	1.79
TOTAL	**29**	**29.00**	**10.90**

The *p*-value for the test is the probability that a random value from the χ^2 distribution (with 2 degrees of freedom) exceeds 10.90. For this data set the *p*-value is 0.004296305. This can be obtained from tables of the χ^2 distribution. With typical values of α (where α is the significance level of the test) such as 0.01, 0.05 and 0.10 the null hypothesis can be rejected. We then conclude that the Poisson distribution is an inadequate fit.

The results in Table 3.17 show that the Poisson distribution does not fit the data well. We tested this formally by using a χ^2 test statistic, which gave a big measurement in the above Table. For this reason we examine as an alternative the negative binomial distribution.

We studied the negative binomial as a mixture of Poisson. The moment equations for the data of Table 3.15 gave estimators of the parameters as follows:

$r = 0.4884593 \qquad \beta = 17.71933$

On the following Table 3.18 the results for the fitted negative binomial distribution and the χ^2 test are shown:

Table 3.18 – Observed and expected frequencies

No. of Claims / Year	Negative Binomial Probability	Expected No.	Observed No.	χ^2
0 – 6	0.852	24.72	12	13.48
7 – 8	0.062	1.80	2	0.02
9 – 10	0.036	1.04	4	2.19
11 +	0.049	1.41	11	8.36
TOTAL	**0.999**	**28.97**	**29**	**24.05**

From Table 3.18 it can be seen that the χ^2 statistic is much higher (24.05) for the fitted negative binomial than for the fitted Poisson distribution (10.90). We therefore decided to proceed with the Poisson distribution.

3.4.2 Amount of Claims

The total number of claims observed during the period 1970 - 1998 was 251 and the mean claim size was equal to US$43,086.17. The above figure refers to claims net of deductible based on 1998 prices.

The claims were then classified into groups according to claim size as shown in Table 3.19.

The claims are classified into groups according to claim size [7]. In the above table 3.19 geometrically increasing class limits (column 2) are used, except for the highest classes. The numbers of observed claims in each class are displayed in column 4, and the average size of claims in each class is given in column 3. For example the number of claims in class 10 between US$160,000 and US$226,000 is 6.

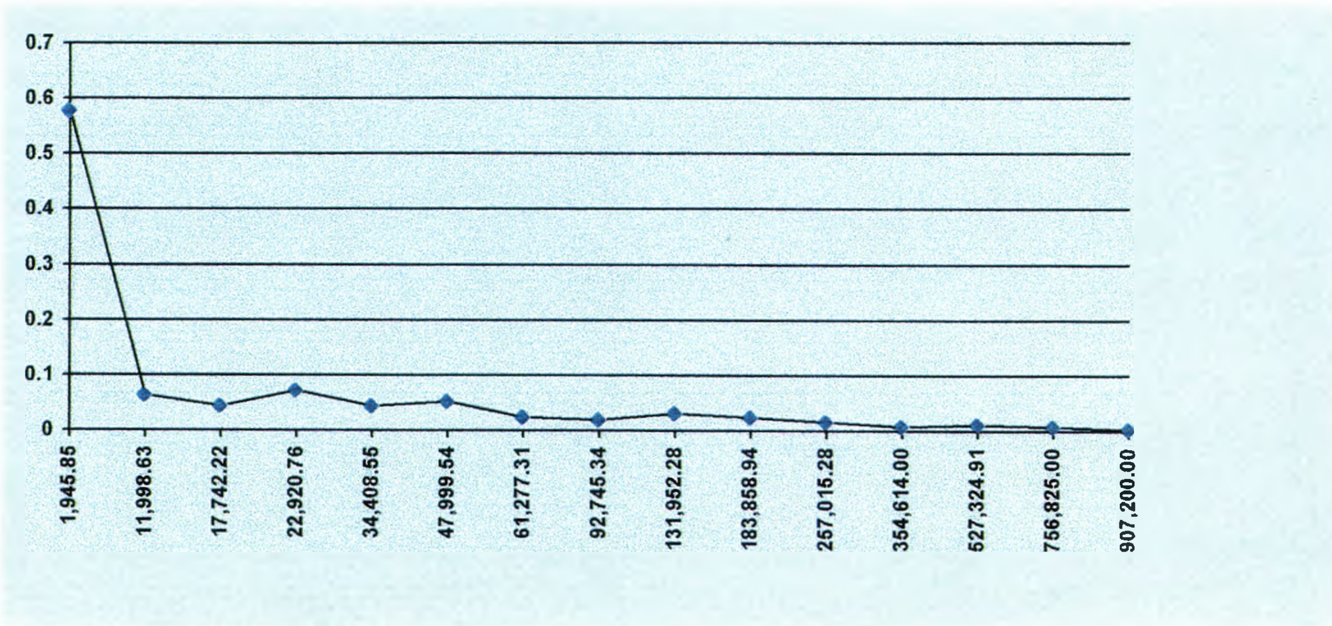
[7] Daykin, Chris D., Pentikainen, Teivo & Pesonen, Martti, (1993), *Practical Risk Theory for Actuaries*, London: Chapman & Hall, January.

Table 3.19 – Compilation of claim statistics

Class	Upper Class Limit	Class Average	Observed No. of Claims	Value of the Distribution Function
1	10,000	1,945.85	145	0.577689243
2	14,000	11,998.63	16	0.641434263
3	20,000	17,742.22	11	0.685258964
4	28,000	22,920.76	18	0.756972112
5	40,000	34,408.55	11	0.800796813
6	57,000	47,999.54	13	0.852589641
7	80,000	61,277.31	6	0.876494024
8	113,000	92,745.34	5	0.896414343
9	160,000	131,952.28	8	0.928286853
10	226,000	183,858.94	6	0.952191235
11	320,000	257,015.28	4	0.968127490
12	453,000	354,614.00	2	0.976095618
13	640,000	527,324.91	3	0.988047809
14	905,000	756,825.00	2	0.996015936
15	> 905,000	907,200.00	1	1.000000000

In the following graph we show the empirical distribution of the observed data, given in Table 3.19.

Graph 3.13 – Empirical distribution of the observed data



In our analysis we used *Bestfit 2.0d*, a program that fits the data to statistical distributions and displays the results in high-resolution graphs. We tried various distributions and the best is the Gamma with χ^2 goodness-of-fit *p*-value of 115.304085. The remaining distributions had the following χ^2 values shown in Table 3.20.

Table 3.20 – Summary of results

Order	Distributions	χ^2
1.-	Gamma	115.304085
2.-	LogLogistic	124.230038
3.-	PearsonVI	146.234311
4.-	Triang	175.687383
5.-	Extreme Value	187.450154
6.-	Logistic	258.359414
7.-	Weibull	312.352163
8.-	Beta	343.904414
9.-	Uniform	394.733333
10.-	Normal	472.918016

The order in column one of table 3.20 above ranks the distributions according to the χ^2 goodness-of-fit test, selected to measure how well the sample data fit the hypothesized probability density function.

Table 3.21 below offers three ways to compare the input data to the results:

1. Basic statistics: Basic statistics (mean, variance, mode, etc.) for each distribution are reported and can be compared to the statistics of the input.
2. Goodness-Of-Fit and Confidence Intervals: For each result, goodness-of-fit values and the corresponding confidence intervals are reported. These statistics measure how good the distribution fits the input data and how confident we can be that the data was produced by the distribution function.

3. Target values: The targeting function of BestFit compares percentile values and probabilities between distributions and the input data.

Table 3.21 – Statistics

	Input Distribution	Gamma
Parameter 1		0.195579
Parameter 2		503,203.100000
Parameter 3		
Formula		=RISKGamma(0.20;503,000)
Minimum	0.577689	
Maximum	907,200.000000	
Mean	98,416.170000	98,416.170000
Mode	45,360.550000	8.911836e-21
Median	12.0	9611.099737
Standard Deviation	222,538.400000	222,538.400000
Variance	49,523,320,000.000000	49,523,320,000.000000
Skewness	3.686066	4.522394
Kurtosis	8.754577	33.678076
Histogram	=RiskHistogrm(0,577689;907,20 0.000000;{59,0;4,0;3,0;2,0;1,0;1 ,0;0,0;1,0;1,0;3,0})	
Minimum	0.577689	0.577689
Maximum	907,200.000000	907,200.000000
P1	59.000000	18.213105
P2	4.000000	6.284693

P3	3.000000	3.479591
P4	2.000000	2.216579
P5	1.000000	1.512128
P6	1.000000	1.074451
P7	0.000000	0.784384
P8	1.000000	0.583766
P9	1.000000	0.440774
P10	3.000000	0.336559
#Classes	10.000000	
Interval Width	90,719.940000	
Critical Value @ .75		5.898826
Critical Value @ .5		8.342833
Critical Value @ .25		11.388751
Critical Value @ .1		14.683657
Critical Value @ .05		16.918978
Critical Value @ .025		19.022768
Critical Value @ .01		21.665994
<u>Targets</u>		
# 1 Value	0.886454	2.523595
# 1 Percentile %	10%	10%
# 2 Value	1.000000	87.347603
# 2 Percentile %	20%	20%
# 3 Value	3.500000	695.098604
# 3 Percentile %	30%	30%

# 4 Value	7.000000	3037.724997
# 4 Percentile %	40%	40%
# 5 Value	11.500000	9611.099737
# 5 Percentile %	50%	50%
# 6 Value	145.000000	25,039.170000
# 6 Percentile %	60%	60%
# 7 Value	25,460.380000	58,081.140000
# 7 Percentile %	70%	70%
# 8 Value	92,745.340000	128,145.700000
# 8 Percentile %	80%	80%
# 9 Value	337,307.000000	297,592.300000
# 9 Percentile %	90%	90%
# 10 Value	669,206.200000	510,037.700000
# 10 Percentile %	95%	95%

To explain the statistical information given by BestFit in Table 3.21 we obtain the following information:

1) Minimum: For the input distribution the smallest claim is US$0.577689.

2) Maximum: The largest observed claim is US$907,200.000000.

3) Mean: The average claim amount is US$98,416.170000.

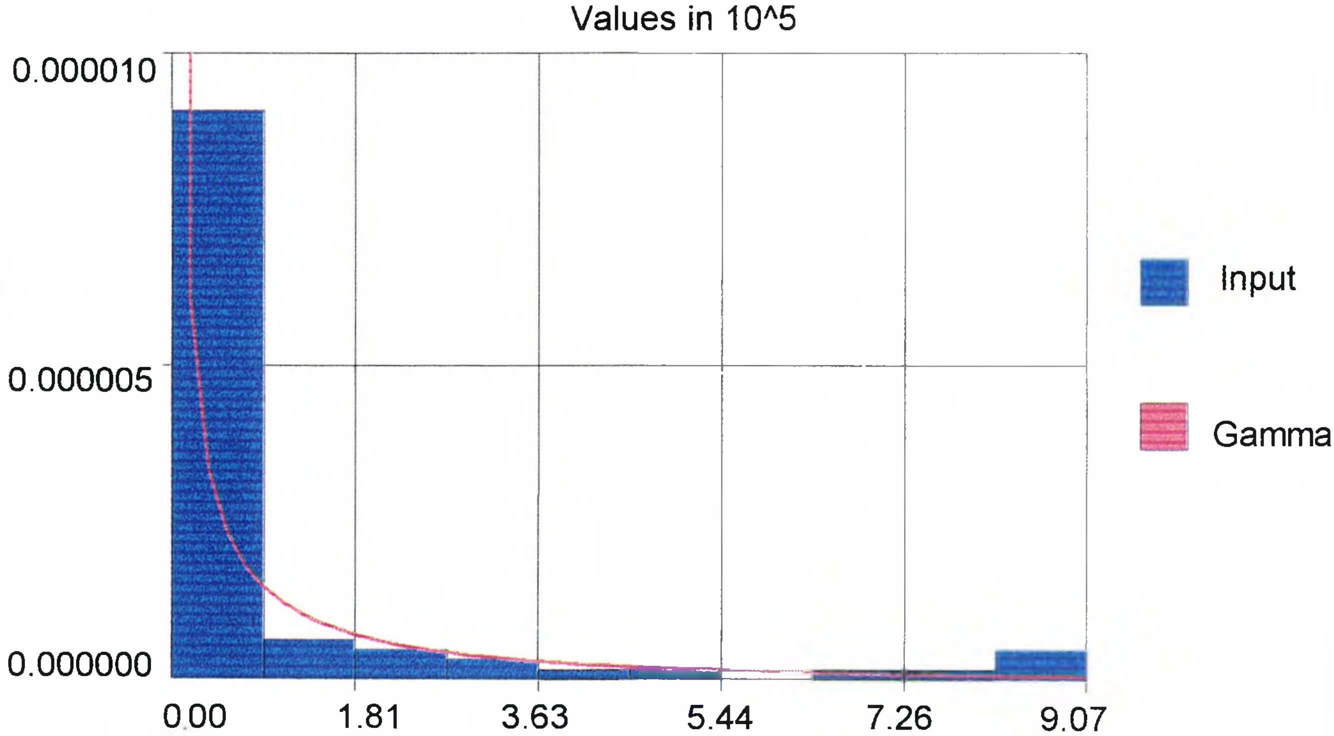
4) Standard Deviation: Of course, the variance is simply the square of the standard deviation. The variance measures the average squared deviation about the mean.

5) Skewness: Skewness is a measure of symmetry. A normal distribution would have a skewness of 0. For the average claim amount the skewness is 3.686066 for the input distribution and 4.522394 for the gamma distribution. Both the input and Gamma distributions are positively skewed, which tend to have most of the probability on small values, but the remaining probability is stretched over a long range of larger values.

6) Kurtosis: The kurtosis is smaller for the input distribution, which indicates that it has a sharper peak in the middle, whilst the Gamma distribution, because of the size of its kurtosis, indicates a much slower drop-off. All these are shown on graph 3.14.

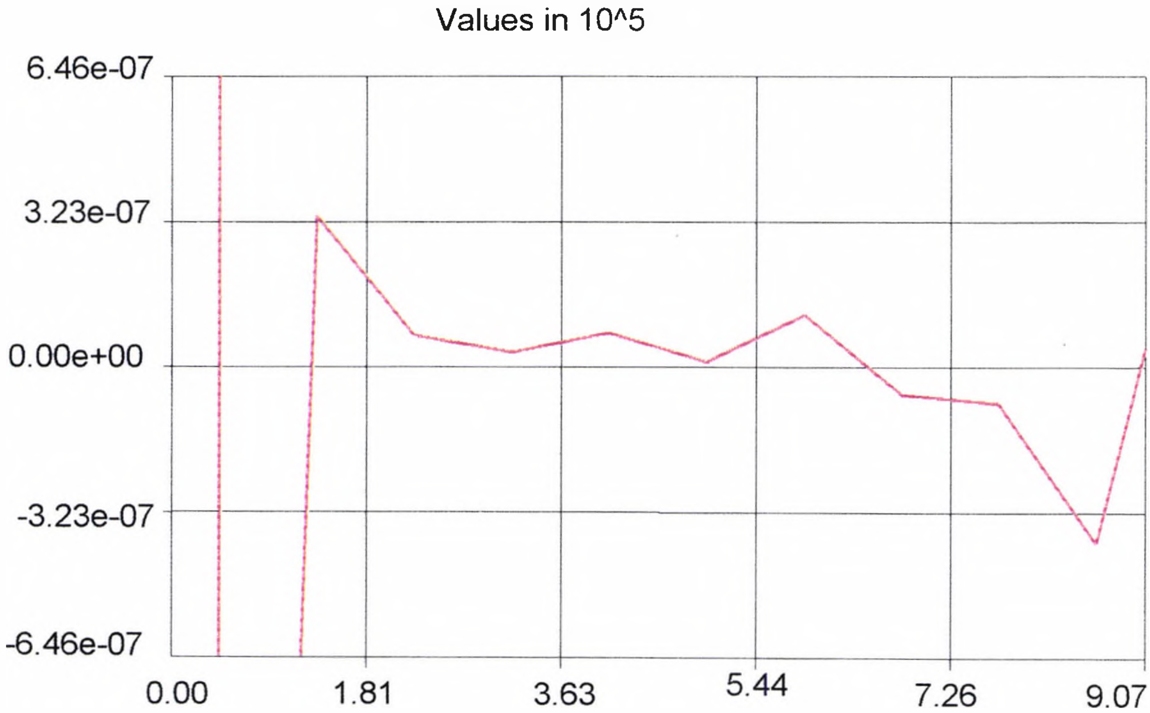
7) Percentile Probabilities: For the input distribution percentile probability tells us that there is at least 60% chance that the claim amount will be above average.

Graph 3.14 – Comparison of Input Distribution and Gamma (0.20;5.03e+5)



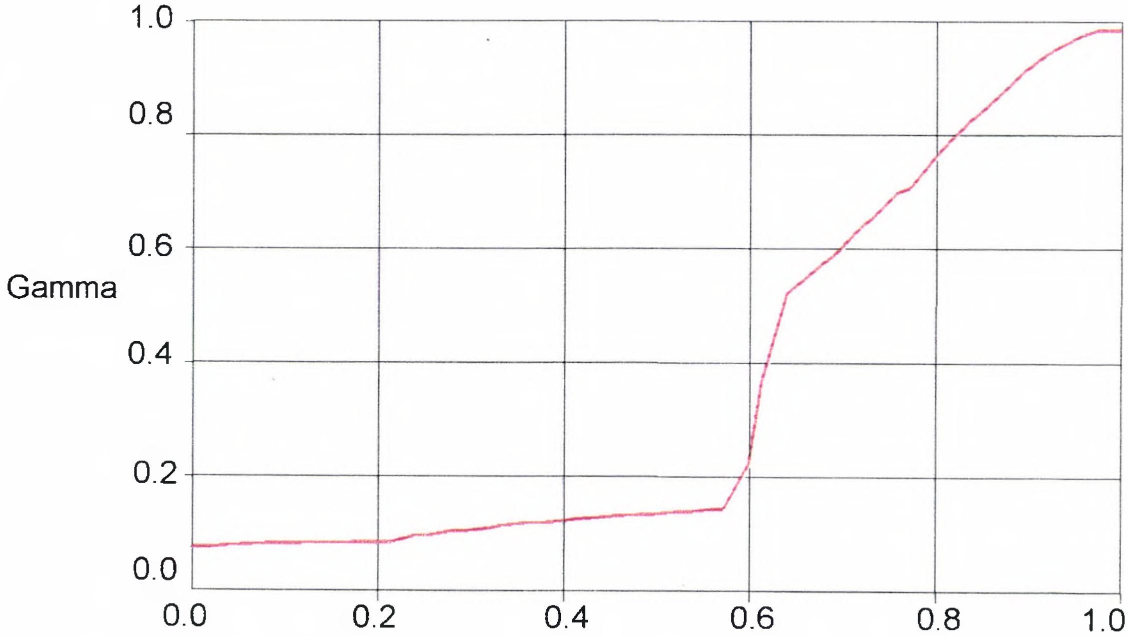
The above graph 3.14 superimposes the input and Gamma distributions on the same graph, allowing us to visually compare them.

Graph 3.15 – Difference between Input Distribution and Gamma (0.20;5.03e+5)



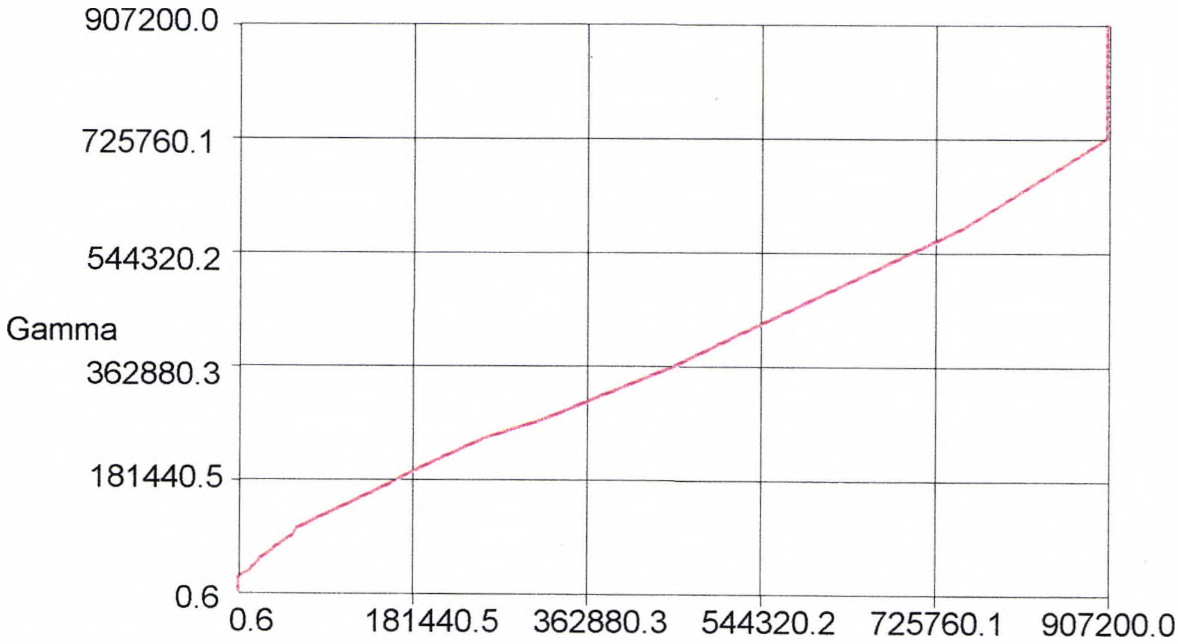
The above graph 3.15 displays the absolute error between the input and Gamma distributions.

Graph 3.16 – P-P Comparison between Input Distribution and Gamma (0.20;5.03e+5)



Probability-Probability (or P-P) graphs plot the distribution of the input data vs. the distribution of the results. If the fit is "good", the plot will be nearly linear.

Graph 3.17 – Q-Q Comparison between Input Distribution and Gamma (0.20;5.03e+5)



Quantile-Quantile (or Q-Q) graphs plot the plot percentile values of the input distribution vs. percentile values of the result. If the fit is "good", the plot will be nearly linear.

3.5 Frequency and Severity

According to David B.Houston (1964), "In order to explicate risk in the insurer's context, it is necessary to start by defining the most important mean concepts employed in analyzing risk and insurance situations. First, there is the "frequency" of number of losses suffered by each exposure unit. The mean of this variable is the average frequency where:

$$\text{Average Frequency} = \frac{\#\mathit{losses}}{\#\mathit{exposure\ units}}\text{"}$$

According to the calculations from Chapter 3 the Average Frequency for Fishing Vessels from 1970 until 1998 is estimated to 0.0288506.

"The second notion which must be examined is "severity" or average size loss. This is defined as the ratio of the dollar amount of all losses to the number of losses. Thus:

$$\text{Severity} = \frac{\$\mathit{losses}}{\#\mathit{losses}}\text{"}$$

We reckon that the Severity of the Fishing Vessels portfolio for the period from 1970 until 1998 was $86,228.96.

"The average frequency tells in some sense how often the event insured against can be expected to occur, and severity indicates, given that loss has occurred, how large it is likely to be. Now, if the average frequency of loss occurrence is multiplied by the average size loss, the insured's loss expectation or pure premium is determined. This is the amount, disregarding expenses, which each insured must pay if all losses are to be met. In a simple formula:

Average Frequency	x Severity	=	Pure Premium

$$\frac{\#\,losses}{\#\,exposure\ units} \times \frac{\$losses}{\#\,losses} = \frac{\$losses}{\#\,exposure\ units}$$ "

The pure premium for Fishing Vessels is thus estimated to be $2,487.76.

"These concepts are what have here been termed mean concepts. They adequately define the insurance situation in that they produce a logically developed premium. Why then introduce risk at all? By using only the mean values of the distributions referred to, no account has been taken of the dispersion or variation of values around those means. Thus, if the pure premium distribution is widely dispersed, it is quite possible for the actual pure premium to be much greater than the predicted mean pure premium."

"What is needed then, is a notion to indicate (1) the variation within the pure premium distribution, and (2) the expected variation of the actual pure premium in relation to the predicted pure premium."

"The first component is the dispersion inherent in the population, i.e., the pure premium distribution. A measure of the variability inherent in the population is the standard deviation denoted by:

$$\sum pp = \sqrt{\frac{\sum(pp-\mu)^2}{n}}$$

This is the standard deviation of the pure premium distribution and sufficiently defines the first element of variation. However, variation can arise from another source, sometimes called sampling or random variation. In effect, the insurer does not observe the entire pure premium population, but only a sample therefrom. Thus, when he attempts to estimate, μ, error or variation from the true value of μ may be present because he has only partial (sample) information. This sampling error or variation is a function of the sample size, usually being inversely related to the square root of the sample size."

"These components of variation may now be combined into a single statistic, the standard error of the mean pure premium denoted by,

$$\sigma_\mu = \frac{\sigma_{pp}}{\sqrt{n}}$$

where σ_{pp} is the standard deviation of the pure premium as defined above and n is the number of exposure units or insureds. This quantity, σ_μ represents risk from the insurer's point of view, and the objective of insurance operations is to reduce σ_μ by increasing the sample size, i.e. the number of units insured."

"To summarize, the variability in the pure premium distribution is the risk which the insurer faces. Several pure premiums (outcomes) are possible, some high, some low, but he may charge only one of those premiums to all of his insureds. The problem then is to choose a pure premium from among the possible ones, which exactly balances the highs and lows or, in other words, is the average of all the pure premiums. The insurer must reduce the variation of the pure premium which he selects, from the true average pure premium, to zero or as close as possible."

In the case of the fishing vessels the $\sum pp$ is estimated to be \$554.90.

In this chapter we examined the claims experience of the fishing vessels for the years 1970 – 1998. We looked at characteristics, such as the individual causes, types, size, age etc. We also examined which distributions better express the number and amount of claims. These distributions will be used in Chapter 5 when we shall model the claims.

CHAPTER 4 - DEDUCTIBLE ANALYSIS

In this chapter we examine a method for estimating the optimum deductible level. Our findings are also used to examine whether the data is consistent with the von Neumann-Morgenstern expected utility hypothesis to determine the optimal deductible.

Modern utility theory, as a technique for analyzing and solving decision problems involving risk and uncertainty, was developed by von Neumann and Morgenstern. Their axiomatic treatment of the subject, along with the developments by others justified the hypothesis that decisions involving risk should be made so as to maximize expected utility. Utility theory, and specifically the utility function, is a framework through which the decision maker can quantify his preferences for various outcomes or rewards. By explicitly articulating these preferences, the decision maker is able to choose between several courses of action offering chances for various rewards according to different probability distributions (see Freifelder, 1976).

Axiomatic treatments of utility theory attempt to specify a minimum set of conditions necessary for a utility function to exist. This presentation follows DeGroot's formulation of the subject (see DeGroot, 1970), but presents only the most important axioms.

The decision making problem involves choosing one probability distribution from a set of probability distributions {P} defined on a set of rewards {R}. The operator > is defined to read "is preferred to" and the operator = is defined to read "is equivalent to".

Axiom 4.1 – Comparability: If P1 and P2 are any probability distributions in {R}, then either P1 > P2, P2 > P1, or P1 = P2.

Axiom 4.2 – Transitivity: If P1, P2 and P3 are any probability distributions in {P} with P1 > P2 and P2 > P3, then P1 > P3.

Axiom 4.3 – Certain Equivalence: If P1, P2 and P3 are any probability distributions in {P}, with P1 > P2 > P3, then there exists a unique number α, $0 < \alpha < 1$, such that P2 = αP1+(1-α)P3.

In insurance terms the first two axioms state that a company can always rank various prospects in terms of desirability and that such preferences are consistent. The other axiom effectively asserts that the risk inherent in any situation can always be given a price. If the indicated preferences meet the above conditions, a utility function for the decision maker can be developed.

Definition: Utility Function: A real valued function, U, is a utility function, if and only if, for P1 and P2 $\in$ {P} and P1 > P2,

$E(U \mid P1) > E(U \mid P2)$.

In other words, utility must preserve the preference ordering. If P2 is preferred to P2, then the expected utility of P1 must be greater than the expected utility of P2. Positive linear transformations of utility functions are also utility functions. If U is a utility function, then $V = \alpha U + B$, $\alpha>0$ is one too. The most important property of V is that it has the same preference as U. When V is used in place of U the same decisions are made.

A deductible, according to Strauss (1975), "can be defined as the participation of the insured in a loss up to a certain limit agreed on in advance."

Although this definition is very closely related to the definition of Excess of Loss insurance[8], the basic difference between the two is that Excess of Loss insurance is usually concluded on a first loss basis, where the sum insured does not fully correspond to the value of the risk. In the case of a deductible however, the traditional concept of full value insurance with its under-insurance clauses remains unaffected.

Speaking of deductibles as such, we may basically distinguish between amount deductibles and time deductibles. Referring to amount deductibles first of all, the most important category we have here is that of the so-called "pure" deductible where the insurer does not provide any indemnification at all for losses below the amount agreed on. When indemnifying losses exceeding that amount, he will be responsible for the claim minus the deductible amount. When applying another kind of deductible, the so-called franchise, the insurer is required to indemnify any losses exceeding the agreed

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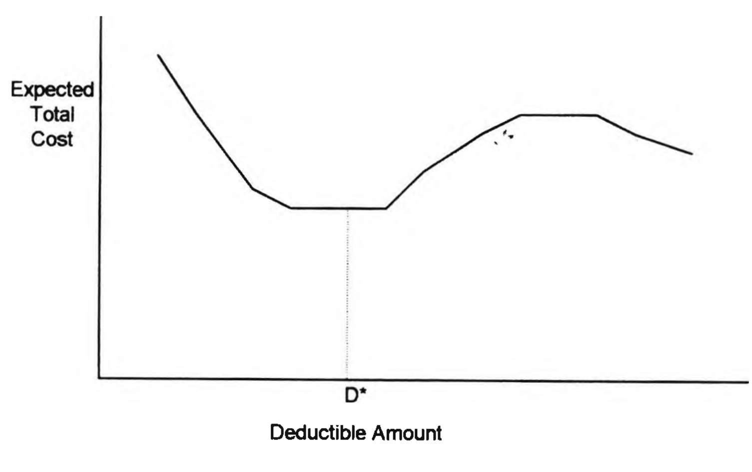
[8] Excess of Loss Treaty is a type of Non-Proportional Treaty commonly described. Non-Proportional Treaties are agreements between a Reinsured and a Reinsurer(s), whereby the Reinsurer(s) agrees to pay the Reinsured all losses exceeding a certain specified limit (deductible) set by the Reinsured, arising out of risks being protected, up to a predetermined fixed limit.

limit in full (i.e. he cannot deduct the insured's share), while the insured is responsible for any losses lower than the amount agreed on. The reason why such franchises are not as common as "pure" deductibles is most probably because policyholders always feel rather annoyed when they have to pay losses just below the fixed amount. The situation is similar when one applies the so-called disappearing deductible, which is a kind of combination of a "pure" deductible and a franchise. The special characteristic of this disappearing franchise is that here the insured is liable for all losses up to the amount agreed on (which makes this the same as a "pure" deductible). The insured's share is reduced as the amount of the claim increases, so that when a certain limit is reached, the insured does not have to pay anything at all. It can be seen, therefore, that of the various kinds of amount deductibles, the deductible as such is the easiest to use. Compared with a franchise, it offers the advantage of being non-manipulatable, so that indemnification does not depend on whether a loss has exceeded the amount fixed or not.

When applying a time deductible, the deductible is defined in units of time. It is obvious therefore that such deductibles are only possible with an insurance where a loss occurs over a certain period of time and is not an instantaneous event. Thus, a time deductible is quite suitable in Fire Loss of Profits insurance. When applying a time deductible, we must again distinguish between two different types: First of all there is the "pure" time deductible as such where the insured is responsible for that share of a loss constituted by the period agreed on. Secondly we also have proportionate time deductibles where the insured pays a certain percentage in the overall loss resulting from the ratio between the time of the deductible and the duration of the loss as a whole. As proportionate time deductibles cannot be manipulated in any way, they appear preferable to standard time deductibles where the insured has the possibility in some cases of limiting the amount of a claim for, say, the first three days, thus increasing it for the following period and manipulating loss development.

Two published studies by Allen & Duvall (1971) and Schkade & Menefee (1967), both concerned with the question of optimal deductible selection by policyowners rather than pricing considerations, have indicated that some deductible credits are less than the reduction in expected loss payments. In each of the two studies, a curve of total expected cost to the policyowner as a function of the deductible amount is developed from loss distributions and deductible rate credits. An expected total cost curve similar to ones found in the two studies appears in Graph 4.1. As shown in Graph 4.1, total expected cost to the policyowner is relatively high for very small deductibles but falls as the deductible is increased to D*, at which expected total cost reaches a minimum. As the deductible is increased beyond D*, expected total cost increases. The authors of the studies conclude that D* is the optimal deductible because it minimizes expected total cost to the policyowner.

<u>Graph 4.1 – Optimum Deductible</u>

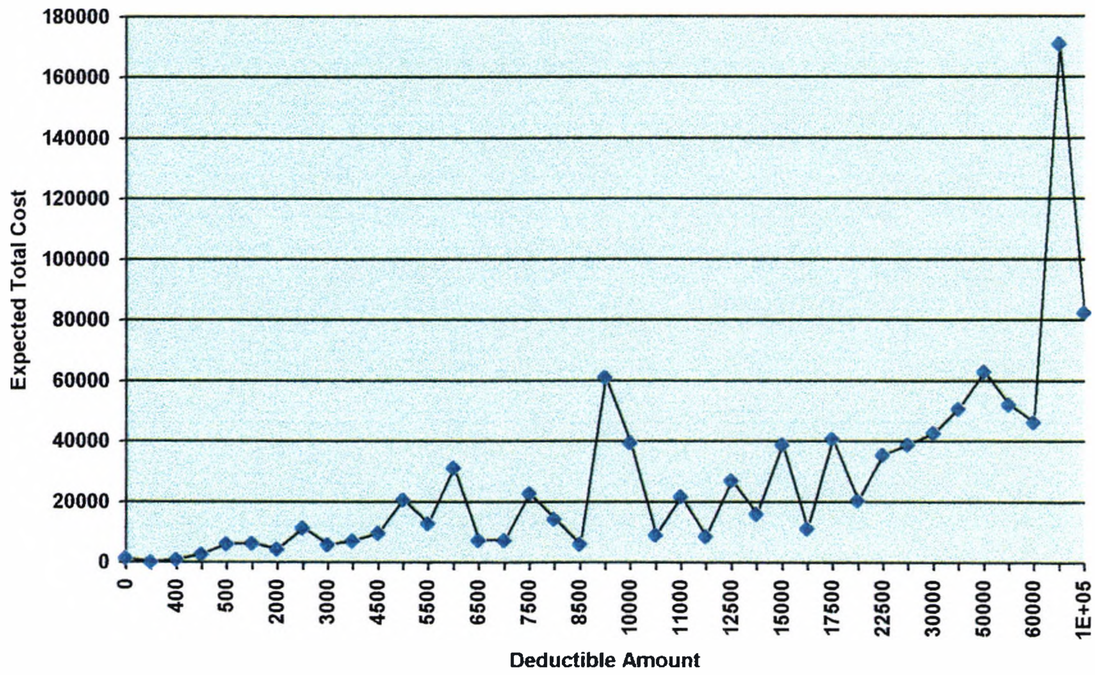


From another viewpoint, a local minimum in expected total cost implies that credits for larger deductibles may not be adequate. As shown earlier, expected total cost to a policyowner increases when a deductible is increased only if the associated deductible credit is less than the reduction in expected total cost, such as the one shown in Graph 4.1. This can occur if the policyowner's expected total cost increases for deductibles larger than the optimum one. As illustrated in Graph 4.1, expected total cost increases if the deductible is increased beyond D*. This implies that rate credits for deductibles larger than D* are less than the reduction in expected loss payments. Without the inadequate rate credits, the local minimum would not exist.

One possible explanation for the apparently inadequate rate credits is that insurers have attempted to influence the deductible selected by policyowners. A second possible explanation is that the loss data analyzed in the two studies does not correspond with the loss experience anticipated by insurers when establishing the deductible credits. Thirdly, insurers' marketing considerations and expense savings may indicate that deductible credits should differ considerably from the anticipated reduction in loss payments. This, in turn, may result in an expected total cost curve with varying slope over different segments. On the other hand, it is normally difficult to justify a deductible credit less than the reduction in expected loss payments.

We used the above methodology found in Smith and Head (1978) to derive the following Graph 4.2, based on current prices of the results of the sample.

Graph 4.2 – Optimum deductible for the entire fishing fleet



As shown in the above graph total expected cost to the policyholder is relatively low for very small deductibles but increases as deductible is increased. The total cost reaches a minimum at US$90. As the deductible is increased beyond US$90 expected total cost increases. We therefore conclude that US$90 is the optimal deductible because it minimizes expected total cost to the policyowner.

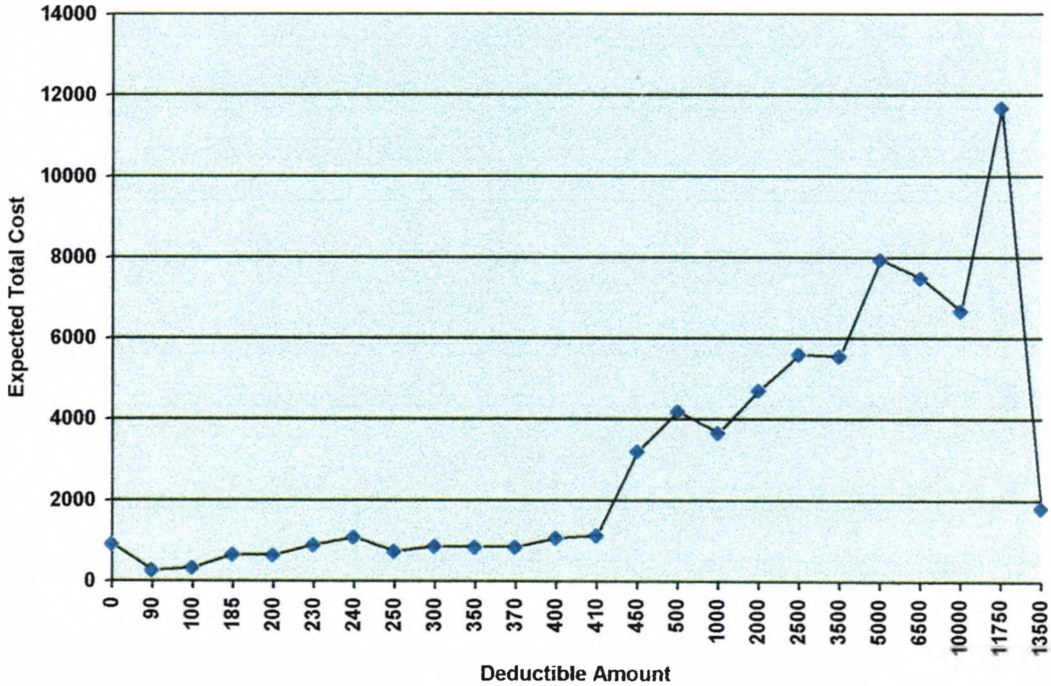
As illustrated in the graph 4.2 above, expected total cost increases if the deductible is increased beyond US$90. This implies that rate credits for deductibles larger than US$90 are less than the reduction in expected loss payments. Without the inadequate rate credits, the local minimum would not exist.

We shall now examine the level of optimum deductible for each type of fishing vessels, i.e. for wooden, fiberglass and steel vessels:

4.1 Wooden Vessels

The results are the same in wooden fishing vessels as for the entire fishing fleet. As we notice from graph 4.3 the optimum deductible for wooden vessels is also US$90.

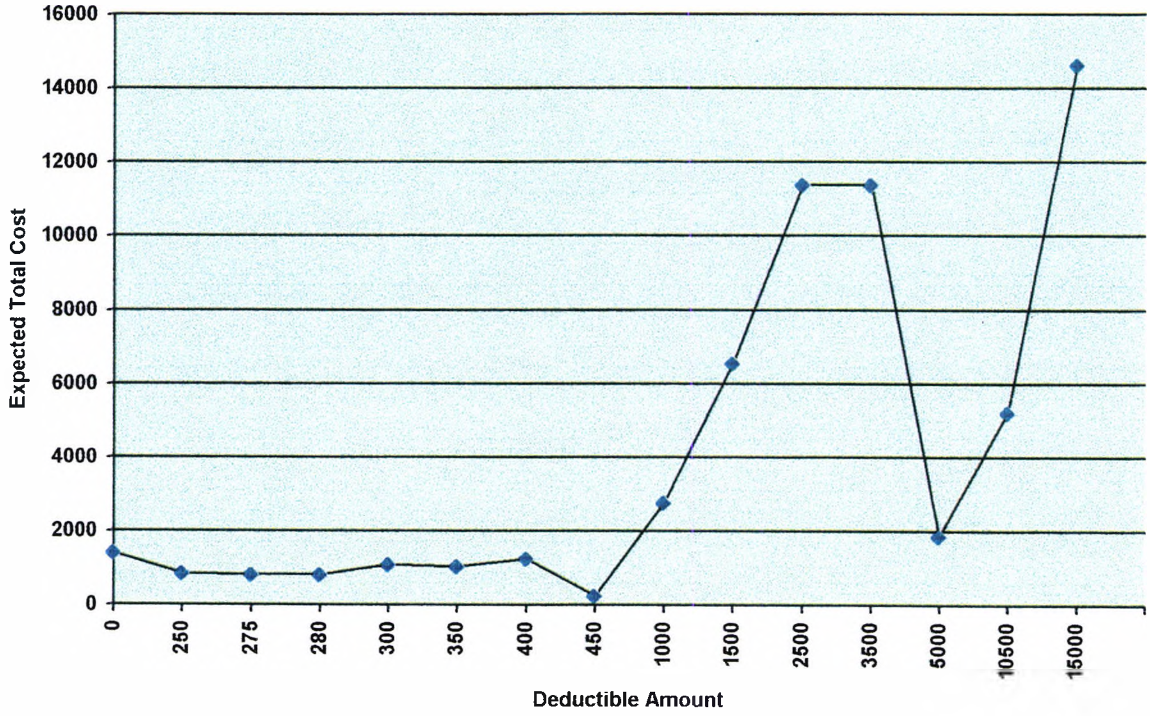
Graph 4.3 – Optimum deductible for wooden vessels



4.2 Fibreglass Vessels

In the limited number of fibreglass vessels the optimum deductible is US$450. Refer to the following graph 4.4.

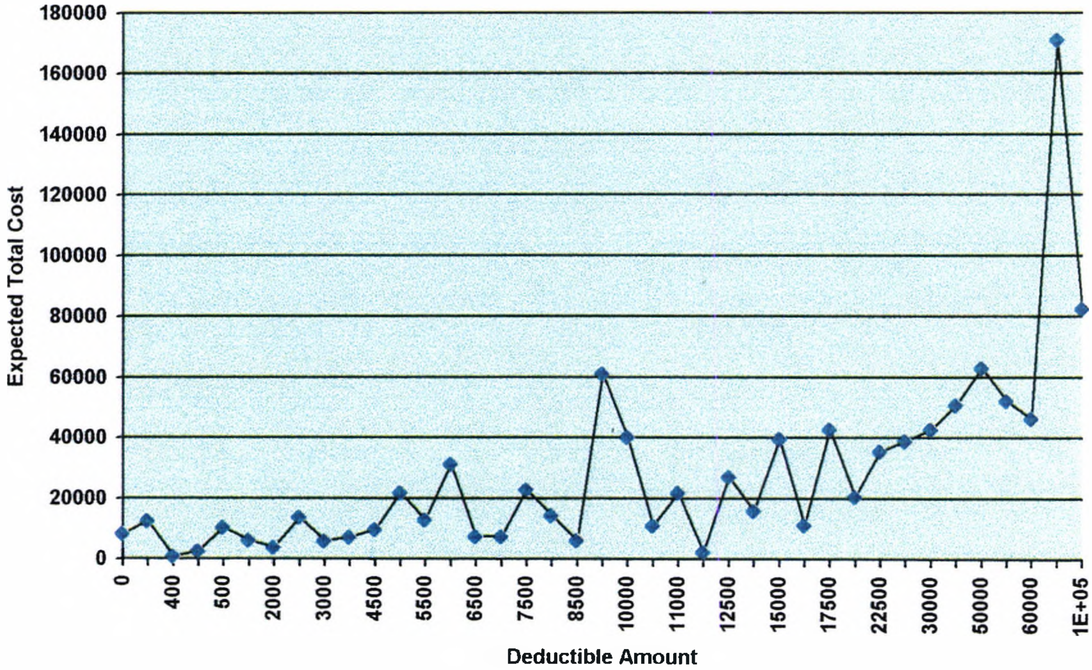
Graph 4.4 – Optimum deductible for fibreglass vessels



4.3 Steel Vessels

The optimum level of deductible for steel vessels is estimated to be US$400. See the following graph 4.5.

Graph 4.5 – Optimum deductible for steel vessels



If we assume that the above optimum deductibles were always chosen by Insureds /Assureds and the claims distribution had followed the pattern shown in the next chapter we shall discover that the portfolio will continue its profitability at 25.98%, whilst the existing deductible levels give a return of 29.48%. Of course, these returns are based on current prices, as so far, we have not yet taken into account the inflationary increases, which would affect both claims and premium figures. On the other hand we cannot estimate the possible increase in premiums following acceptance of terms by Assureds on lower deductibles. Similar results were derived once we included the inflation factor. For example, for the entire fleet the optimum deductible level is at US$18 using 1998 prices, whilst the optimum levels for steel, wooden and fibreglass vessels were found to be US$12, US$33 and US$109 respectively.

In their paper using the von Neumann-Morgenstern expected utility hypothesis to determine the optimal deductible for a given insurance policy, Pashigian, Schkade and Menefee (1966) concluded: "The results of these preliminary tests suggest that consumers do not act in accordance with the expected utility hypothesis when selecting a deductible for collision losses. This is unfortunate since the expected utility hypothesis is a convenient and relatively simple method to deal with uncertainty." The authors assume that each individual has a utility of wealth (money) function which he maximizes in the Von Neumann-Morgenstern sense and which has the following properties:

$$U = U(A), \qquad 4.1(a)$$

$$U'(A) = \frac{dU}{dA} > 0, \qquad 4.1(b)$$

$$\frac{d^2U}{dA^2} < 0 \qquad 4.1(c)$$

where U is utility and A is initial wealth (before purchase of insurance policy). Condition 1(a) specifies that utility is a function of the wealth of the individual, 4.1(b) notes that marginal utility is positive so that the individual prefers more wealth to less and 4.1(c) states the condition for diminishing marginal utility of wealth.

Moreover, the individual faces a "rate schedule" which relates the annual premium R to the deductible D, where

$R = R(D),$ 4.2(a)

$R_D < 0$ 4.2(b)

"The function $R(D)$ represents the price policy of the company. R_D denotes the first derivative of this function. For low values of the deductible, the annual premium will be quite high because the company assumes a larger liability. As the size of the deductible increases, the annual premium declines (Condition 4.2(b)). Denote the value of the item insured as V". The authors assume "R_D is continuous and differentiable and $R(V) = 0$, that is, a policy with the deductible equal to the value of the insured item will have a zero premium. Suppose the individual has selected a deductible and suffers a casualty loss less than the selected deductible. The utility of the individual will equal $U(A - L - R)$. If the casualty is greater than the deductible, the utility equals $U(A - L - R + I)$ where I denotes the indemnity. Hence, $U(A - L - R + I) = U(A - D - R)$. The utility of the individual for losses greater than the deductible is independent of L - for losses greater than the deductible, the wealth position of the individual is independent of the size of the loss. Define $f(L)$ as the probability density for a loss of size L (with $0 \leq L \leq V$). The authors also assume that the buyer expects to have at most one accident per year. The expected utility for a given deductible is

$$EU(D) = \int_0^D f(L)U[A - L - R(D)]dL \qquad 4.3(a)$$

$$+ \int_D^V f(L)\, U[A - D - R]dL.$$

The first integral represents the contribution to expected utility from losses less than the deductible D. The second integral represents the contributions to expected utility from losses greater than the deductible. Inspection of 4.3(a) indicates that expected utility is a function of the deductible. An individual will select D so that (4.3(a)) is maximized. Differentiation of (4.3(a)) with respect of the parameter D gives:

$$\frac{d(EU)}{dD} = -R_D \int_0^D f(L)U'(A - L - R)dL \qquad 4.4$$

$$- [1 + R_D]\, U'(A - D - R)\, p^* = 0,$$

where, $p^* = \int_D^V f(L)dL$, is the probability that a loss in excess of the deductible will occur."

A quadratic utility function is also assumed:

$$"U = A - \frac{B}{2} A^2, \qquad 4.5(a)$$

$$\frac{dU}{dA} = 1 - BA, \qquad 4.5(b)$$

$$0 \leq B \leq \frac{1}{A}, \qquad 4.5(c)$$

After some simplification, equation (4.4) becomes:

$$-R_D = \frac{([1 - B(A - R - D)]p^*)}{([1 - B(A - R - Dp^* - L)])} \qquad 4.6$$

where $L = \int_0^D L f(L)dL$.

We may note that $D(1 - p^*) - L = \int_0^D (D - L)f(L)dL > 0$. Hence, $L + Dp^* < D$. The right side of (4.6) is not less than p^*. This establishes a lower bound on $-R_D$

$$-R_D \geq p^*, \qquad 4.7(a)$$

A strict equality between $-R_D$ and p^* holds when $B = 0$. In this case utility is linear in wealth. This situation represents risk indifference and would be applicable to an individual that maximizes expected profit or minimized expected cost and is indifferent toward risk. Such an individual will seldom insure, since most, if not all, insurance policies cost more than their actuarial value because of loading. As B approaches zero, the deductible selected by an individual will approach the deductible that would satisfy the strict equality in (4.7(a)). More generally, if two individuals face the same premium schedule and are alike in all other respects, except that one is (near) risk neutral and the other is a risk averter, the risk averter will select a smaller deductible and engage in less self-insurance.

The opposite extreme is to assume B approaches $\frac{1}{A}$. This case depicts extreme risk aversion with negative marginal utility for wealth for wealth positions greater than initial wealth. Substituting $B = \frac{1}{A}$ in (4.6) establishes an upper bound on

$$-R_D \leq \frac{((R+D)p^*)}{(R+Dp^*+L)} \qquad 4.7(b)$$

Thus, the bounds on $-R_D$ are

$$p^* \leq -R_D \leq \frac{((R+D)p^*)}{(R+Dp^*+L)} \qquad 4.8$$

Equation (4.8) places bounds on $-R_D$. These bounds are in terms of objective data and are independent of the initial asset position of the consumer and the parameter of the utility function. To summarize, if the insured has a quadratic utility function and is maximizing expected utility, he will select a deductible for which the slope of the premium-deductible schedule lies between the two bounds in (4.8). Thus, it is possible to perform a test of the expected utility hypothesis without knowing the initial asset position of the insured or the particular shape of the assumed quadratic utility function."

We followed the same pattern for the fleet of fishing vessels over the years from 1970 to 1998 and derived the following results:

(a) In the total of 39 different deductible levels the estimate of $-R_D$ falls between p^* and $\frac{[(R+D)p^*]}{[R+Dp^*+L]}$.

(b) This rule does not apply for 15 out of 39 different deductible levels.

(c) We tried the same estimate for individual groups of vessels, i.e. steel, wooden and fibreglass with similar results.

For more specific results refer to Table 4.1.

Table 4.1 – Deductible results (in US$)

Deductible	Value of p*	Upper Bound of –Rd	-Rd
0	0.02885060	0.028850575	0.029343980
500	0.11101240	0.119726224	0.115986575
1,000	0.11247640	0.125949801	0.113599550
1,500	0.10828030	0.121265804	0.111261612
2,000	0.11085970	0.123555730	0.111126956
2,500	0.11318550	0.122935484	0.123937062
3,000	0.10506330	0.122177908	0.106542121
3,500	0.10629920	0.120794693	0.110832160
4,000	0.10231920	0.115364526	0.102280848
4,500	0.10578280	0.126402209	0.107710523
5,000	0.10719530	0.118964341	0.109960818
5,500	0.10947710	0.125232321	0.109448248
6,000	0.11591700	0.127109496	0.118734930
6,500	0.11992620	0.137837570	0.120398780
7,000	0.11594200	0.138864273	0.122556659
7,500	0.11235960	0.127133492	0.117429513
8,000	0.10557770	0.128213872	0.106452842
8,500	0.09604520	0.116100166	0.095906890
9,000	0.10493830	0.118056094	0.109055512
9,500	0.10526320	0.130089316	0.105085257
10,000	0.11162790	0.122997688	0.115181809
10,500	0.11388890	0.139140057	0.113747197

11,000	0.10991960	0.131322854	0.109582523
11,750	0.11884060	0.147506163	0.118575351
12,500	0.12238810	0.143851542	0.127923582
13,500	0.11480360	0.146819812	0.116914920
15,000	0.12671230	0.146511301	0.127794000
16,500	0.10101010	0.135276321	0.150995139
17,500	0.12236290	0.144939945	0.132743787
20,000	0.12162160	0.152403743	0.123712206
22,500	0.14285710	0.175698111	0.179019067
25,000	0.11392410	0.138242072	0.120746434
30,000	0.11023620	0.136611001	0.118382146
37,500	0.08333330	0.107749054	0.083144720
50,000	0.12903230	0.162116901	0.131924501
55,000	0.09803920	0.130446801	0.100763928
60,000	0.02127660	0.029187456	0.021045055
75,000	0.11111111	0.134199992	0.110294583
100,000	0.07142860	0.095794054	0.074063804
TOTAL	**4.14118495**	**4.915438765**	**4.324205588**

Therefore, the shipowners' choices of deductibles are not inconsistent with the Von Neumann-Morgenstern expected-utility hypothesis as Pashigian, Schkade and Menefee indicated.

CHAPTER 5 - A STUDY OF THE CLAIMS FROM FISHING VESSELS

5.1 Introduction

In this chapter we shall form two models for the number and the amount of claims. The results will help us examine which factors are important, also which parameters affect the portfolio. Section 2 deals with the analysis of the number of claims and section 3 with the amounts of claims. In order examine the results in terms of different trading areas we split the fishing fleet in section 4 in two parts – vessels operating in Mediterranean Sea and those operating off West / East Africa. Finally, section 5 deals with a comparison between the main effects for vessels operating in Mediterranean Sea and off West / East Africa.

5.2 Number of Claims

The data in Table 5.1 of Appendix "D" concerns claims occurred in fishing vessels during the years 1970 – 1999. The following types of classification have been taken into account:

Ship Type: Wooden – Steel – Fibreglass.

Year of Construction: 1925-29, 1930-34, 1935-39, 1940-44, 1945-49, 1950-54, 1955-59, 1960-64, 1965-69, 1970-74, 1975-79, 1980-84, 1985-89, 1990-94, 1995-99.

Period of Operation: 1970-74, 1975-79, 1980-84, 1985-89, 1990-94 & 1995-99.

The data in table 5.1 give the number of damage incidents (as distinct from the number of ships damaged), the aggregate number of months' service or total period at risk and the three classifying factors. Throughout the period of 30 years from 1970 to 1999 there has never been a case of a single ship, which was damaged more than once during the same period. No ships constructed after 1985 could have operated before 1984.

We suppose that the number of damage incidents is directly proportional to the aggregate months' service or total period of risk. This assumption is checked later. The following model was constructed:

$$\log(m) = \beta_0 + \text{typef} + \text{YoCf} + \text{SePf} + \log(n2) + e$$

Where:

(m): Expected number of damage incidents

typef: Effect due to ship type

YoCf: Effect due to year of construction

SePf: Effect due to service period

(n2): Aggregate months' service

The term before the error sign is a quantitative factor. The remaining three terms in the model being qualitative.

The analysis is based on *R (Version 1.3.0. – 22nd June 2001)*, an integrated language and environment for statistical computing and graphics. *R* provides a wide variety of statistical and graphical techniques.

The results obtained using the Poisson log likelihood (for reasons discussed in Chapter 3) are shown in Table 5.2:

Table 5.2 – Regression results

Parameter		**Estimate**	**S. E.**	**t-ratio**	**Probability (>|t|)**
Intercept		-3.02080185	0.80159	-3.768	0.0001640
Ship Type	**Steel**	0.06196881	0.47239	0.131	0.8956310
	Wooden	-1.65384274	0.48297	-3.424	0.0006160
	Fibreglass	0	-		
Year of Construction	**1925-29**	0	-		
	1930-34	0	-		
	1935-39	-0.09487817	0.69328	-0.137	0.8911470
	1940-44	-0.61114291	0.72578	-0.842	0.3997610
	1945-49	-1.33560681	0.63541	-2.102	0.0355560
	1950-54	-1.38932831	0.65371	-2.125	0.0335620
	1955-59	-1.61798261	0.62908	-2.572	0.0101110
	1960-64	-1.81040419	0.62608	-2.892	0.0038320
	1965-69	-1.24902336	0.60916	-2.050	0.0403240
	1970-74	-1.50427629	0.60455	-2.488	0.0128370
	1975-79	-2.06169542	0.62123	-3.319	0.0009040

	1980-84	-1.74826142	0.62732	-2.787	0.0053220
	1985-89	-2.10121608	0.63062	-3.332	0.0008620
	1990-94	-3.18512592	0.79939	-3.984	0.0000676
	1995-99	0	-		
Service Period	**1970-74**	0	-		
	1975-79	-0.20689292	0.30341	-0.682	0.4953030
	1980-84	-0.46274947	0.30903	-1.497	0.1342800
	1985-89	0.09505234	0.30102	0.316	0.7521820
	1990-94	0.37776460	0.33488	1.128	0.2593000
	1995-99	0.64052917	0.56399	1.136	0.2560810

Other useful computer output:

Deviance Residuals[9] : Min – 2.34460

: 1Q – 0.68620

: Median – 0.12710

: 3Q 0.77730

: Max 5.74020

Null Deviance : 341.54 on 78 degrees of freedom

Residual Deviance : 107.94 on 59 degrees of freedom

---

[9] If the deviance is used as a measure of discrepancy of a generalized linear model, then each unit contributes a quantity d_i to that measure, so that $\sum d_i = D$. Hence, if we define $r_D = \text{sign}(y-\mu)\sqrt{d_i}$, we have a quantity that increases with $y_i - \mu_i$ and for which $\sum r_D^2 = D$. (McCullagh, P., & Nelder, John A., (1999), *Generalized Linear Models, 2nd Edition,* Chapman & Hall, pp. 39)

Akaike Info. Criterion: 367.45

By reading the results of Table 5.2 we reach the following conclusions:

1. Coefficients: We can predict *ceteris paribus* that a one unit increase in the Wooden Fishing Vessels would lead to a decrease of 1.65384274 in the number of incidents. For the Steel Vessels a one unit increase in their number would lead to an increase in the number of incidents by 0.06196881.
2. Both ship type and year of construction parameters are statistically significant.
3. The dispersion parameter for Poisson family is taken to be 1, since dispersion parameter $\varphi = \frac{\sigma^2}{\mu}$ and for Poisson distributions the μ equals σ^2[10].
4. Thus for 78 degrees of freedom the probability of obtaining a *t* value of 0.131 or greater for steel fishing vessels is 0.895631 and the probability of obtaining a *t* value of –3.424 or greater for the wooden fishing vessels is 0.0006160. By presenting the *p* values of the estimated *t* coefficients, we can see at once the exact level of significance of each estimated *t* value. Under the null hypothesis that the true population intercept value is zero, the exact probability (i.e. the *p* value) of obtaining a *t* value of –3.768 or greater is only about 0.0002. Therefore, if we reject the null hypothesis, the probability of our committing a Type I error is about 16 in 100,000, a very small probability indeed.

[10] McCullagh, P., & Nelder, John A., (1999), *Generalized Linear Models*, *2nd Edition,* Chapman & Hall, pp. 28-30.

An analysis of deviance is produced for the sequential addition of each variable by using the analysis of variance (anova) function, specifying the χ^2 test to test for differences:

Table 5.3 – Analysis of Variance – χ^2 test of significance

Model: poisson, link: log

Response (m)

Terms added sequentially (first to last)

	Degrees of Freedom	Deviance Resid.	Degrees of Freedom	Resid.Dev.	Pr(>χ^2)
NULL			78	341.54	
Typef	2	180.29	76	161.26	7.104E-40
YoCf	12	40.20	64	121.05	6.653E-05
SePf	5	13.11	59	107.94	0.02

Table 5.4 – Analysis of Variance – F-test

	Df	Sum of Squares	Mean Square[11]	F value	Pr(>F)
NULL					
Typef	2	63.63554	31.8177700	90.1428	2.2E-16
YoCf	12	119.72929	9.9774408	3.3503	6.653E-05
SePf	5	18.98839	3.7976780	2.6221	0.02236
Residuals	59	283.30882	4.8018444		

Residual Standard Error: 2.191311

[11] Mean square is obtained by dividing the sum of squares by their degrees of freedom.

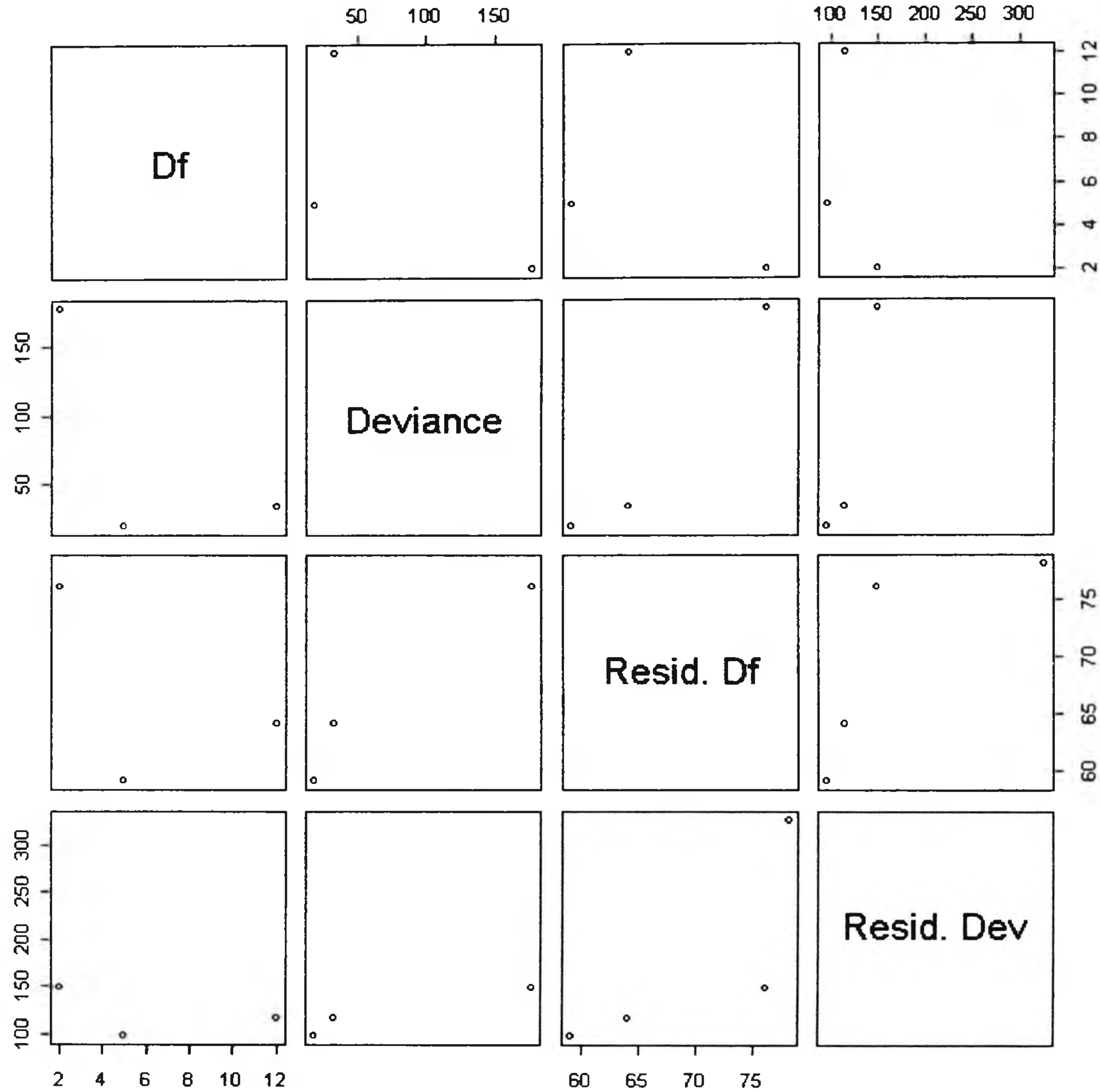
As shown on the above tables 5.3 and 5.4 the *p* value for the Typef is extremely small probability. The computed F value is obviously significant at this level. The same applies for the YoCf, but at lower *p* value. The *F* test gives $\frac{10.650169}{4.8018444} = 2.2179331$. If we use the 5 percent level of significance, the critical *F* value for 19 and 59 df, $F_{0.05}(19,59)$ is 1.77. Obviously, the computed *F* value is significant, and hence we can reject the null hypothesis. If the level of significance is assumed to be 1 percent then $F_{0.01}(19, 59) = 2.23$. The computed *F* does not exceed marginally this critical value. Therefore, we cannot reject the null hypothesis if the level of significance is assumed to be 1 per cent.

<u>Residuals:</u> Some large residuals remain, especially on observations 24, 29 and 57 (as shown both in Graph 5.4 and in Table 5.5). The respective observed values are 0, 0 and 7, while the fitted values are 5.44297244, 5.64365045 and 0.14517104 giving standardized residuals –2.34463094, 2.32213568 and 5.74017140 respectively. In particular observation 24 shows the minimum deviance residual (-2.34463094) and observation 57 the maximum (5.74017140), as shown in Table 5.5, while observation 29 is the second local maximum (2.32213568).

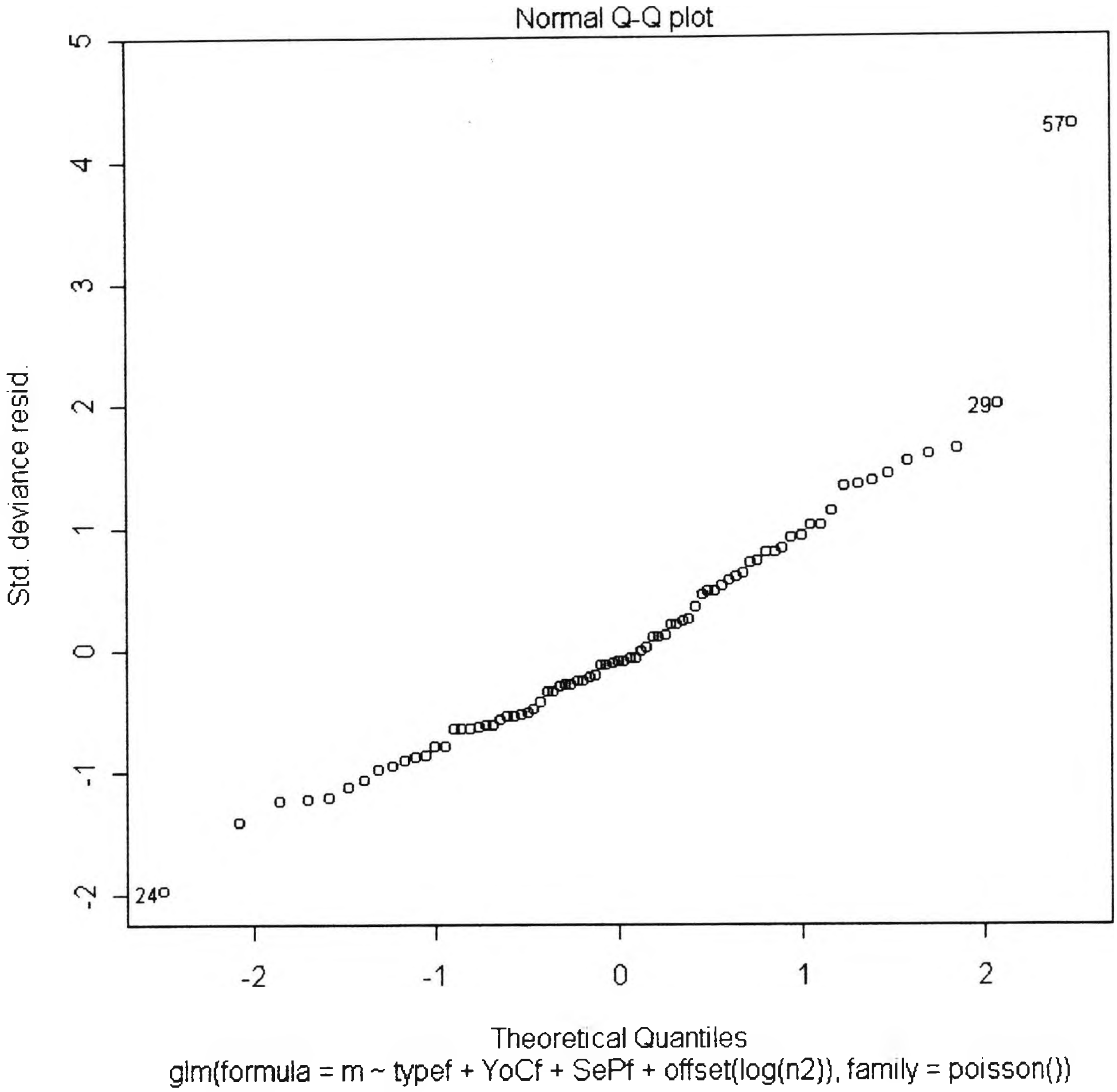
<u>Normality Test:</u> Another useful diagnostic plot is the normal plot of residuals. It gives no reason to doubt that the residuals are normally distributed (Graph 5.2), with the exception of observations 24, 29 and 57.

Cook's Distance Plot (Graph 5.3): Cook's distance is a measure of the influence of individual observations on the regression coefficients. The three most extreme values (60, 74 & 78) are identified in each of the residual plots and the Cook's distance plots.

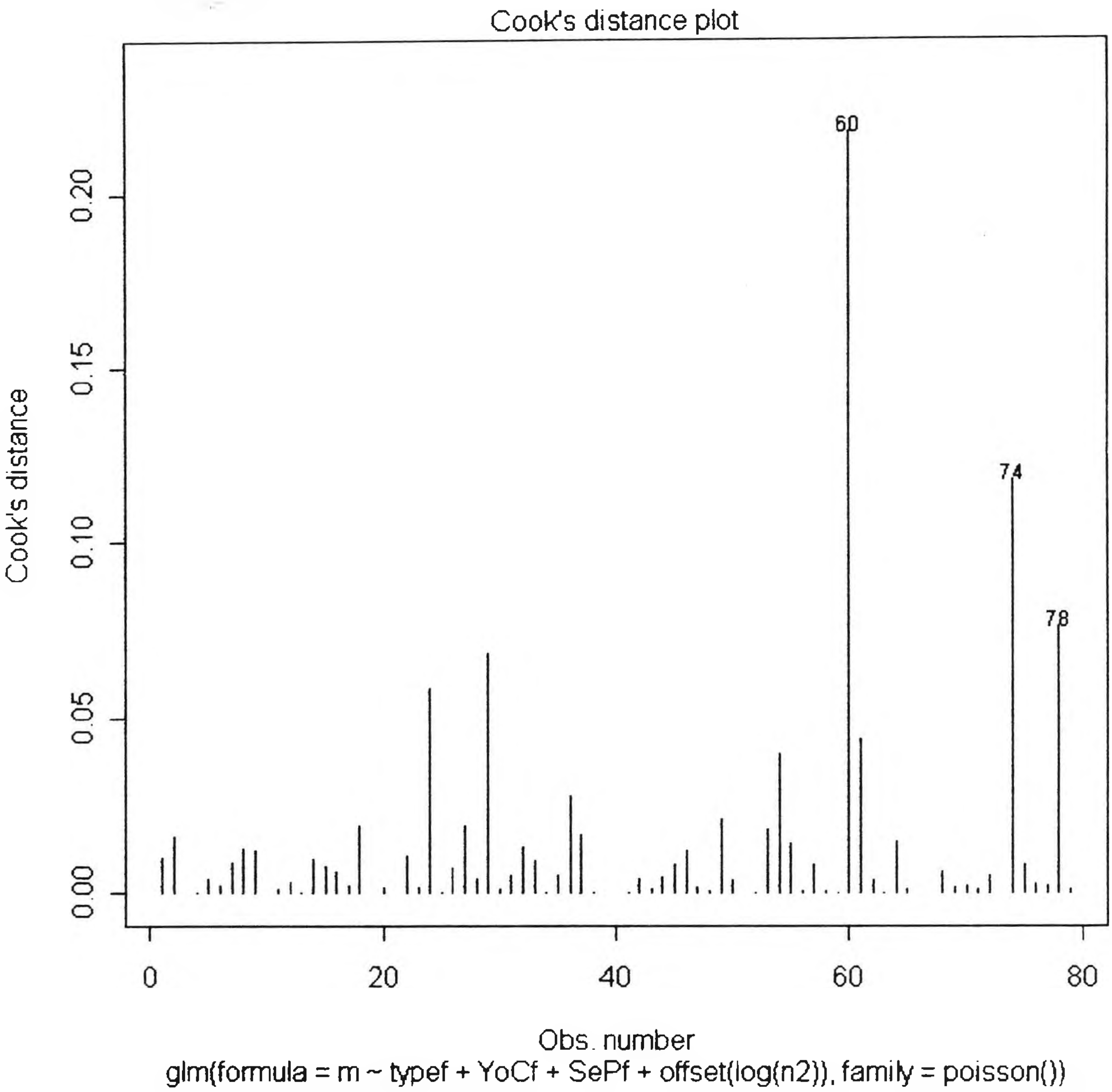
Graph 5.1 – Analysis of deviance



Graph 5.2 – Normal Q-Q plot



Graph 5.3 – Cook's distance plot



Graph 5.4 – Scale-location plot

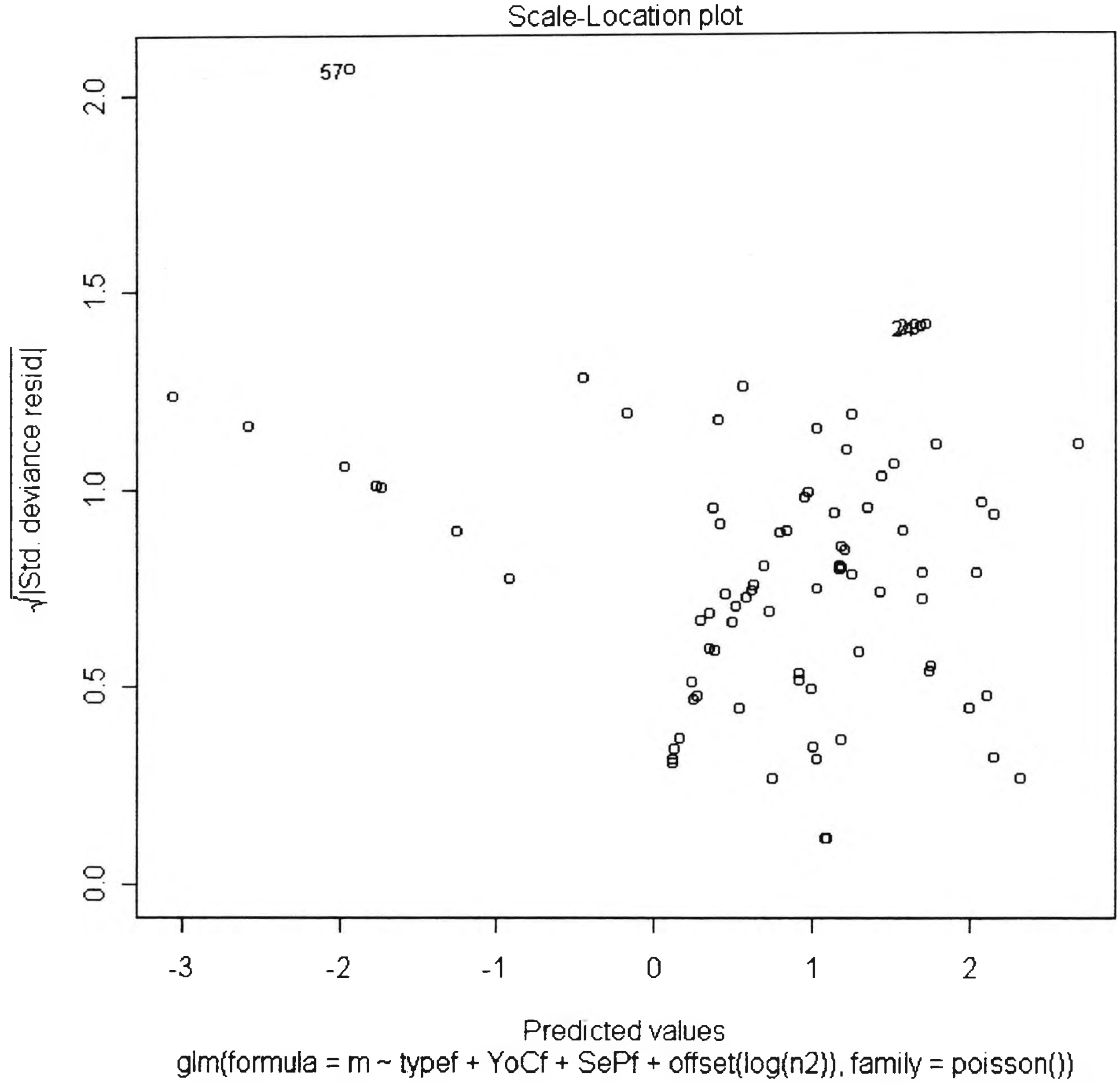


Table 5.5 – Fitted Values. Effects and Residuals of Regression

Observation	Fitted Values	Effects[12]	Residuals
1	1.42604439	84.33933619	0.45283518
2	1.57395715	13.43723355	-0.49064086
3	1.14539783	3.42622484	-0.13889243
4	2.82848570	-3.66246318	0.10097649
5	1.68253304	-1.54521144	-0.56961850
6	1.34358698	-0.70004510	0.52762783
7	1.46717583	0.39948266	1.10724401
8	2.66922165	0.24649341	-1.17254828
9	2.61652475	0.96357715	-1.14427072
10	2.12612065	-3.21636045	-0.08737225
11	1.47414190	-1.68901734	-0.41488756
12	3.67530884	1.34816423	-0.36396210
13	2.76657405	-0.70985470	0.13843170
14	2.23737507	0.46198372	-0.92959317
15	3.35728700	3.39037996	0.83523712
16	2.34201280	-0.54012270	0.98300287

[12] Returns (orthogonal) effects from the fitted model. The effects are the uncorrelated single-degree-of-freedom values obtained by projecting the data onto the successive orthogonal subspaces generated by the QR decomposition during the fitting process. The first *r* (the rank of the model) are associated with coefficients and the remainder span the space of residuals (but are not associated with particular residuals).

17	1.89602192	-3.11369376	-0.71591054
18	1.50166894	-1.11525183	1.68554912
19	3.28086299	-0.64322449	-0.15735548
20	1.85616544	-1.13570180	-0.68942392
21	1.12779218	0.17162787	-0.12272149
22	7.78343997	-0.57155780	-0.66634287
23	5.81413279	-0.83651291	-0.34601776
24	5.44297244	-1.96218439	-2.34463094
25	0.17175028	1.82553579	1.36635573
26	3.24164541	-1.28206991	-0.74266774
27	8.63545897	-0.73445001	-0.94947839
28	5.51819324	0.21992121	0.60532771
29	5.64365045	2.68754768	2.32213568
30	0.04719416	4.32515757	2.04972155
31	3.29596781	-0.91644719	-0.77053550
32	4.84153581	-1.58899268	-0.90075160
33	5.52944277	-1.03175500	-0.68450279
34	0.07620061	3.19885491	1.81691297
35	3.26230551	-1.31501822	-0.75330148
36	8.07209952	0.57196971	0.97611248
37	2.83074602	1.93688975	1.63588576
38	0.39953371	0.73283463	0.79622968
39	3.02204289	0.60044746	-0.01269543
40	2.97796020	0.22418657	0.01275598

41	1.29620017	-0.69319391	-0.27115727
42	2.00805031	-0.70466447	-0.78852527
43	1.64922595	-0.79571482	-0.54574700
44	1.53048596	1.12964859	1.04839583
45	0.63702948	2.62197498	2.13807595
46	0.84660596	2.47554947	1.81218242
47	1.80682262	-0.13665710	-0.65612922
48	2.52586008	-0.14947115	-0.34348560
49	4.26516935	-0.49029402	-1.22515300
50	2.80683518	0.57561831	0.66900271
51	1.17967232	-0.14829296	-0.16991536
52	1.42844814	0.95592834	0.45069995
53	1.75781411	2.67015214	1.99230941
54	5.99186919	-0.36695042	-1.35388021
55	3.87571656	-1.00378859	-1.05123717
56	0.17853873	1.81545284	1.34274977
57	0.14517104	15.33762236	5.74017140
58	7.39554749	0.35072061	0.21933898
59	8.68304920	-0.86232677	0.10691660
60	3.38774504	-0.75169814	-0.81695821
61	3.51557273	-1.81871523	-1.58642383
62	3.50522092	1.03992036	0.74985697
63	2.51074616	-0.48168953	-0.33430690
64	4.61400796	-1.04714513	-1.37266788

65	5.76834797	-1.03147067	-0.32744130
66	1.13251040	-0.16429989	-0.12707193
67	1.31735226	-0.58342313	-0.28888891
68	3.28844897	0.78458917	0.87585210
69	2.08993613	-0.04007574	0.59054632
70	0.28808346	1.23460456	1.03207415
71	8.31267918	-0.01278774	0.23521363
72	4.21643991	-1.54199705	-0.62498533
73	10.21575280	0.27051830	-0.06774244
74	14.83105980	-2.03297099	-1.04302255
75	2.72140632	-1.25240798	0.16611356
76	1.27885251	-0.86189230	-0.25647343
77	0.14061256	2.14348288	1.48481854
78	3.13647714	-1.01802133	-0.68785321
79	1.72290825	-0.30752168	0.20579212

Table 5.6 – Estimates for the main effects in the ship damage (ship types)

Ship Type	Estimate	Standard Error
Wooden	-1.65384274	0.48297
Steel	0.06196881	0.47239
Fibreglass	0.00000000	-

From the above table 5.6 we conclude that wooden fishing vessels have the lowest risk, while steel vessels the highest. If we plot the exponential function based on the above results we shall obtain the following graph 5.5:

Graph 5.5 – Estimate comparisons among different types of vessels

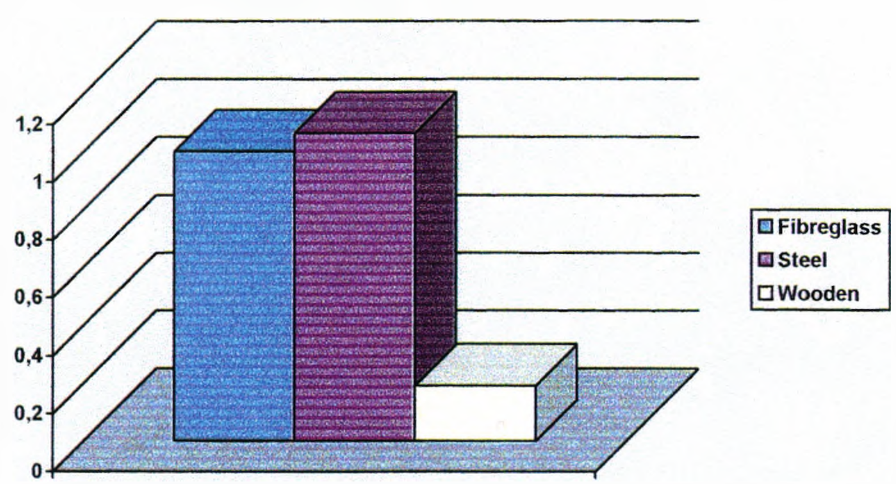
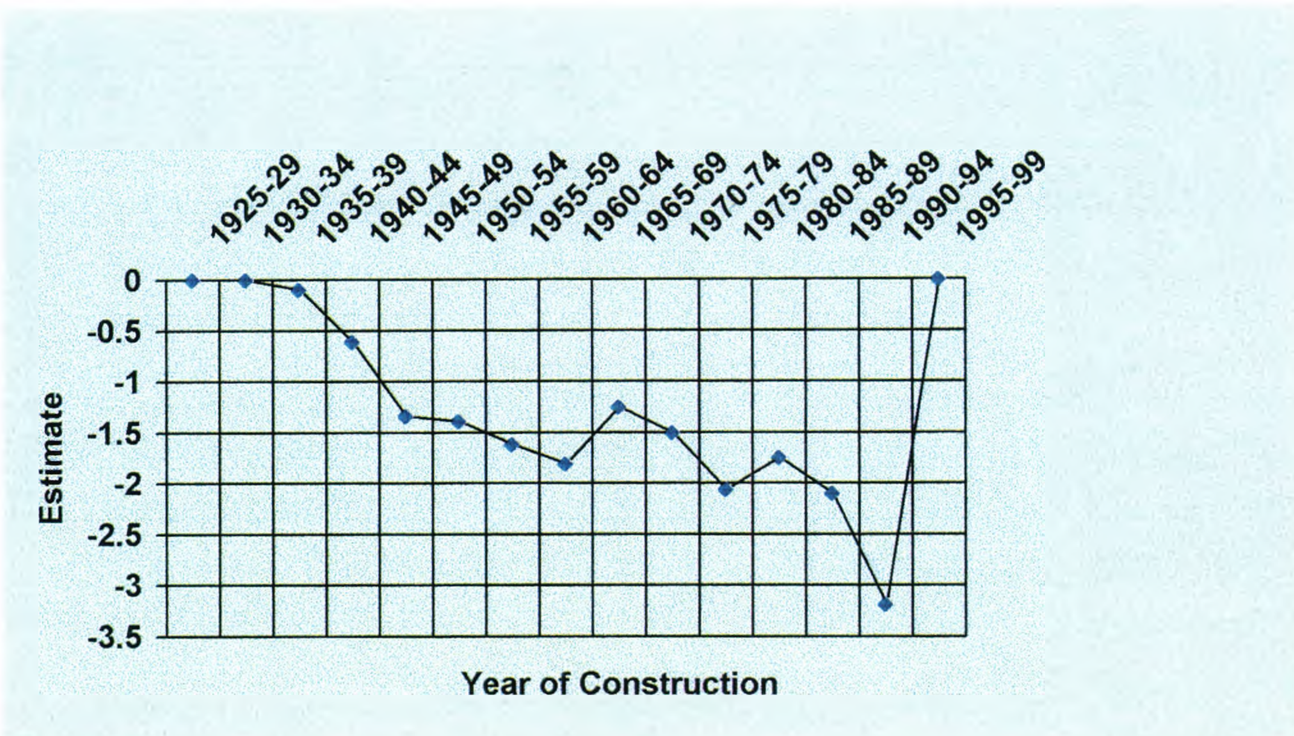


Table 5.7 – Estimates and standard errors for the main effects in the ship damage (year of construction)

Year of construction	Estimate	Standard Error
1925 – 1929	0	-
1930 – 1934	0	-
1935 – 1939	-0.09487817	0.69328
1940 – 1944	-0.61114291	0.72578
1945 – 1949	-1.33560681	0.63541
1950 – 1954	-1.38932831	0.65371
1955 – 1959	-1.61798261	0.62908
1960 – 1964	-1.81040419	0.62608
1965 – 1969	-1.24902336	0.60916
1970 – 1974	-1.50427629	0.60455
1975 – 1979	-2.06169542	0.62123
1980 – 1984	-1.74826142	0.62732
1985 – 1989	-2.10121608	0.63062
1990 – 1994	-3.18512592	0.79939
1995 – 1999	0	-

The ships built between 1935 and 1939 appear to have the highest risk, while the modern tonnage (built between 1990 and 1994) seem to have the lowest. This is also derived from Graph 5.6:

Graph 5.6 – Estimates for the main effects in the ship damage (year of construction)



We also notice from the above Graph 5.6 that the trend is negative, which proves that the younger vessels are less risky than the old ones[13].

[13] The estimate for vessels built in 1995-99 is 0, as these vessels have no claims for the period of operation 1995-99.

5.3 Amounts of Claims

The table 5.8 in Appendix "D" gives the average claims of fishing vessels between 1970 and 1999, adjusted for inflation:

The following model was constructed:

$$T = \beta_0 + typef + YoCf + SePf + e, \; e \sim \text{Gamma}(m)$$

Where:

T: Average cost of claim

m: Expected number of damage incidents

typef: Effect due to ship type

YoCf: Effect due to year of construction

SePf: Effect due to service period

The results obtained using the Gamma distribution (for reasons discussed in Chapter 3) are shown in Table 5.9 that follows:

Table 5.9 – Regression results

Parameter		Estimate	S. E.	t-ratio	Probability (>t)
Intercept		6.66533371	1.44183	4.632	2.11E-05
Ship Type	**Steel**	-0.18073856	0.83611	-0.216	0.8296
	Wooden	-1.96004269	0.84727	-2.313	0.0242
	Fibreglass	0	-		
Year of Construction	**1925 – 1929**	0	-		
	1930 – 1934	0	-		
	1935 – 1939	1.33658035	1.24013	1.078	0.2855
	1940 – 1944	1.93407159	1.29394	1.495	0.1403
	1945 – 1949	0.81794655	1.15301	0.709	0.4809
	1950 – 1954	0.72530876	1.17340	0.618	0.5389
	1955 – 1959	1.03880312	1.12103	0.927	0.3579
	1960 – 1964	0.07213996	1.12306	0.064	0.9490
	1965 – 1969	0.77310188	1.09094	0.709	0.4813
	1970 – 1974	0.04627530	1.08031	0.043	0.9660
	1975 – 1979	0.76517334	1.12217	0.682	0.4980
	1980 – 1984	0.22929154	1.12973	0.203	0.8399
	1985 – 1989	0.77335379	1.12853	0.685	0.4959
	1990 – 1994	-0.39421811	1.42330	-0.277	0.7828
	1995 – 1999	0	-		
Service Period	**1970 – 1974**	0	-		
	1975 – 1979	1.34259069	0.55562	2.416	0.0188

	1980 – 1984	2.47913268	0.55891	4.436	4.07E-05
	1985 – 1989	3.51884999	0.54992	6.399	2.79E-08
	1990 – 1994	4.80645661	0.60187	7.986	5.78E-11
	1995 – 1999	5.82137884	0.98287	5.923	1.74E-07

Other useful computer output:

Deviance Residuals[14]: Min – 3.7728

: 1Q – 1.4766

: Median – 0.1693

: 3Q 0.6586

: Max 4.1351

Null Deviance : 933.31 on 78 degrees of freedom

Residual Deviance : 215.61 on 59 degrees of freedom

Akaike Info. Criterion: 5,114.7

[14] See footnote on page 109.

By reading the results of Table 5.9 we reach the following conclusions:

1. Coefficients: We can predict *ceteris paribus* that a one unit increase in the Wooden Fishing Vessels would lead to a decrease of 1.96004269 in the average cost of claim. For the Steel Vessels a one unit increase in their number would lead to a decrease in the average cost of claims by 0.18073856.
2. Both ship type and service period parameters are statistically significant.
3. The dispersion parameter for Gamma family is taken to be 3.194549, since dispersion parameter $\varphi = v^{-1}$ for Gamma distributions[15].
4. Thus for 78 degrees of freedom the probability of obtaining a *t* value of -0.216 or greater for steel fishing vessels is 0.8296 and the probability of obtaining a *t* value of –2.313 or greater for the wooden fishing vessels is 0.0242. By presenting the *p* values of the estimated *t* coefficients, we can see at once the exact level of significance of each estimated *t* value. Under the null hypothesis that the true population intercept value is zero, the exact probability (i.e. the *p* value) of obtaining a *t* value of 4.632 or greater is only about 0.0002. Therefore, if we reject the null hypothesis, the probability of our committing a Type I error is about 2 in 100,000, a very small probability indeed.

An analysis of deviance is produced for the sequential addition of each variable by using the analysis of variance (anova) function, specifying the χ^2 test to test for differences:

[15] McCullagh, P., & Nelder, John A., (1999), *Generalized Linear Models*, *2nd Edition,* Chapman & Hall, pp. 28-30.

Table 5.10 – Analysis of Variance – χ^2 test of significance

Model: Gamma, link: log

Response T

Terms added sequentially (first to last)

	Degrees of Freedom	Deviance Resid.	Degrees of Freedom	Resid.Dev.	$Pr(\chi^2)$
NULL			78	933.31	
Typef	2	342.77	76	590.55	5.021E-24
YoCf	12	68.58	64	521.96	0.04
SePf	5	306.35	59	215.61	3.864E-19

Table 5.11 – Analysis of Variance – F-test

	Degrees of Freedom	Sum of Squares	Mean Square	F value	Pr(F)
Typef	2	307463740765	153731870383		
YoCf	12	140098635057	11674884255	53.648	5.297E-14
SePf	5	630370981821	126074196364	1.789	0.07111
Residuals	59	207224048214	3512272004	19.180	2.771E-11

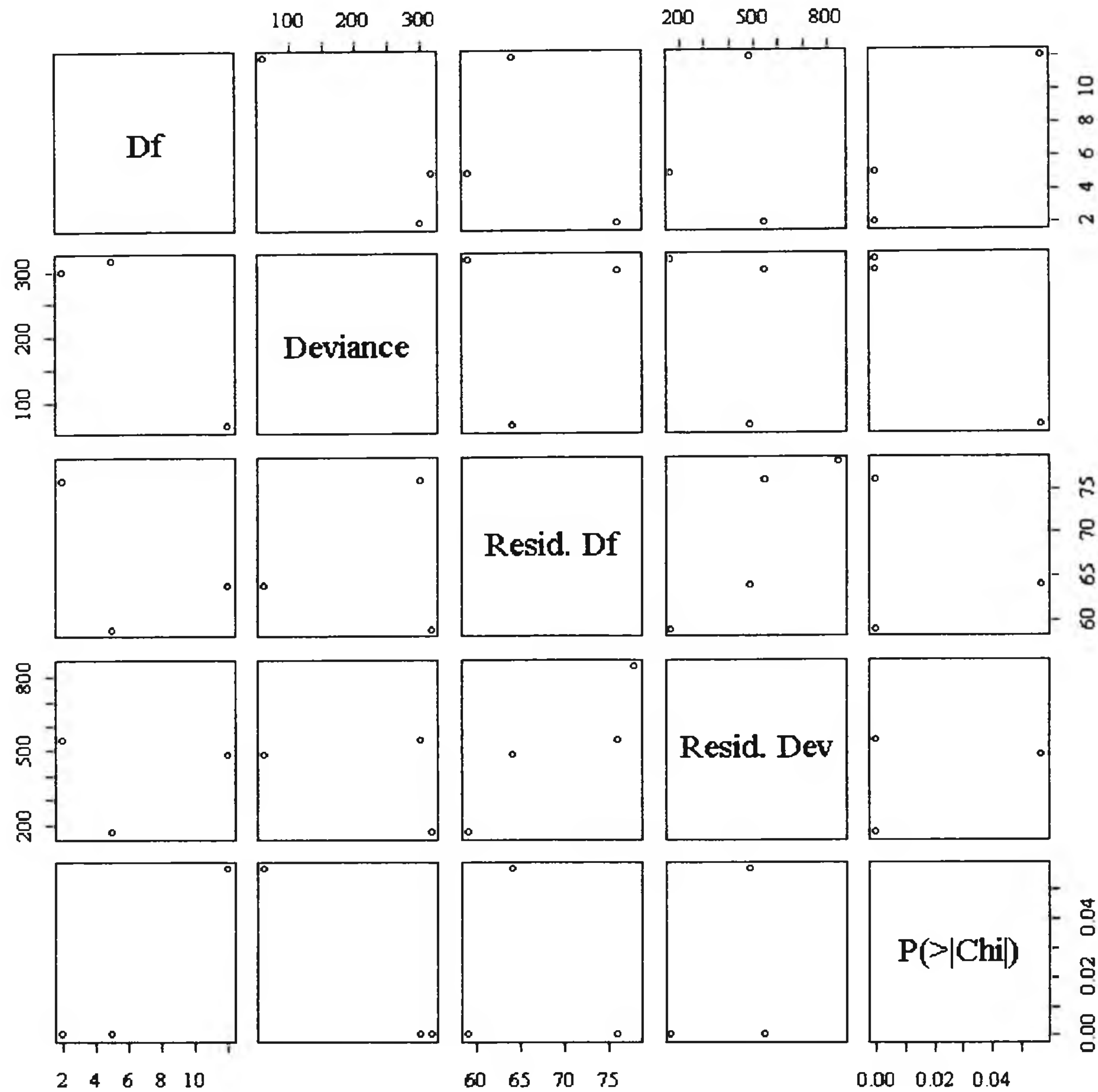
As shown on the above tables 5.10 and 5.11 the *p* value for the Typef is extremely small probability. The computed F value is obviously significant at this level. The same applies for the YoCf, but at lower *p* value. The *F* test gives $\frac{56,733,334,612.79}{3,512,272,004} =$ 16.15288752. If we use the 5 percent level of significance, the critical *F* value for 19 and 59 df, $F_{0.05}(19, 59)$ is 1.77. Obviously, the computed *F* value is significant, and hence we can reject the null hypothesis. If the level of significance is assumed to be 1 percent $F_{0.01}(19, 59) = 2.23$. The computed *F* exceeds this critical value by far. Therefore, we can also reject the null hypothesis if the level of significance is assumed to be 1 percent.

Residuals: Some large residuals remain, especially on observations 12, 23 and 57 (as shown in both graphs 5.10 and 5.11). In particular at Table 5.12 observation 23 shows the minimum deviance residual (-3.77278003) and observation 57 the maximum (4.13510816), as shown in Table 5.12, while observation 12 is the second local minimum (-3.68213834).

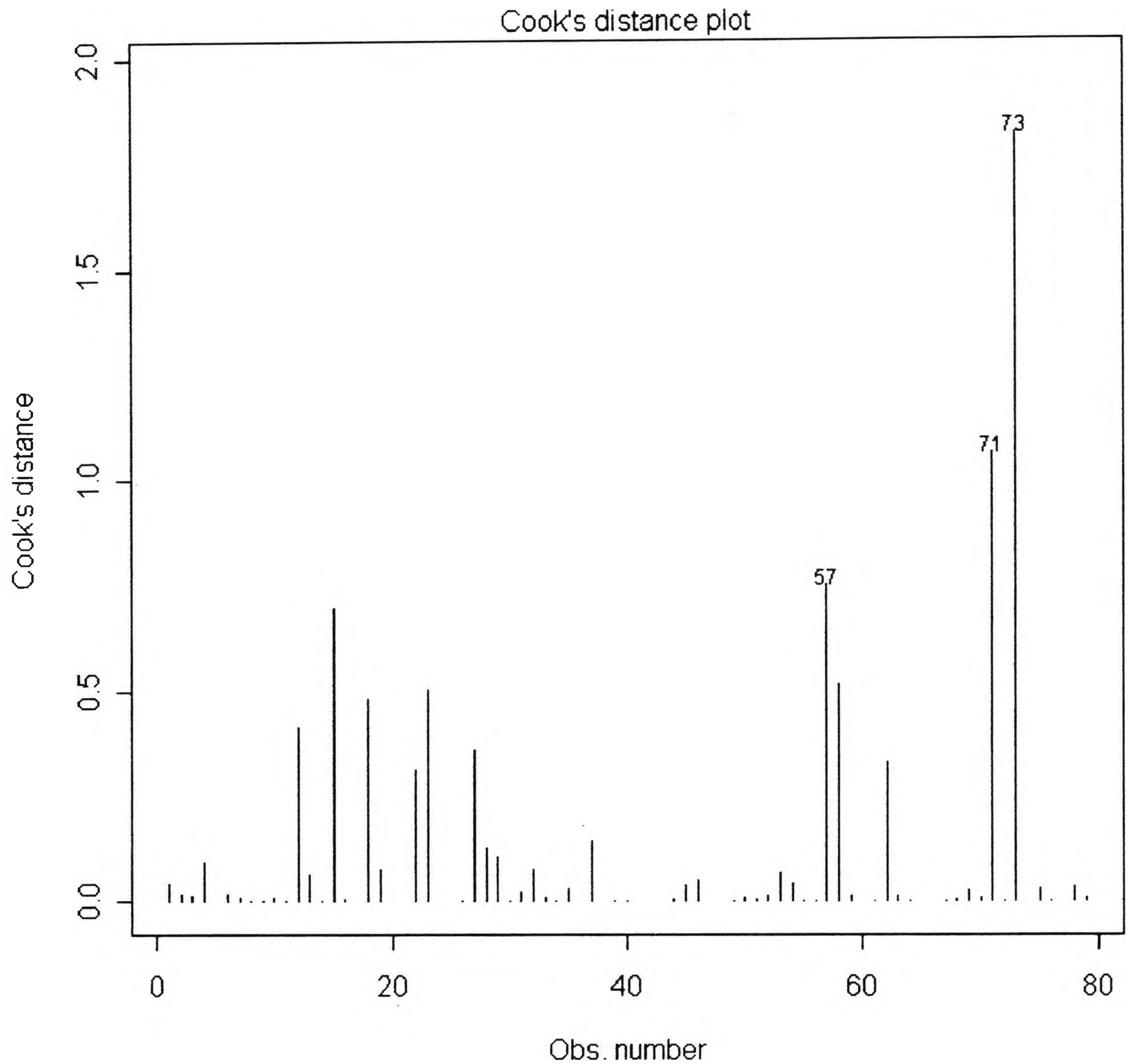
Normality Test: Another useful diagnostic plot is the normal plot of residuals. It gives no reason to doubt that the residuals are normally distributed (Graph 5.9) with the exception of observations 57, 71 and 73.

Cook's Distance plot (Graph 5.8): Cook's distance is a measure of the influence of individual observations on the regression coefficients. The three most extreme values (57, 71 & 73) are identified in each of the residual plots and the Cook's distance plots.

Graph 5.7 – Analysis of deviance

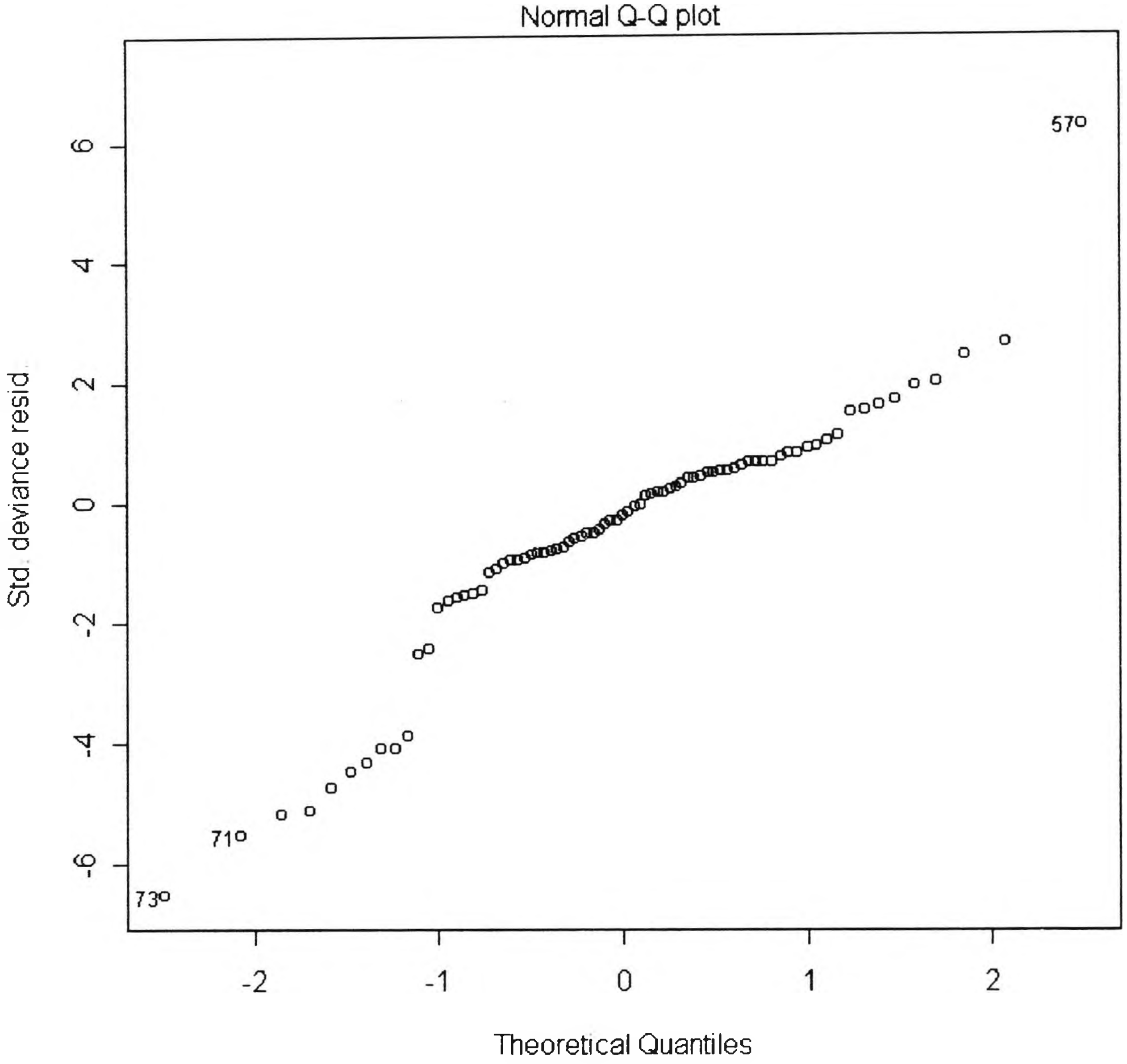


Graph 5.8 – Cook's distance plot



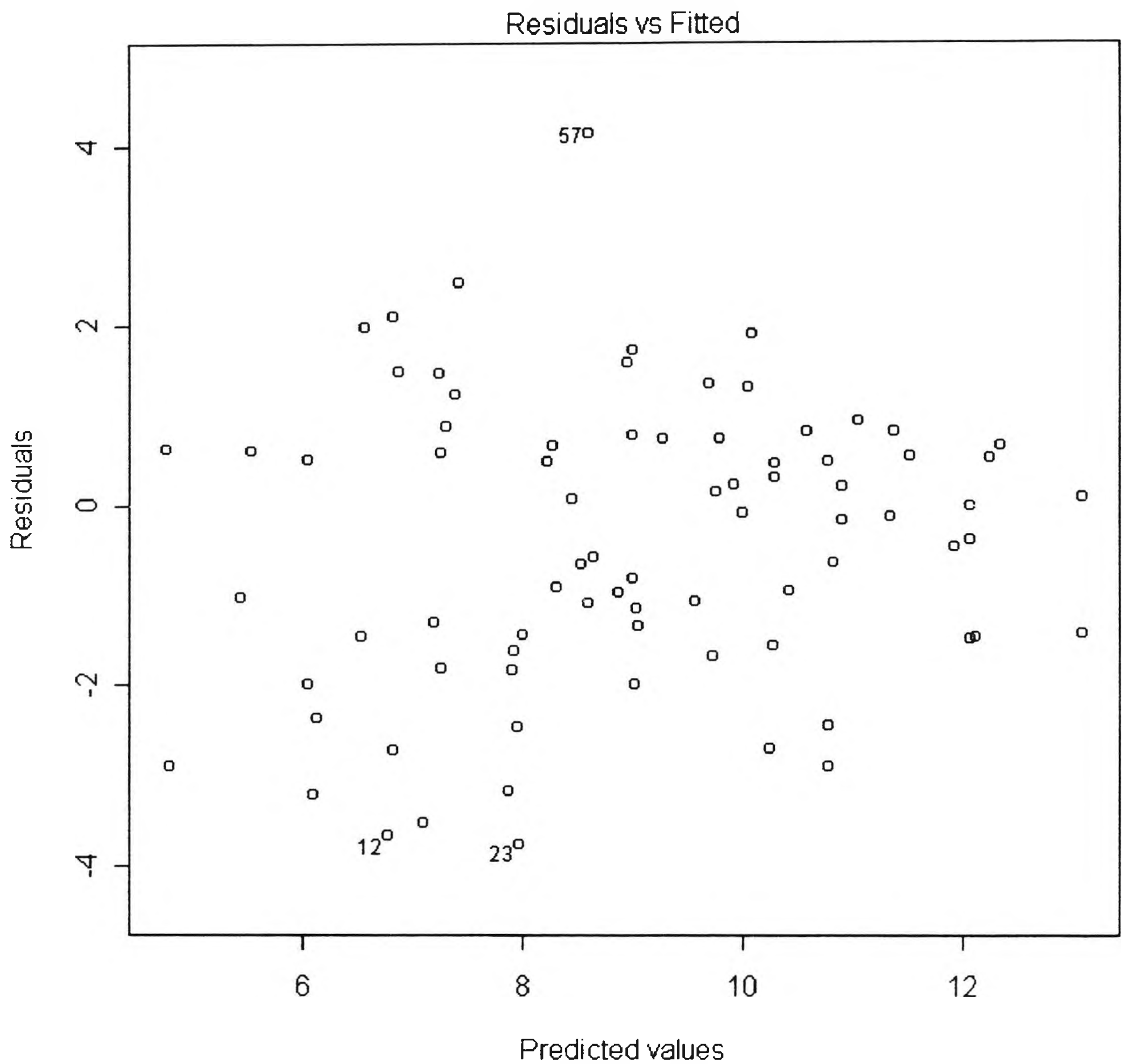
glm(formula=T~typef+YoCf+SePf, family=Gamma (link="log"), weights=m)

Graph 5.9 – Normal Q-Q plot



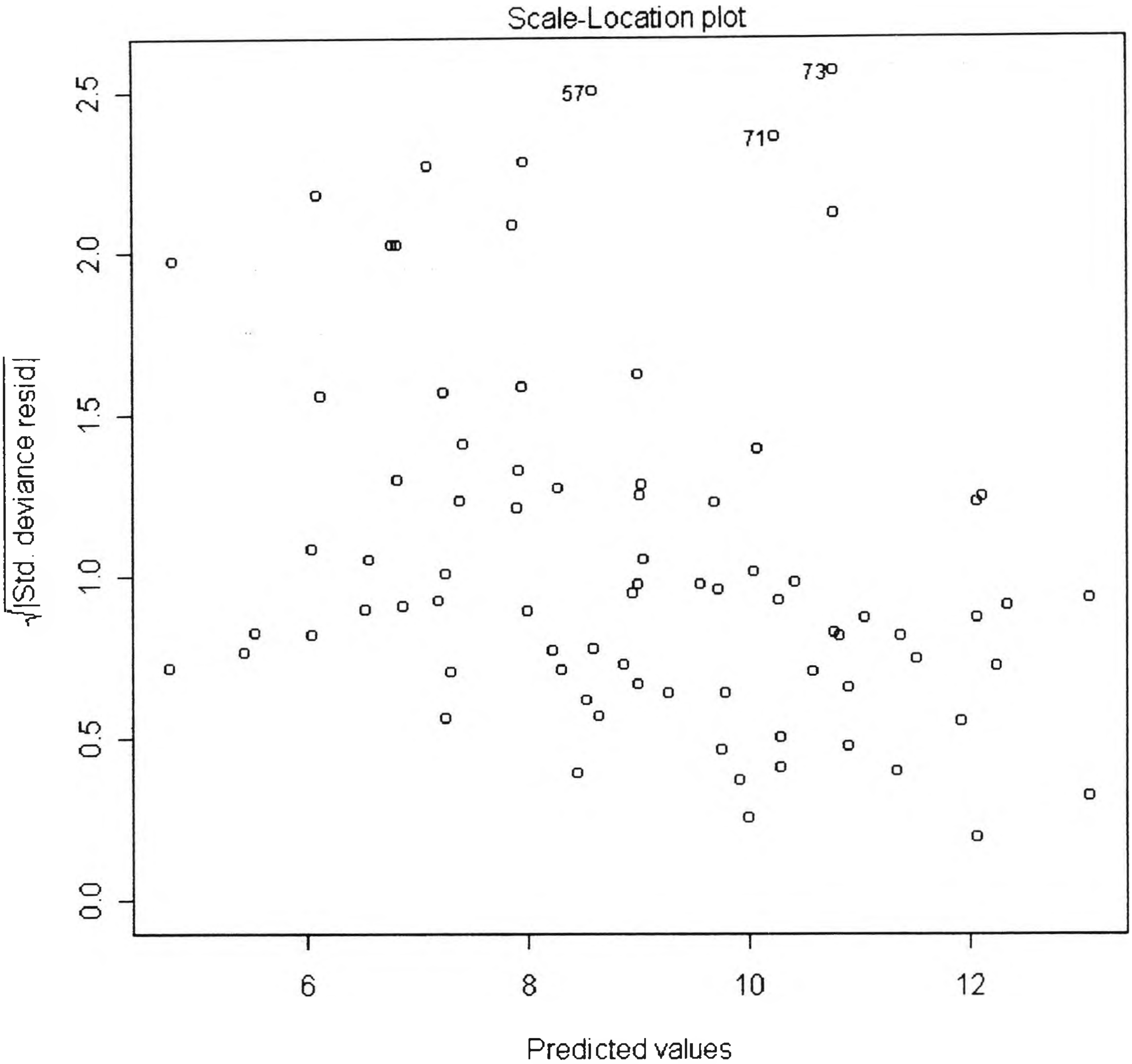
glm(formula=T~typef+YoCf+SePf, family=Gamma (link="log"), weights=m)

Graph 5.10 – Residuals vs. fitted



glm(formula=T~typef+YoCf+SePf, family=Gamma (link="log"), weights=m)

Graph 5.11 – Scale-location plot



glm(formula=T~typef+YoCf+SePf, family=Gamma (link="log"), weights=m)

Table 5.12 – Fitted Values, Effects and Residuals of Regression

Observation	Fitted Values	Effects[16]	Residuals
1	423.2156	-145.19739312	0.51629964
2	1,318.7290	21.93902193	-1.31196661
3	420.6795	7.50435635	-1.99855677
4	1,610.7611	-0.98195416	1.23336568
5	5,019.0906	0.53415183	-0.66225757
6	14,196.0829	1.05997393	-1.06303727
7	250.4446	-1.59427699	0.61232484
8	958.9398	1.46656370	1.49775255
9	2,988.0320	7.32828718	-1.44345551
10	8,451.4014	0.27702447	-1.35435929
11	228.2861	6.33989985	-1.02201151
12	874.0962	0.36566175	-3.68213834
13	2,723.6617	2.27414524	-1.62639169
14	7,703.6519	-3.12616103	1.59784445
15	1,195.9365	-2.60920590	-3.54349618
16	3,726.5078	-9.84467731	0.48166114
17	10,540.1192	-4.19024901	0.74539980
18	118.7988	-0.98468889	-2.90221680
19	454.8745	-10.39546886	-2.37150931

[16] See footnote on page 118.

20	1,417.3776	-10.58602813	0.58075755
21	4,008.9353	-1.05883016	-0.92188188
22	916.8864	-1.40864837	-2.72062097
23	2,856.9948	-1.99505972	-3.77278003
24	8,080.7736	-0.97972518	-0.82399975
25	29,285.5505	0.43147300	0.30484767
26	115.7655	0.49034794	0.62354837
27	443.2602	-1.65494383	-3.22018744
28	1,381.1876	1.72429426	1.47934807
29	3,906.5750	-0.60839984	0.65723011
30	39,063.5527	0.55072184	0.82684916
31	909.6456	3.52973775	2.11291353
32	2,834.4326	-1.33425849	-2.47477171
33	8,016.9582	0.31571442	0.78619434
34	29,054.2768	-0.71801395	-1.55910292
35	1,658.5769	4.18153735	2.47525984
36	4,691.1477	-0.76711338	0.06352206
37	8,082.8095	0.39828563	1.72656916
38	29,292.9287	0.27885589	0.46847173
39	17,348.4323	-0.72375797	0.16062270
40	54,057.2755	0.13250115	-0.16926788
41	1,484.0672	1.45812466	0.88895235
42	5,682.4195	0.13716228	-0.58383964
43	17,706.2751	1.36659418	0.73780367

44	50,080.7353	-0.41131380	-0.63744504
45	181,497.7095	-0.14024065	-1.46376082
46	16,139.6877	2.21694644	1.35702110
47	7,086.7984	-0.05116381	-0.96449254
48	22,082.2843	0.59362028	-0.07887151
49	62,457.9157	1.34435354	0.94326791
50	226,353.8779	1.88138333	0.66000821
51	703.9696	3.22696671	1.99246788
52	2,695.4644	-1.09027682	-1.84236909
53	8,398.9988	-1.22681317	-1.14229701
54	23,755.8738	1.88926209	1.91361281
55	86,093.7177	0.96611150	0.82236141
56	1,418.9849	-1.15386008	-1.82680603
57	5,433.2226	6.67789431	4.13510816
58	47,884.4944	-3.11350206	-2.45588336
59	173,538.3076	-0.37932233	-0.37457502
60	478,818.0126	-0.77373415	0.10175285
61	685.9951	-1.11510647	-1.45691085
62	2,626.6410	-1.79755893	-3.18403619
63	8,184.5469	-1.35966438	-1.99569314
64	23,149.3142	1.10416466	1.32088098
65	83,895.4835	-0.17767547	-0.11692694
66	5,390.3154	-0.60255712	-1.09806858
67	16,796.0862	-0.92517539	-1.69180930

68	47,506.3412	-0.35558655	0.48728229
69	172,167.8419	-0.99065344	-1.48941839
70	475,036.6937	-1.40119899	-1.42880571
71	27,798.4815	-3.01136559	-2.71459247
72	100,744.5415	0.77440330	0.54226269
73	47,896.5584	-4.70450220	-2.90773751
74	173,582.0289	-1.23712128	-0.01509578
75	54,005.0939	1.53578994	0.21574071
76	149,008.0897	-0.24539926	-0.45367725
77	20,123.4228	-0.17896380	0.22470050
78	33,305.4136	-1.80081430	-0.95651755
79	207,968.9594	-0.48555984	0.51727853

Table 5.13 – Estimates for the main effects in the ship damage (ship types)

Ship Type	Estimate	Standard Error
Wooden	-1.96004269	0.84727
Steel	-0.18073856	1.44183
Fibreglass	0	-

In terms of the amounts of claims wooden fishing vessels have the lowest risk, while fibreglass vessels the highest. If we plot the exponential function based on the above results we shall obtain graph 5.12:

Graph 5.12 – Estimate comparisons among different types of vessels

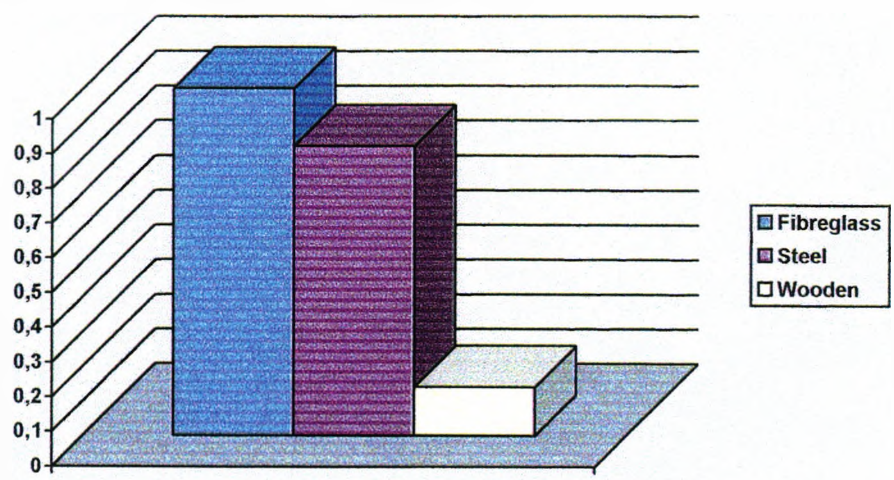
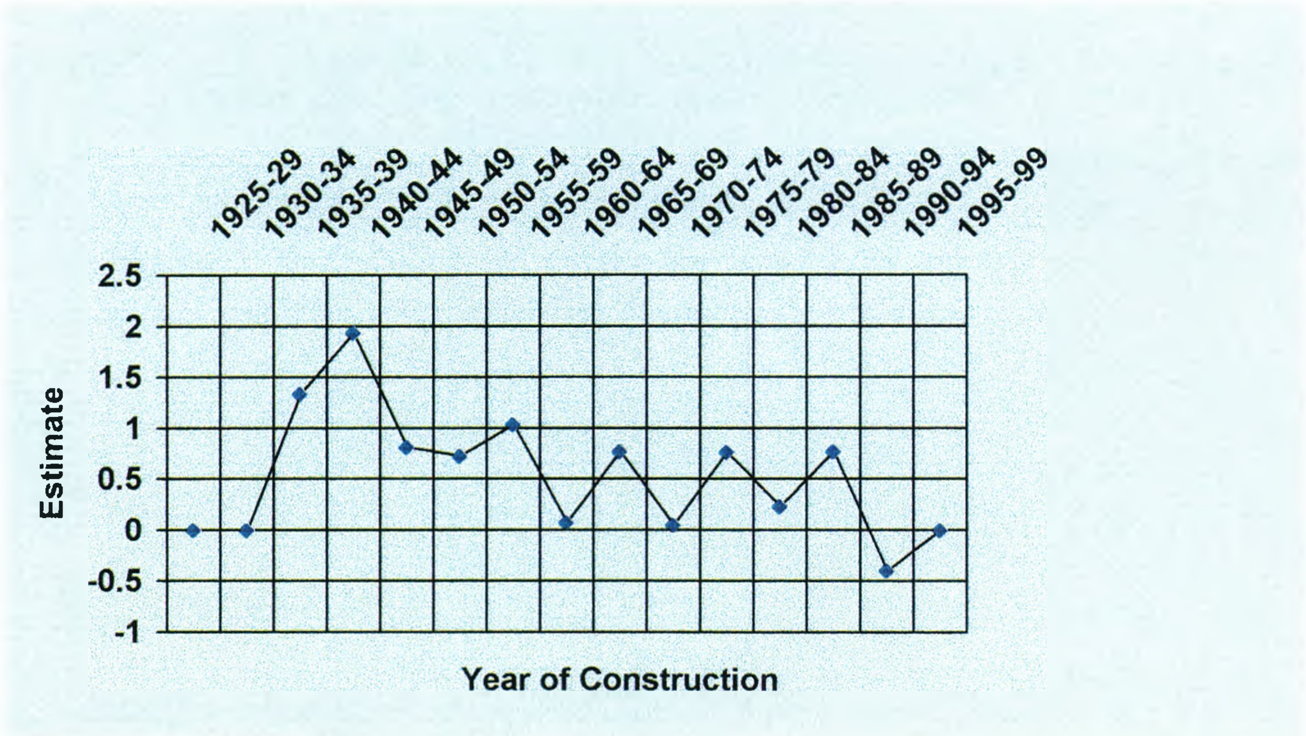


Table 5.14 – Estimates and standard errors for the main effects in the ship damage (year of construction)

Year of construction	Estimate	Standard Error
1925 – 1929	0	-
1930 – 1934	0	-
1935 – 1939	1.33658035	1.24013
1940 – 1944	1.93407159	1.29394
1945 – 1949	0.81794655	1.15301
1950 – 1954	0.72530876	1.17340
1955 – 1959	1.03880312	1.12103
1960 – 1964	0.07213996	1.12306
1965 – 1969	0.77310188	1.09094
1970 – 1974	0.04627530	1.08031
1975 – 1979	0.76517334	1.12217
1980 – 1984	0.22929154	1.12973
1985 – 1989	0.77335379	1.12853
1990 – 1994	-0.39421811	1.42330
1995 – 1999	0	-

The ships built between 1940 and 1944 still have the highest risk, while the modern tonnage (built between 1990 and 1994) seem to have the lowest. This is also derived from Graph 5.13:

Graph 5.13 – Estimates for the main effects in the ship damage (year of construction)



We also notice from the above Graph 5.13 that the trend is negative, which proves that the younger vessels are less risky than the old ones.

5.4 Amounts of Claims by Trading Area

We decided to split the fleet and examine the results for vessels operating in Mediterranean Sea as opposed to vessels trading off West & East Africa areas. Table 5.15 in Appendix "D" shows the data for vessels operating in the Mediterranean Sea. The results obtained are as follows:

5.4.1 Vessels trading in Mediterranean Sea

The following model was constructed:

$$T = \beta_0 + \text{typef} + \text{YoCf} + \text{SePf} + e,\ e \sim \text{Gamma (m)}$$

Where:

T: Average cost of claim

m: Expected number of damage incidents

typef: Effect due to ship type

YoCf: Effect due to year of construction

SePf: Effect due to service period

The results obtained using the Gamma distribution (for reasons discussed in Chapter 3) are shown in Table 5.16:

Table 5.16 – Regression results

Parameter		Estimate	S. E.	t-ratio	Probability (>t)
Intercept		5.93843	1.60785	3.693	0.000661
Ship Type	**Steel**	-1.45920	0.98858	-1.476	0.147758
	Wooden	-1.60621	1.01100	-1.589	0.119994
	Fibreglass	0	-		
Year of Construction	**1925 – 1929**	0	-		
	1930 – 1934	0	-		
	1935 – 1939	0.71686	1.31477	0.545	0.588619
	1940 – 1944	2.09912	2.21566	0.947	0.349123
	1945 – 1949	1.43673	1.26078	1.140	0.261252
	1950 – 1954	0.65227	1.25004	0.522	0.604690
	1955 – 1959	0.96144	1.21163	0.794	0.432165
	1960 – 1964	-0.37511	1.18880	-0.316	0.753994
	1965 – 1969	-0.43547	1.17725	-0.370	0.713405
	1970 – 1974	-0.03278	1.12191	-0.029	0.976837
	1975 – 1979	0.74807	1.19615	0.625	0.535261
	1980 – 1984	-0.01410	1.20413	-0.012	0.990715
	1985 – 1989	0.59197	1.21564	0.487	0.628944
	1990 – 1994	-1.10622	1.64751	-0.671	0.505791
	1995 – 1999	0	-		
Service Period	**1970 – 1974**	0	-		
	1975 – 1979	1.69602	0.71686	2.366	0.02292

	1980 – 1984	3.25367	0.71711	4.537	0.0000511
	1985 – 1989	4.33121	0.72104	6.007	0.0000004620
	1990 – 1994	5.68448	0.84547	6.723	0.0000000456
	1995 – 1999	6.13466	1.48224	4.139	0.000175

Other useful computer output:

Deviance Residuals : Min – 3.0689

: 1Q – 1.3282

: Median – 0.5815

: 3Q 0.6504

: Max 3.1398

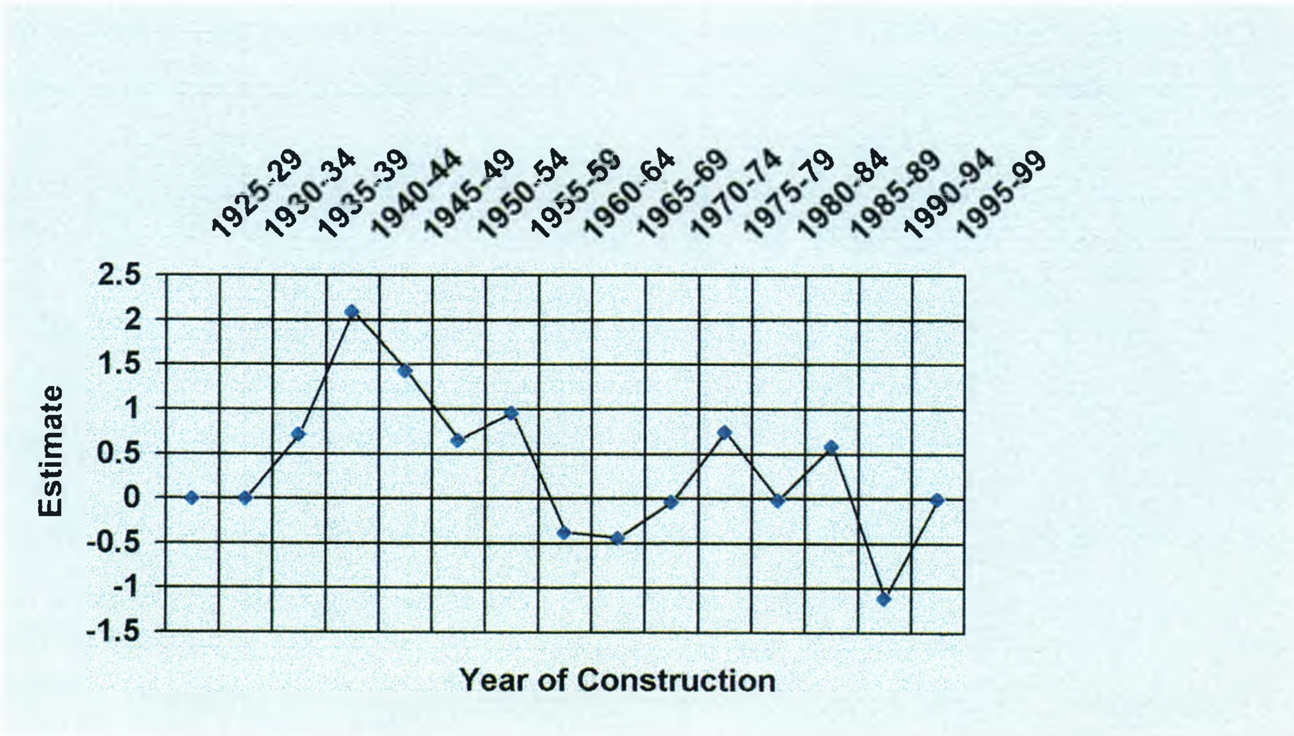
Null Deviance : 513.39 on 59 degrees of freedom

Residual Deviance : 112.91 on 40 degrees of freedom

Akaike Info. Criterion: 3,067.8

The Graph 5.14 that follows shows the estimates for main effects for the different years of construction of vessels operating in the Mediterranean Sea:

Graph 5.14 – Estimates for the main effects in the ship damage (year of construction)



It appears that ships built in 1940-44 are riskier, while those built in 1990-94 are safer. Therefore, the conclusion is the same as shown for both the number and the amounts of claims (Graphs 5.6 and 5.13 respectively).

5.4.2 Vessels trading off West / East Africa

Table 5.17 in Appendix "D" shows the data for vessels operating off West / East Africa.

The following model was constructed:

$$T = \beta_0 + typef + YoCf + SePf + e, \; e \sim Gamma\ (m)$$

Where:

T: Average cost of claim

m: Expected number of damage incidents

typef: Effect due to ship type

YoCf: Effect due to year of construction

SePf: Effect due to service period

The results obtained using the Gamma distribution (for reasons discussed in Chapter 3) are as shown in Table 5.18.

Table 5.18 – Regression results

Parameter		Estimate	S. E.	t-ratio	Probability (>t)
Intercept		9.4937	1.7263	5.499	0.0000611
Ship Type	**Steel**	-0.2544	1.4223	-0.179	0.860461
	Wooden	-0.3689	2.0368	-0.181	0.858687
	Fibreglass	0	-		
Year of Construction	**1925 – 1929**	0	-		
	1930 – 1934	0	-		
	1935 – 1939	0	-		
	1940 – 1944	0	-		
	1945 – 1949	-1.0326	0.6805	-1.518	0.149931
	1950 – 1954	-0.5816	1.0455	-0.556	0.586201
	1955 – 1959	-0.6637	0.6913	-0.960	0.352299
	1960 – 1964	-1.2058	0.7210	-1.673	0.115142
	1965 – 1969	-1.0111	0.7075	-1.429	0.173432
	1970 – 1974	-1.1858	0.9105	-1.302	0.212431
	1975 – 1979	-1.0920	0.8129	-1.343	0.199129
	1980 – 1984	-1.1104	0.9059	-1.226	0.239191
	1985 – 1989	-0.4725	0.7979	-0.592	0.562535
	1990 – 1994	-1.4826	1.1523	-1.287	0.217714
	1995 – 1999	0	-		
Service Period	**1970 – 1974**	0	-		
	1975 – 1979	0.5056	0.7997	0.632	0.536738

	1980 – 1984	1.7244	0.7241	2.382	0.030919
	1985 – 1989	2.4202	0.6856	3.530	0.00303
	1990 – 1994	3.7650	0.6312	5.965	0.0000259
	1995 – 1999	4.4487	0.9528	4.669	0.000303

Other useful computer output:

Deviance Residuals : Min – 1.93

: 1Q – 0.6382

: Median – 4.036E-09

: 3Q 0.4497

: Max 1.477

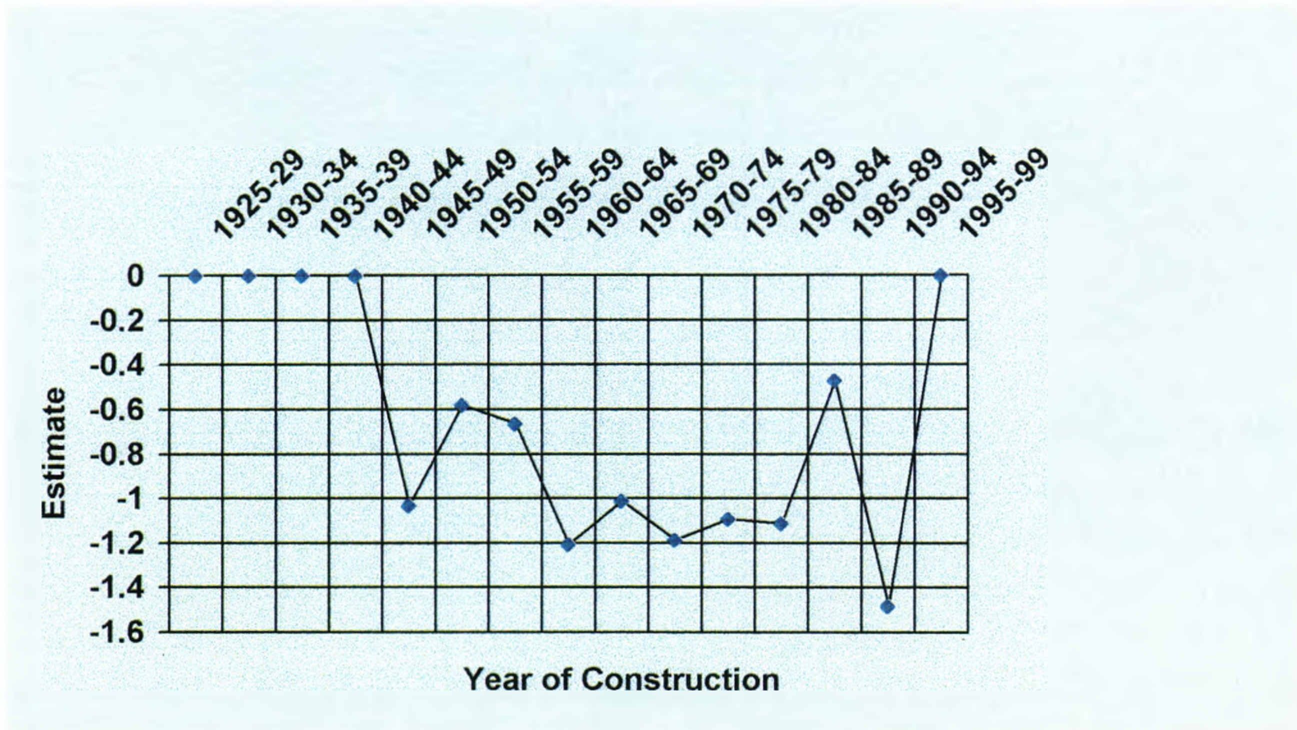
Null Deviance : 126.464 on 32 degrees of freedom

Residual Deviance : 22.412 on 15 degrees of freedom

Akaike Info. Criterion : 2,002.8

Graph 5.15 that follows shows the estimates for main effects for the different years of construction of vessels operating off West / East Africa:

Graph 5.15 – Estimates for the main effects in the ship damage (year of construction)



From the above Graph 5.15 it appears that the negative trend of the estimates for the different years of construction proves that younger vessels are safer than old ones[17]. Similar conclusions were reached in Graphs 5.6, 5.13 and 5.14.

[17] The estimate for vessels built in 1995-99 is 0, as these vessels have no claims for the period of operation 1995-99.

5.5 Comparison for the different trading areas

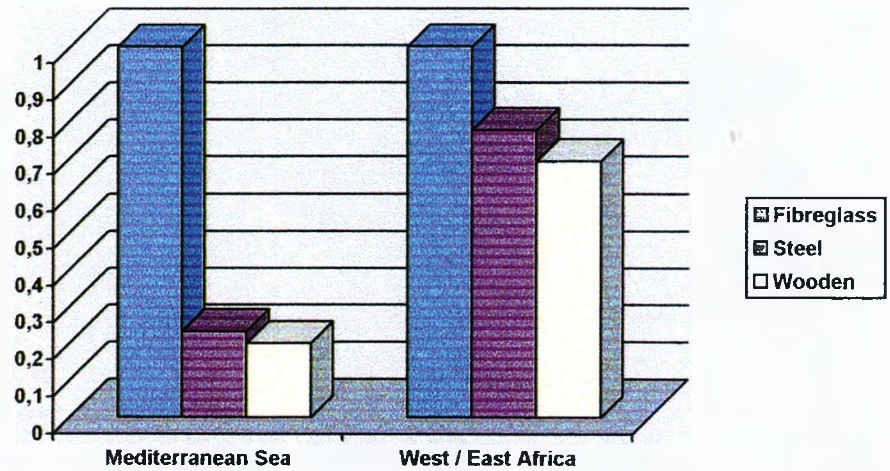
In this section we compare the estimates for the various ship types in terms of the different trading areas (Mediterranean Sea vessels as opposed to fishing vessels operating off West / East Africa). The Table 5.19 that follows shows the estimates for the main effects and the standard errors:

Table 5.19 – Estimates and standard errors for the main effects in the ship damage (ship types)

	Vessels trading in Mediterranean Sea		Vessels trading off West / East Africa	
Ship Type	**Estimate**	**Standard Error**	**Estimate**	**Standard Error**
Wooden	-1.60621	1.01100	-0.36890	2.03680
Steel	-1.45920	0.98858	-0.25440	1.42230
Fibreglass	0	-	0	-

In terms of the amounts of claims vessels operating in Mediterranean Sea vessels have lower risk than those operating off West / East Africa. If we plot the exponential function based on the above results we obtain graph 5.16.

Graph 5.16 – Comparison of estimates between different ship types and trading areas



It therefore appears that vessels operating in the Mediterranean are less risky than those operating in West / East Africa. This is due to the fact that Mediterranean fishing vessels operate at short distance from home country and that the Owners of these vessels still operate them on a family basis.

In this chapter we examined the significance of various parameters that affect the portfolio of fishing vessels. We also looked defined which are the riskier vessels and the reasons behind that. The above results will enable our analysis in the conclusion chapter, after we carry out the simulation analysis in chapter 6, that will check the results of chapter 5.

CHAPTER 6 - SIMULATION ANALYSIS

6.1 Introduction

The analysis of the model with simulation is an attempt to determine the range and probabilities of as many outcomes as possible for the results of the worksheet. Based on the results provided and personal judgment we can then make a decision. In this chapter we shall carry out a risk analysis on the models of the previous chapter. The chapter is split in four parts. The first part deals with the analysis of the entire fleet. The second and third parts respectively deal with vessels operating in Mediterranean Sea and West / East Africa. The final part of the chapter deals with conclusions. Each part is divided into sections. In the first section we present the software system and the data. In section 2 we analyze the statistical results of the simulation. Finally, in section 3 we study the sensitivity testing of our model.

6.2 Setting up the @RISK Model

The software system @RISK (version 3.5.1) is an add-in for spreadsheets such as Microsoft Excel or Lotus 1-2-3 that performs Risk Analysis on any spreadsheet. Risk Analysis is any method, either quantitative or qualitative, for assessing the impacts of risk on decision situations. @RISK uses Monte Carlo Simulation[18] to

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[18] The type of simulation is often called a "Monte Carlo simulation", because the random number used for each trial is analogous to a spin of the roulette wheel at a casino. Like the spins of a roulette wheel, the random numbers used to generate demands for each trial are independent. The term "Monte Carlo simulation" was coined by mathematicians Stanislaw Ulam and James von Neumann when they developed computer simulations of nuclear fission, which were used to determine whether an atom

perform Risk Analysis. We constructed the Table 6.1 that follows:

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bomb was feasible. These simulations were given the code name Monte Carlo. (Winston, Wayne, L., (1996), *Simulation Modelling Using @RISK*, Duxbury Press, Belmont, Ca.)

Table 6.1 – Modeling an uncertain number of events, each with uncertain parameters for the entire portfolio of fishing vessels

Row	A / B	C	D	E	F	G	H
14	*No. of Claims*						
15	8						
17	*Claim#*	1	2	3	4	5	6
18	*$Amount*	$100.600	$100.600	$100.600	$100.600	$100.600	$100.600
19		$1.194,14	$247,52	$22,14	$3.044,71	$7.154,23	$6.014,02
20		$100.600	$100.600	$100.600	$100.600	$100.600	$100.600
22	*Wooden Vessels' Average Claim Amount*		$38.791				
24		$76.029,45	$146.835,30	$211.680,00	$3.220,00	$2.976,52	$102.485,95
25		$100.600	$146.835	$211.680	$100.600	$100.600	$102.486
27	*Steel Vessels' Average Claim Amount*		$242.428				
29		$24.990,00	$31.089,44	$587.163,75			
30		$100.600	$100.600	$587.164			
32	*Fibreglass Vessels' Average Claim Amount*		$262.788				

Row	I	J	K	L	M	N	O	P
17	7	8	9	10	11	12	13	14
18	$100.600	$100.600	$0	$0	$0	$0	$0	$0
19	$699,41	$9.557,62	$451,03	$2.707,88	$133,46	$34,89	$2.687,62	$81.834,69
20	$100.600	$100.600	$451	$2.708	$133	$35	$2.688	$81.835
24	$101.513,45	$203.770,68	$64.562,94	$4.497,84	$83.494,13	$113.850,00	$618.969,36	$15.789,69
25	$101.513	$203.771	$64.563	$4.498	$83.494	$113.850	$618.969	$15.790

Row	Q	R	S	T	U	V	W	X	Y
17	15	16	17	18	19	20	21	22	23
18	$0	$0	$0	$0	$0	$0	$0	$0	$0
19	$141,03	$28.184,45	$81.834,69	$17,70	$311,03	$9.628,08	$1.350,48	$1.411,68	$837,55
20	$141	$28.184	$81.835	$18	$311	$9.628	$1.350	$1.412	$838
24	$1.026,99	$9.611,42	$60.437,16	$877.776,71	$106,04	$20.350,00	$156.289,50	$1.374.865,70	$858.600,00
25	$1.027	$9.611	$60.437	$877.777	$106	$20.350	$156.290	$1.374.866	$858.600

Row	Z	AA	AB	AC	AD	AE	AF	AG
17	24	25	26	27	28	29	30	31
18	$0	$0	$0	$0	$0	$0	$0	$0
19	$3.111,22	$39.142,50	$174,57	$497,06	$18.421,02	$56.344,17	$80.815,32	$6.029,79
20	$3.111	$39.143	$175	$497	$18.421	$56.344	$80.815	$6.030
24	$101,20	$2.049,02	$1.304,68	$51.965,50	$397.923,03	$1.409,46	$1.627,30	$234.496,63
25	$101	$2.049	$1.305	$51.966	$397.923	$1.409	$1.627	$234.497

Row	AH	AI	AJ	AK	AL	AM	AN	AO
17	32	33	34	35	36	37	38	39
18	$0	$0	$0	$0	$0	$0	$0	$0
19	$1.315,79	$46.376,72	$3.586,62	$12.904,34	$52.597,25	$91.142,18	$45.237,37	
20	$1.316	$46.377	$3.587	$12.904	$52.597	$91.142	$45.237	
24	$189.456,68	$243.108,08	$86.290,73	$406.977,27	$161.881,21	$2.073.517,86	$183.042,00	$91.219,16
25	$189.457	$243.108	$86.291	$406.977	$161.881	$2.073.518	$183.042	$91.219

To model situations where 2 or more levels of uncertainty are present, a worksheet was set up which includes a column of calculations for each of the possible events. We used 39 columns, each to calculate the results from a single possible claim (as shown in tables 5.1 and 5.8). A claim # (1-39) was given at the top of each column.

To run the analysis:

1. First a cell was used to sample the number of claims (the λ from our analysis in Chapter 3).
2. The number of claims was compared to the # at the top of each column, which refers to the calculation of the average claims.

We have, therefore, included the following formulas in the above table:

- In cell *A15*: =INT(RiskPoisson(8.6551724)).
- In cell *C18*: =IF(*C17*<=$A15;RiskGamma(0.2;503000);0). This formula is also copied in all cells up to cell *AO18*. The formula in cell *C18* says "if the Claim # is less than or equal to the *Number of Claims,* return a sample from the gamma distribution – otherwise return from a value of 0".
- In cells *C19:AN19*, *C24:AO24* and *C29:E29* we show the average amounts of claims for wooden, steel and fiberglass vessels respectively (as derived from Table 5.8).
- In cell *C20*: =IF(*C19*<=*C18*;RiskGamma(0.2;503000);*C19*). This formula is also copied in all cells from *C20* to *AN20* (wooden vessels), from *C25* to *AO25* (steel vessels) and from *C30* to *E30* (fiberglass vessels). The formula in cell *C20* says "if the average amount of claim is less than or equal to the result in cell *C19*,

return the sample from the gamma distribution – otherwise return from a value of cell *C19*".

- In cell *D22*: =SUM(*C20:AN20*)/38 to calculate the average claims' amount for wooden vessels. In cell *D27*: =SUM(*C25:AO25*)/39 to calculate the average claims' amount for steel vessels. Finally, in cell *D32*: =SUM(*C30:E30*)/3 to calculate the average claims' amount for fiberglass vessels.

To use the @RISK glossary cells *D22*, *D27* and *D32* are the output cells, which are the cells that we are interested in studying – the bottom-line values. During a simulation, each time the spreadsheet is recalculated the value of the "dependent cell" is recorded. The result will be a range of possible outcome values.

6.3 Simulation Results

The Iterations-tab of the Simulation settings defines the number of iterations to run during a simulation. By each iteration a new set of random numbers is generated and the worksheet is recalculated.

To obtain more precise results we run a number of 1,000 iterations.

We then set the @RISK Settings command Standard Recalc option to "Monte Carlo" and click the Excel-recalc button (F9). We notice that the columns with the distributions change.

The results obtained are shown in both sub-sections 6.3.1 and 6.3.2:

6.3.1 Statistical results

The results obtained are shown on Table 6.2 below:

Table 6.2 – Detail statistics for the various types of vessels

	Wooden Vessels Average Claim Amount Output	Steel Vessels Average Claim Amount	Fibreglass Vessels Average Claim Amount
Minimum	17,141.360	216,210.100	8,417.952
Maximum	146,065.900	295,508.600	974,100.900
Mean	33,958.400	240,054.800	224,752.500
Standard Deviation	16,311.210	9,655.682	72,174.070
Variance	266,055,600.000	93,232,190.000	5,209,096,000.000
Skewness	1.852478	2.020074	3.046690
Kurtosis	7.704159	8.291637	25.964620
Mode	18,347.260	236,797.700	214,414.400
5% Percentile	18,574.250	230,550.700	195,852.300
10% Percentile	19,278.220	231,684.300	204,051.300
15% Percentile	20,326.290	233,066.900	204,261.200
20% Percentile	21,220.230	234,088.400	206,084.400
25% Percentile	22,347.560	234,780.500	206,116.200
30% Percentile	23,489.310	235,303.500	206,937.700
35% Percentile	24,672.380	236,288.000	210,037,600
40% Percentile	25,706.240	236,722.000	214,414.400

45% Percentile	26,838.340	236,797.700	214,414.400
50% Percentile	28,361.810	236,922.700	214,414.400
55% Percentile	29,828.810	237,412.700	214,414.400
60% Percentile	31,799.740	238,088.800	214,414.400
65% Percentile	34,643.540	239,081.100	214,414.400
70% Percentile	37,394.340	240,813.800	214,414.400
75% Percentile	40,324.120	242,266.900	214,696.400
80% Percentile	44,097.390	244,283.000	223,239.400
85% Percentile	49,272.230	247,638.500	236,969.500
90% Percentile	56,891.020	252,401.800	268,804.800
95% Percentile	67,247.700	261,886.900	351,123.800

To explain the statistical information given by @RISK we obtain the following:

6.3.1.1 Expected / Mean Result:

The average claim for wooden vessels was estimated to be US$33,958.40, for steel vessels US$240,054.80 and for fiberglass vessels US$224,752.50. The result follows the same pattern as shown both in Table 5.13 and Graph 5.12 in as far as that both steel and fiberglass vessels are much riskier than wooden vessels.

6.3.1.2 Maximum Result:

The largest claim was estimated to be US$146,065.90 for wooden vessels, US$295,508.60 for steel and US$974,100.90 for fiberglass.

6.3.1.3 Minimum Result:

For the average claim the minimum amount was US$17,141.36 for wooden, US$216,120.10 for steel and US$8,417.95 for fiberglass vessels.

6.3.1.4 Standard Deviation:

For the three types of vessels the sample standard deviation was 16,311.21 – 9,655.68 – 72,174.07 respectively. The steel vessels have lower standard deviation than wooden vessels. The latter have much lower standard deviation than fiberglass vessels, which makes the wooden vessels a better risk, especially, if we compare with the combined standard deviation of both steel and fiberglass vessels. The variance is simply the square of the standard deviation. The variance measures the average squared deviation of average claim about the mean.

6.3.1.5 Skewness:

It is a measure of symmetry. All distributions shown above are positively skewed with the fiberglass vessels to have the longest positive tail extending to the right.

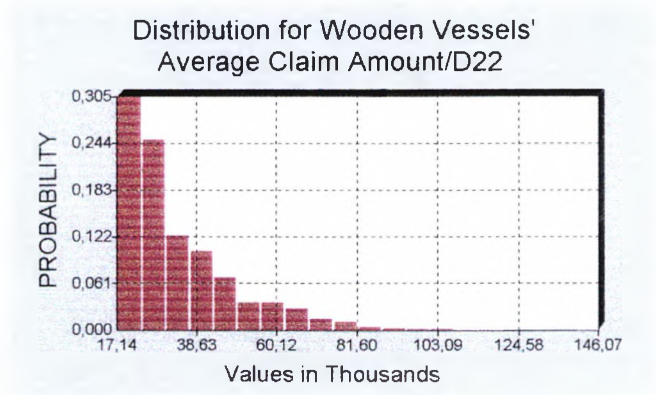
6.3.1.6 Percentile probabilities:

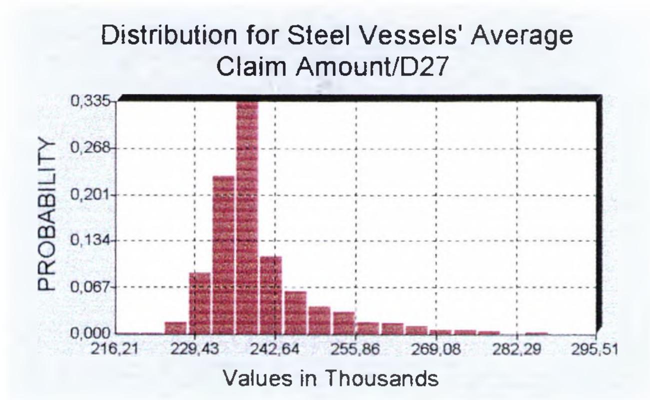
For a continuous random variable, such as average claim amount, percentile probability tells us, for example that for wooden vessels there is at exactly 95% probability that the average claim will be approximately US$67,250.00 or less.

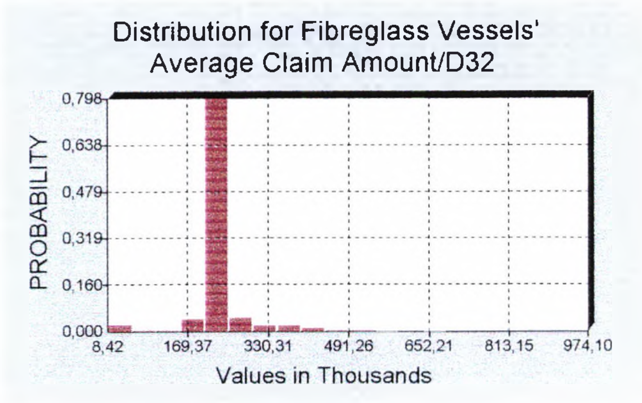
6.3.2 Summary Graph

Where output variables have been selected as a "range" of cells – Summary graphs of risk are created following simulation. A Summary graph (such as Graph 6.1) displays how risk changes across a range of output cells. A Summary graph is especially useful in displaying trends such as how risk changes across time. The narrower the band is, the less the uncertainty about the average cost of claim. Conversely, the wider the band the greater the possible variance in the average cost of claim and the greater the risk.

Graph 6.1 – Summary graph







6.4 Sensitivity Analysis with Scenarios

The @RISK scenario report lists all "input" variables that are "significant" towards reaching a defined goal for an output variable. @RISK calculates three statistics for each significant input distribution in a scenario:

1. Percentile Median of Samples in Iterations Meeting Target: The percentile value of the subset median in the distribution generated for the whole simulation (equivalent to entering the subset median as a Target Value in the @RISK statistics report). If this value is less than 50% the subset median is smaller than the median for the whole simulation, if it is greater than 50% the subset median is greater than the median for the whole simulation.
2. Actual Median of Samples in Iterations Meeting Target: The median of the subset of iterations for the selected input. This is comparable to the median of the selected output for the whole simulation (the 50% percentile reported in the statistics report).
3. Ratio Shown Median to Original Standard Deviation: The difference between the subset median and the median for the whole simulation, divided by the standard deviation of the input for the whole simulation. A negative number indicates that the subset median is smaller than the median for the whole simulation, a positive

number indicates that the subset median is greater than the median for the whole simulation. The larger the magnitude of this ratio, the more "significant" the variable is in reaching the defined target.

- Target 1: *J* > 75%
- Target 2: *J* < 25%
- Target 3: *J* > 90%

Table 6.3 shows the simulation sensitivities for the total claims of the various types of construction, whilst Table 6.4 shows the different scenarios:

Table 6.3 – Simulation Sensitivities

Simulation Sensitivities for Wooden Vessels' Average Claims Amount

Rank	Cell	Name	Sensitivity (RSqr=0.1180785)	Rank Correlation Coefficient
#1	A15	No. of Claims	0.343626	0.360092
#2	A15	No. of Claims	0	2.69E-02
#3	C18	$Amount / 1930-34	0	0.011159
#4	D18	$Amount / 1935-39	0	1.25E-02
#5	E18	$Amount / 1940-44	0	3.48E-02
#6	F18	$Amount / 1945-49	0	-0.55056
#7	G18	$Amount / 1950-54	0	-3.91E-02
#8	H18	$Amount / 1955-59	0	0
#9	I18	$Amount / 1960-64	0	0
#10	J18	$Amount / 1965-69	0	0
#11	K18	$Amount / 1970-74	0	0
#12	L18	$Amount / 1975-79	0	0

#13	M18	$Amount / 1980-84	0	0
#14	N18	$Amount / 1985-89	0	0.985236
#15	O18	$Amount / 1990-94	0	0.340418
#16	P18	$Amount / 1995-99	0	-3.86E-02
#17	C20	1930-34	0	-6.85E-02
#18	D20	1935-39	0	-4.70E-02
#19	E20	1940-44	0	7.27E-02
#20	F20	1945-49	0	0
#21	G20	1950-54	0	9.15E-02
#22	H20	1955-59	0	0
#23	I20	1960-64	0	0
#24	J20	1965-69	0	0
#25	K20	1970-74	0	0
#26	L20	1975-79	0	0
#27	M20	1980-84	0	0
#28	N20	1985-89	0	0
#29	O20	1990-94	0	0
#30	P20	1995-99	0	-1.83E-02

Simulation Sensitivities for Steel Vessels' Average Claims Amount

Rank	Cell	Name	Sensitivity (RSqr=1.622303E-02)	Rank Correlation Coefficient
#1	A15	No. Of Claims	0.12737	5.38E-02
#2	A15	No. Of Claims	0	2.56E-04
#3	C18	$Amount / 1930-34	0	-2.72E-02

#4	D18	$Amount / 1935-39	0	5.77E-03
#5	E18	$Amount / 1940-44	0	3.67E-03
#6	F18	$Amount / 1945-49	0	0.985088
#7	G18	$Amount / 1950-54	0	-2.16E-02
#8	H18	$Amount / 1955-59	0	0
#9	I18	$Amount / 1960-64	0	0
#10	J18	$Amount / 1965-69	0	0
#11	K18	$Amount / 1970-74	0	0
#12	L18	$Amount / 1975-79	0	0
#13	M18	$Amount / 1980-84	0	0
#14	N18	$Amount / 1985-89	0	-0.61032
#15	O18	$Amount / 1990-94	0	-3.71E-02
#16	P18	$Amount / 1995-99	0	-1.81E-02
#17	C20	1930-34	0	-5.13E-02
#18	D20	1935-39	0	1.97E-02
#19	E20	1940-44	0	-3.21E-02
#20	F20	1945-49	0	0
#21	G20	1950-54	0	-2.61E-02
#22	H20	1955-59	0	0
#23	I20	1960-64	0	0
#24	J20	1965-69	0	0
#25	K20	1970-74	0	0
#26	L20	1975-79	0	0
#27	M20	1980-84	0	0

#28	N20	1985-89	0	0
#29	O20	1990-94	0	0
#30	P20	1995-99	0	1.20E-02

Simulation Sensitivities for Fibreglass Vessels' Average Claims Amount

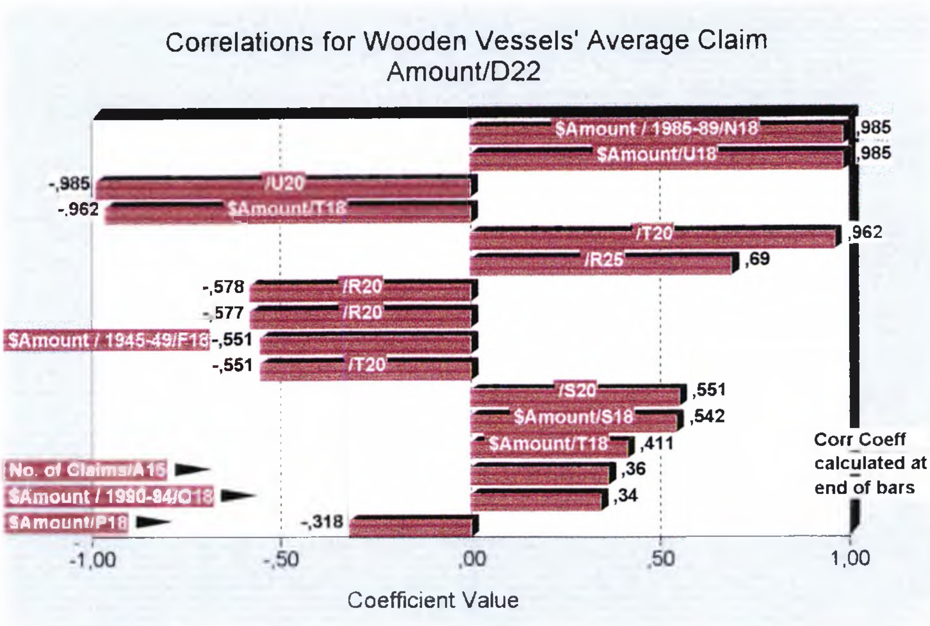
Rank	Cell	Name	Sensitivity (RSqr=0.0108939)	Rank Correlation Coefficient
#1	C18	$Amount	0.104374	9.02E-03
#2	A15	No. of Claims	0	-7.84E-02
#3	C18	$Amount / 1930-34	0	5.58E-03
#4	D18	$Amount / 1935-39	0	-6.12E-02
#5	E18	$Amount / 1940-44	0	-5.04E-02
#6	F18	$Amount / 1945-49	0	0.86583
#7	G18	$Amount / 1950-54	0	-2.59E-02
#8	H18	$Amount / 1955-59	0	0
#9	I18	$Amount / 1960-64	0	0
#10	J18	$Amount / 1965-69	0	0
#11	K18	$Amount / 1970-74	0	0
#12	L18	$Amount / 1975-79	0	0
#13	M18	$Amount / 1980-84	0	0
#14	N18	$Amount / 1985-89	0	-0.94287
#15	O18	$Amount / 1990-94	0	-0.25141
#16	P18	$Amount / 1995-99	0	9.95E-03
#17	C20	1930-34	0	1.21E-02
#18	D20	1935-39	0	-0.02529

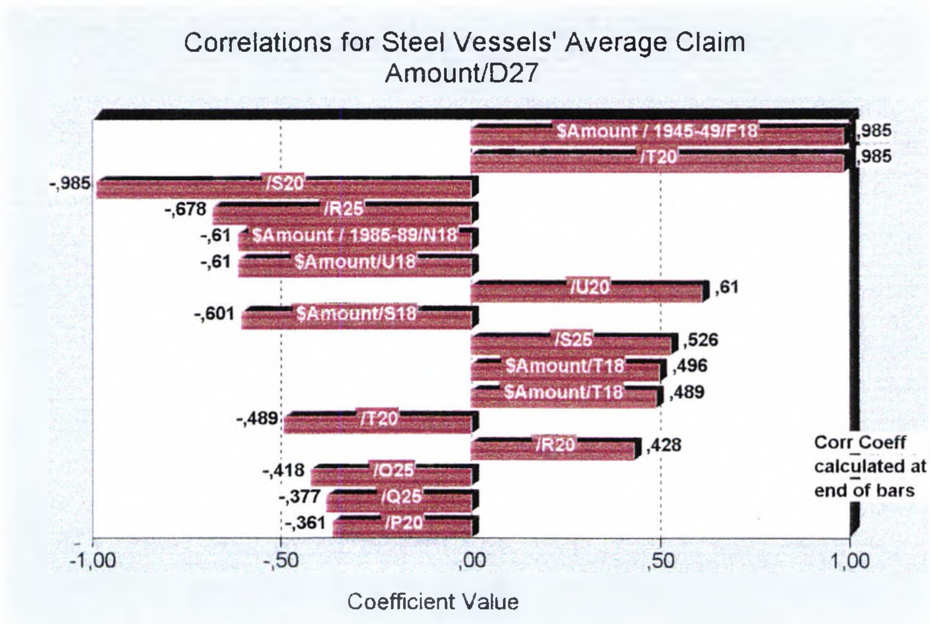
#19	E20	1940-44	0	0.165508
#20	F20	1945-49	0	0
#21	G20	1950-54	0	0.021816
#22	H20	1955-59	0	0
#23	I20	1960-64	0	0
#24	J20	1965-69	0	0
#25	K20	1970-74	0	0
#26	L20	1975-79	0	0
#27	M20	1980-84	0	0
#28	N20	1985-89	0	0
#29	O20	1990-94	0	0
#30	P20	1995-99	0	1.10E-02

In all above cases the number of claims was an important factor for all types of vessels.

This is also reflected in the Graph 6.2 that follows:

Graph 6.2 – Tornado Graphs





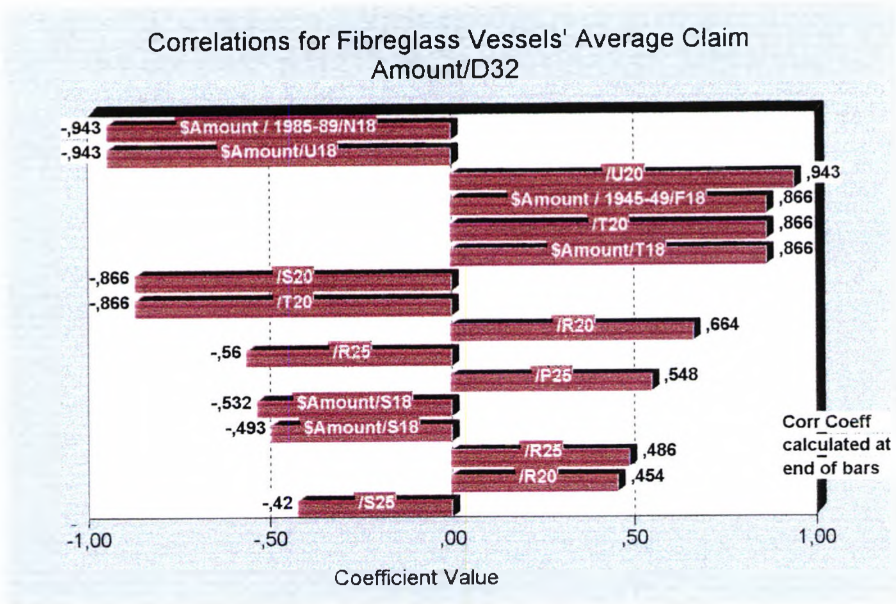


Table 6.4 - Scenarios

Output	Cell	Name	Target	Percentile	Actual	Ratio Median to Std. Deviation
Wooden	D23	No. of Claims	#1	74.60%	10.00	0.679277
Wooden	Q18	$Amount	#2	87.10%	148,101.50	0.857542
Wooden	S18	$Amount	#2	100.00%	53,465.18	2.915504
Wooden	U18	$Amount	#2	100.00%	9,007.37	1.414214
Wooden	S25		#2	100.00%	22,135.40	1.496499
Wooden	A15	No. of Claims	#3	74.60%	10.00	0.679277
Wooden	T18	$Amount	#3	33.33%	126.64	-0.825530
Wooden	S20		#3	100.00%	77,293.79	1.727975
Wooden	T20		#3	100.00%	296,173.50	1.732049
Wooden	S25		#3	25.00%	857.14	-0.896970
Steel	R25		#1	83.33%	148,747.30	1.713042

Steel	A15	No. of Claims	#1	74.60%	10.00	0.679277
Steel	D25		#1	75.11%	147,195.90	0.583304
Steel	E25		#1	84.89%	247,848.60	0.740964
Steel	N25		#1	86.49%	264,853.00	1.433356
Steel	R25		#1	65.00%	139,417.20	0.546018
Steel	Q18	$Amount	#2	72.58%	103,954.30	0.577768
Steel	S20		#2		77,293.79	1.727975
Steel	O25		#2		813.90	-0.629580
Steel	S25		#2		857.14	-0.896970
Steel	Q20		#3	84.62%	364,949.10	1.308030
Steel	P25		#3	94.74%	280,238.90	2.244179
Steel	A15	No. of Claims	#3	74.60%	10.00	0.679277
Steel	T18	$Amount	#3	33.33%	126.64	-0.825530
Steel	T20		#3	100.00%	296,173.50	1.732049
Steel	D25		#3	82.89%	244,512.80	1.011871
Steel	E25		#3	85.80%	293,588.20	0.883962
Steel	N25		#3	91.89%	397,541.20	2.240230
Steel	R25		#3	70.00%	240,845.50	0.968319
Steel	S25		#3	75.00%	13,433.09	0.517625
Fibreglass	R25		#1	83.33%	148,747.30	1.713042
Fibreglass	O25		#1	80.00%	57,013.38	1.028094
Fibreglass	N18	$Amount	#2	100.00%	4.55	1.414214
Fibreglass	T18	$Amount	#2	100.00%	69,074.95	1.708638
Fibreglass	T20		#2	100.00%	13,143.56	1.631146

Fibreglass	U20		#2	100.00%	833,434.90	1.414214
Fibreglass	T18	$Amount	#2	100.00%	428.22	0.977503
Fibreglass	S20		#2	100.00%	77,293.79	1.727975
Fibreglass	S25		#2	25.00%	857.14	-0.896970
Fibreglass	O25		#3	80.00%	57,013.38	1.028094
Fibreglass	C30		#3	90.54%	321,595.50	1.573178
Fibreglass	D30		#3	90.05%	268,379.20	1.150924

6.5 Setting up the @RISK Model for vessels operating in Mediterranean Sea

We used the same pattern for the vessels operating in Mediterranean Sea, as shown in section 6.2. We only took into consideration the data for the vessels operating in Mediterranean Sea. The way the @RISK model was formed is shown on the following Table 6.5:

Table 6.5 – Modeling an uncertain number of events, each with uncertain parameters for the vessels operating in Mediterranean Sea

No. of Claims
8

Claim#	1	2	3	4	5	6	7	8	9	10
$Amount	$100.600	$100.600	$100.600	$100.600	$100.600	$100.600	$100.600	$100.600	$0	$0
	$1.194,14	$247,52	$22,14	$3.044,71	$7.154,23	$6.014,02	$699,41	$9.557,62	$451,03	$2.707,88
	$100.600	$100.600	$100.600	$100.600	$100.600	$100.600	$100.600	$100.600	$451	$2.708
Wooden Vessels' Average Claim Amount		$37.392								
	$211.680,00	$18.266,50	$26.839,64	$1.027,00	$106,04	$202,00	$44.851,72	$101,20	$892,08	$1.304,68
	$211.680	$100.600	$100.600	$100.600	$100.600	$100.600	$100.600	$100.600	$892	$1.305
Steel Vessels' Average Claim Amount		$65.432								
	$31.089,44	$587.163,75								
	$100.600	$587.164								
Fibreglass Vessels' Average Claim Amount		$343.882								

Claim#	11	12	13	14	15	16	17	18	19	20
$Amount	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	$133,46	$34,89	$2.687,62	$81.834,69	$141,03	$28.184,45	$28.660,68	$17,70	$311,03	$9.628,08
	$133	$35	$2.688	$81.835	$141	$28.184	$28.661	$18	$311	$9.628
	$51.965,50	$19.252,50	$1.409,46	$1.627,30	$3.024,05	$39.683,92	$83.215,44	$158.972,00	$26.191,10	$5.224,17
	$51.966	$19.253	$1.409	$1.627	$3.024	$39.684	$83.215	$158.972	$26.191	$5.224

Claim#	21	22	23	24	25	26	27	28	29	30
$Amount	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	$1.350,48	$1.411,68	$837,55	$3.111,22	$39.142,50	$174,57	$497,06	$18.421,02	$56.344,17	$80.815,32
	$1.350	$1.412	$838	$3.111	$39.143	$175	$497	$18.421	$56.344	$80.815

Claim#	31	32	33	34	35	36	37	38
$Amount	$0	$0	$0	$0	$0	$0	$0	$0
	$6.029,79	$1.315,79	$46.376,72	$3.586,62	$12.904,34	$52.597,25	$91.142,18	$45.237,37
	$6.030	$1.316	$46.377	$3.587	$12.904	$52.597	$91.142	$45.237

6.6 Simulation Results

We followed the same methodology as shown in section 6.2. The results obtained are shown in both sub-sections 6.6.1 and 6.6.2:

6.6.1 Statistical results

The results obtained are shown on Table 6.6:

Table 6.6 – Detail statistics for the various types of vessels operating in Mediterranean Sea

	Wooden Vessels Average Claim Amount Output	Steel Vessels Average Claim Amount	Fibreglass Vessels Average Claim Amount
Minimum	16,579.250	22,232.570	0.210
Maximum	109,282.800	191,298.200	993,819.500
Mean	32,201.720	53,796.450	315,728.200
Standard Deviation	15,754.520	24,976.080	80,803.560
Variance	248,205,000.000	623,804,400.000	6,529,215,000.000
Skewness	1.680518	1.912307	1.396605
Kurtosis	6.148927	7.697276	18.327910
Mode	16,947.950	34,791.820	309,126.600
5% Percentile	17,067.730	31,420.960	293,581.900
10% Percentile	17,613.270	33,793.380	293,622.700
15% Percentile	18,413.020	34,728.790	293,965.100
20% Percentile	19,489.030	34,881.420	296,682.400

25% Percentile	20,739.390	35,990.580	306,552.400
30% Percentile	21,901.060	37,517.600	309,126.600
35% Percentile	23,119.970	39,470.290	309,126,600
40% Percentile	24,345.450	41,294.290	309,126,600
45% Percentile	25,746.120	43,804.480	309,126,600
50% Percentile	27,065.610	45,870.050	309,126,600
55% Percentile	28,633.170	48,349.030	309,126,600
60% Percentile	31,065.210	51,371.340	306,552.400
65% Percentile	33,121.800	54,561.670	309,126.600
70% Percentile	35,847.590	58,029.390	309,126,600
75% Percentile	38,799.330	62,756.410	309,126,600
80% Percentile	42,445.880	67,979.590	309,126,600
85% Percentile	46,974.960	77,072.370	309,126,600
90% Percentile	52,972.090	87,062.590	345,016.500
95% Percentile	64,997.150	104,349.300	438,431.200

To explain the statistical information given by @RISK we obtain the following:

6.6.1.1 Expected / Mean Result:

The average claim for wooden vessels was estimated to be US$32,201.72, for steel vessels US$53,796.45 and for fiberglass vessels US$315,728.20. The result follows the same pattern as shown both in Table 5.16 and Graph 5.16 in as far as that both steel and fiberglass vessels operating in Mediterranean Sea are much riskier than wooden vessels operating in the same area.

6.6.1.2 Maximum Result:

The largest claim was estimated to be US$109,282.80 for wooden vessels, US$191,298.20 for steel and US$993,819.50 for fiberglass.

6.6.1.3 Minimum Result:

For the average claim the minimum amount was US$16,579.20 for wooden, US$22,232.57 for steel and US$0.21 for fiberglass vessels.

6.6.1.4 Standard Deviation:

For the three types of vessels the sample standard deviation was 15,754.52 – 24,976.08 – 80,803.56 respectively. The wooden vessels have lower standard deviation than steel and fibreglass vessels. This fact together with the result on the mean claim figures makes the wooden vessels a better risk.

6.6.1.5 Skewness:

All distributions shown above are positively skewed with the steel vessels to have the longest positive tail extending to the right.

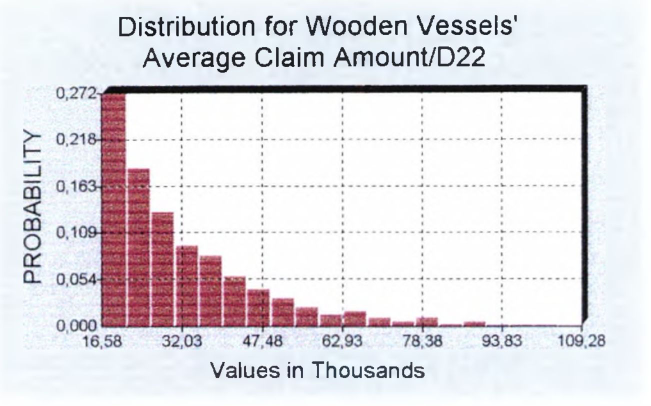
6.6.1.6 Percentile probabilities:

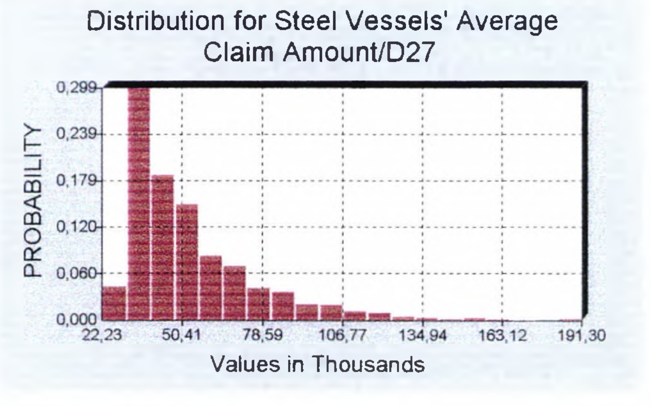
For a continuous random variable, such as average claim amount, percentile probability tells us, for example that for wooden vessels there is at exactly 95% probability that the average claim will be approximately US$64,997.15 or less.

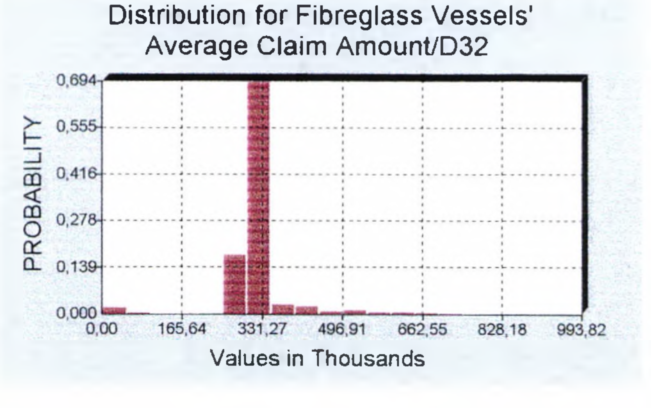
6.6.2 Summary Graph

The summary graphs for the three different types of construction are shown in Graph 6.3 that follows:

Graph 6.3 Summary Graph







6.7 Sensitivity Analysis with Scenarios

Table 6.7 shows the simulation sensitivities for the total claims of the various types of construction, whilst Table 6.8 shows the different scenarios:

Table 6.7 – Simulation Sensitivities

Simulation Sensitivities for Wooden Vessels' Average Claims Amount

Rank	Cell	Name	Sensitivity (RSqr=0.0789841)	Rank Correlation Coefficient
#1	A15	No. of Claims	0.274443	0.335094
#2	C18	$Amount	-5.58E-02	-3.34E-02
#3	A15	No. of Claims	0	2.74E-02
#4	C18	$Amount / 1930-34	0	-2.37E-02
#5	D18	$Amount / 1935-39	0	5.11E-02
#6	E18	$Amount / 1940-44	0	-4.99E-02
#7	F18	$Amount / 1945-49	0	0.751139
#8	G18	$Amount / 1950-54	0	9.41E-03
#9	H18	$Amount / 1955-59	0	
#10	I18	$Amount / 1960-64	0	
#11	J18	$Amount / 1965-69	0	
#12	K18	$Amount / 1970-74	0	
#13	L18	$Amount / 1975-79	0	
#14	M18	$Amount / 1980-84	0	
#15	N18	$Amount / 1985-89	0	
#16	O18	$Amount / 1990-94	0	-5.38E-02
#17	P18	$Amount / 1995-99	0	-3.15E-02

#18	C20	1930-34	0	9.51E-02
#19	D20	1935-39	0	6.01E-02
#20	E20	1940-44	0	0.18744
#21	F20	1945-49	0	
#22	G20	1950-54	0	0.14874
#23	H20	1955-59	0	
#24	I20	1960-64	0	
#25	J20	1965-69	0	
#26	K20	1970-74	0	
#27	L20	1975-79	0	
#28	M20	1980-84	0	
#29	N20	1985-89	0	
#30	O20	1990-94	0	

<u>Simulation Sensitivities for Steel Vessels' Average Claims Amount</u>

Rank	Cell	Name	Sensitivity (RSqr=0.1031031)	Rank Correlation Coefficient
#1	A15	No. of Claims	0.314278	0.363708
#2	C18	$Amount	-6.04E-02	2.23E-02
#3	A15	No. of Claims	0	1.46E-03
#4	C18	$Amount / 1930-34	0	4.55E-02
#5	D18	$Amount / 1935-39	0	2.20E-02
#6	E18	$Amount / 1940-44	0	5.99E-02
#7	F18	$Amount / 1945-49	0	0.957705
#8	G18	$Amount / 1950-54	0	-5.85E-03

#9	H18	$Amount / 1955-59	0	0
#10	I18	$Amount / 1960-64	0	0
#11	J18	$Amount / 1965-69	0	0
#12	K18	$Amount / 1970-74	0	0
#13	L18	$Amount / 1975-79	0	0
#14	M18	$Amount / 1980-84	0	0
#15	N18	$Amount / 1985-89	0	0
#16	O18	$Amount / 1990-94	0	3.91E-02
#17	P18	$Amount / 1995-99	0	2.13E-03
#18	C20	1930-34	0	-7.29E-02
#19	D20	1935-39	0	-1.92E-03
#20	E20	1940-44	0	-0.15336
#21	F20	1945-49	0	0
#22	G20	1950-54	0	8.35E-02
#23	H20	1955-59	0	0
#24	I20	1960-64	0	0
#25	J20	1965-69	0	0
#26	K20	1970-74	0	0
#27	L20	1975-79	0	0
#28	M20	1980-84	0	0
#29	N20	1985-89	0	0
#30	O20	1990-94	0	0

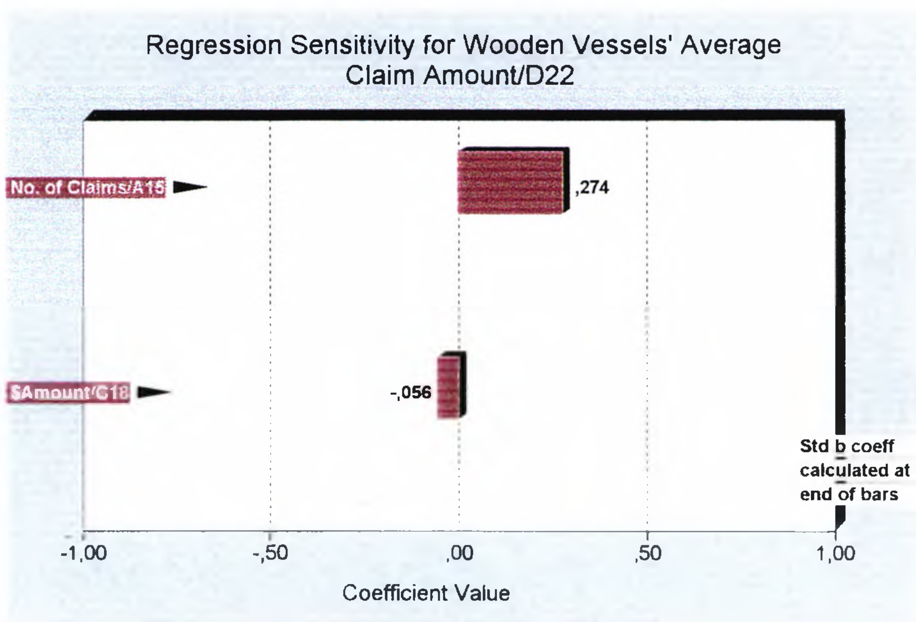
Simulation Sensitivities for Fibreglass Vessels' Average Claims Amount

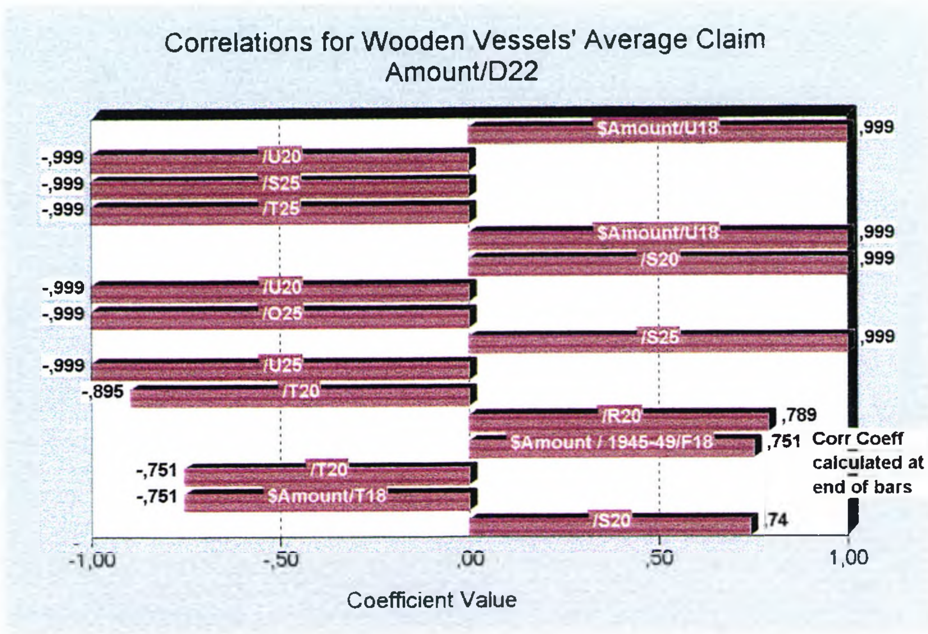
Rank	Cell	Name	Sensitivity (RSqr=4.498378E-02)	Rank Correlation Coefficient
#1	C18	$Amount	0.192847	-0.14151
#2	C18	$Amount	8.68E-02	6.59E-02
#3	A15	No. of Claims	0	-4.33E-02
#4	C18	$Amount / 1930-34	0	-4.96E-02
#5	D18	$Amount / 1935-39	0	-0.05295
#6	E18	$Amount / 1940-44	0	-5.79E-02
#7	F18	$Amount / 1945-49	0	0.248523
#8	G18	$Amount / 1950-54	0	4.02E-02
#9	H18	$Amount / 1955-59	0	0
#10	I18	$Amount / 1960-64	0	0
#11	J18	$Amount / 1965-69	0	0
#12	K18	$Amount / 1970-74	0	0
#13	L18	$Amount / 1975-79	0	0
#14	M18	$Amount / 1980-84	0	0
#15	N18	$Amount / 1985-89	0	0
#16	O18	$Amount / 1990-94	0	-0.31128
#17	P18	$Amount / 1995-99	0	5.22E-02
#18	C20	1930-34	0	4.10E-02
#19	D20	1935-39	0	-6.12E-03
#20	E20	1940-44	0	-0.10438
#21	F20	1945-49	0	0
#22	G20	1950-54	0	5.40E-02

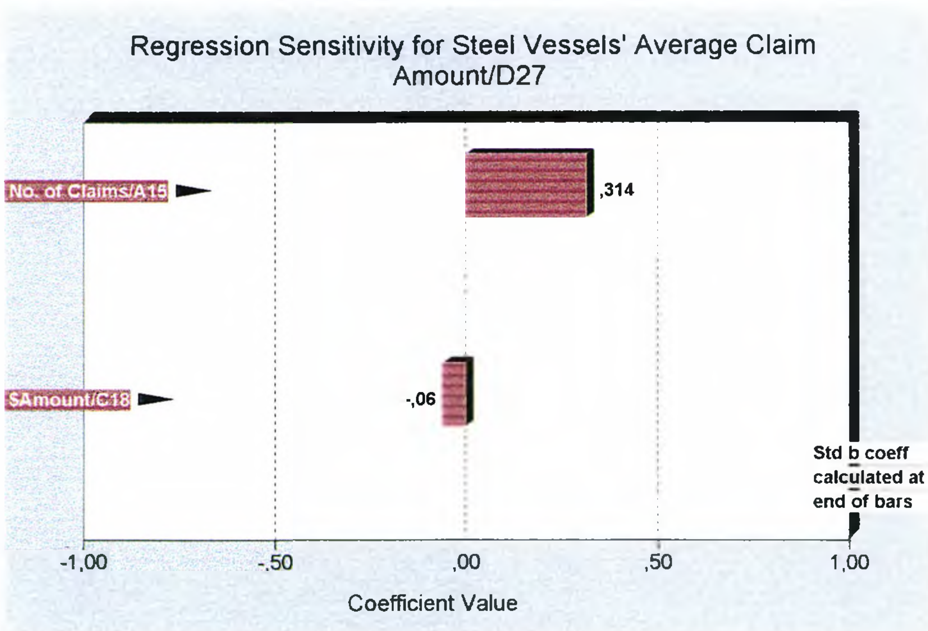
#23	H20	1955-59	0
#24	I20	1960-64	0
#25	J20	1965-69	0
#26	K20	1970-74	0
#27	L20	1975-79	0
#28	M20	1980-84	0
#29	N20	1985-89	0
#30	O20	1990-94	0

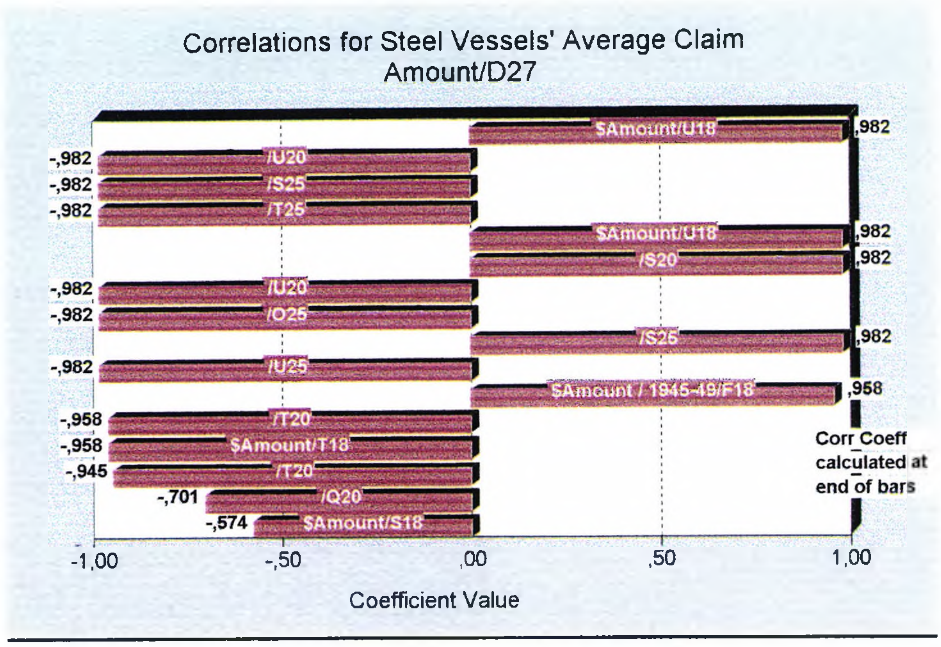
As shown in Table 6.3 the number of claims was the most important factor. This is reflected graphically in the Graph 6.4 that follows:

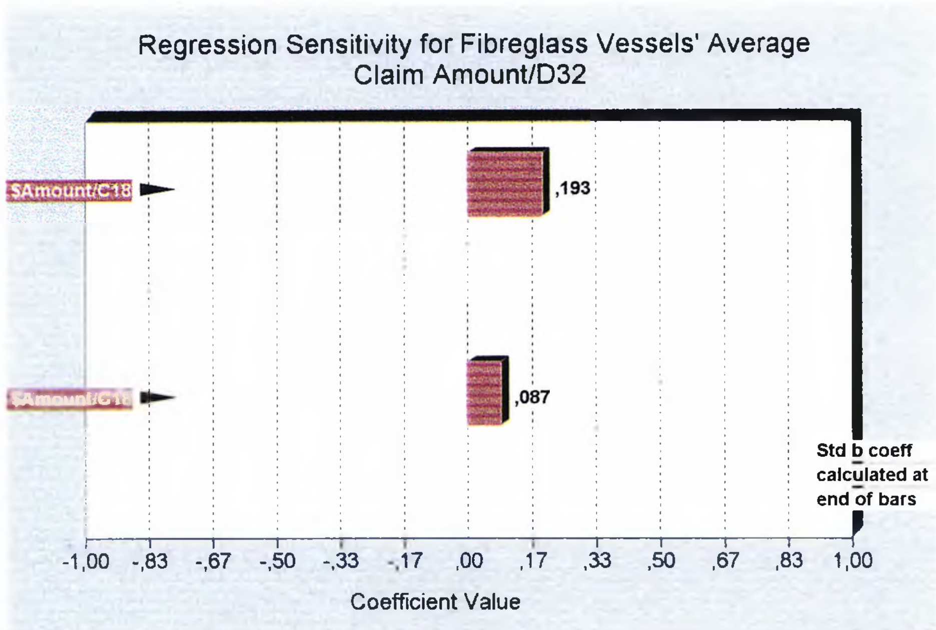
Graph 6.4 – Tornado Graphs




Correlations for Wooden Vessels' Average Claim Amount/D22
$Amount/U18 ,999
-,999 /U20
-,999 /S25
-,999 /T25
$Amount/U18 ,999
/S20 ,999
-,999 /U20
-,999 /O25
/S25 ,999
-,999 /U25
-,895 /T20
/R20 ,789
$Amount / 1945-49/F18 ,751
Corr Coeff calculated at end of bars
-,751 /T20
-,751 $Amount/T18
/S20 ,74
-1,00
-,50
,00
,50
1,00
Coefficient Value


Regression Sensitivity for Steel Vessels' Average Claim Amount/D27
No. of Claims/A15 ,314
$Amount/C18 -,06
Std b coeff calculated at end of bars
-1,00
-,50
,00
,50
1,00
Coefficient Value


Correlations for Steel Vessels' Average Claim Amount/D27
$Amount/U18 ,982
-,982 /U20
-,982 /S25
-,982 /T25
$Amount/U18 ,982
/S20 ,982
-,982 /U20
-,982 /O25
/S25 ,982
-,982 /U25
$Amount / 1945-49/F18 ,958
-,958 /T20
-,958 $Amount/T18
-,945 /T20
-,701 /Q20
-,574 $Amount/S18
Corr Coeff calculated at end of bars
-1,00 -,50 ,00 ,50 1,00
Coefficient Value


Regression Sensitivity for Fibreglass Vessels' Average Claim Amount/D32
$Amount/C18
,193
,087
Std b coeff calculated at end of bars
-1,00 -,83 -,67 -,50 -,33 -,17 ,00 ,17 ,33 ,50 ,67 ,83 1,00
Coefficient Value

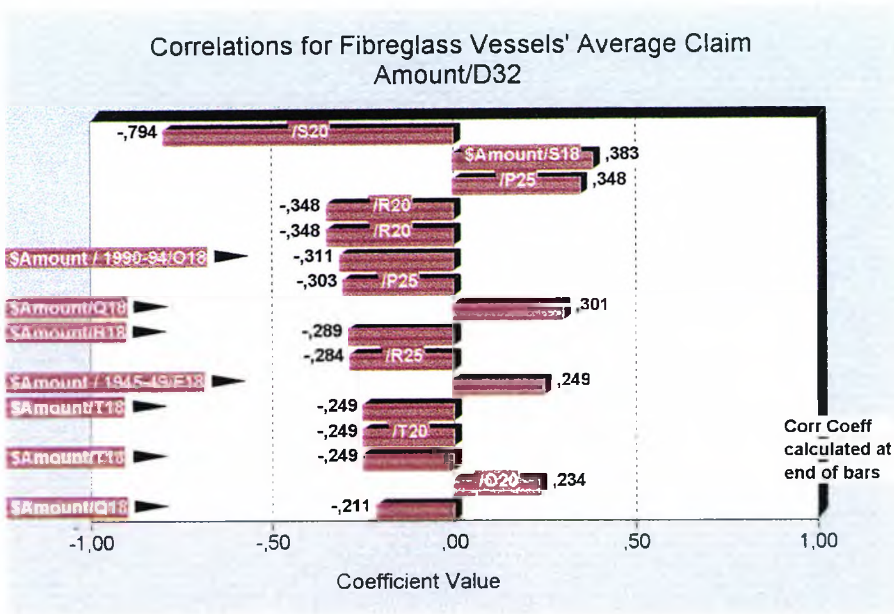


Table 6.8 - Scenarios

Output	Cell	Name	Target	Percentile	Actual	Ratio Median to Std. Deviation
Wooden	F18	$Amount	#1	100.00%	917,742.50	2.029347
Wooden	A15	No. of Claims	#1	74.60%	10.00	0.678374
Wooden	U18	$Amount	#1	100.00%	52,430.07	1.414214
Wooden	R20		#1	80.00%	312,213.70	0.885492
Wooden	D30		#1	80.86%	222,965.30	0.751139
Wooden	R20		#1	100.00%	64,289.79	2.244467
Wooden	R25		#1	28.57%	42.33	-0.516220
Wooden	U18	$Amount	#2	100.00%	364,482.30	1.414214
Wooden	S20		#2	100.00%	2,889.80	1.414214
Wooden	O25		#2	100.00%	106,452.90	1.414214
Wooden	S25		#2	100.00%	626,896.50	1.414214

Wooden	A15	No. of Claims	#3	74.60%	10.00	0.678374
Wooden	U18	$Amount	#3	100.00%	52,430.07	1.414214
Wooden	R20		#3	80.00%	312,213.70	0.885492
Wooden	E25		#3	81.82%	138,471.40	0.558182
Wooden	R18	$Amount	#3	93.75%	122,253.10	0.957768
Steel	A15	No. of Claims	#1	74.60%	10.00	0.678374
Steel	U18	$Amount	#1	100.00%	52,430.07	1.414214
Steel	R25		#1	70.00%	118,909.70	0.543048
Steel	S25		#1	100.00%	12,375.37	1.414214
Steel	N18	$Amount	#2	79.39%	189,118.50	0.684829
Steel	T18	$Amount	#2	100.00%	347,628.70	2.023755
Steel	T25		#2	100.00%	151003.00	1.414214
Steel	O25		#2	100.00%	106,452.90	1.414214
Steel	Q25		#2	67.66%	86,064.39	0.750533
Steel	R20		#2	80.00%	312,213.70	0.885492
Steel	U20		#2	100.00%	41,802.47	1.414214
Steel	O25		#2	100.00%	106,452.90	1.414214
Steel	R25		#2	14.29%	1.77	-0.519520
Steel	U25		#2	100.00	2.34	1.414214
Steel	C18	$Amount	#3	84.77%	193,341.00	0.831692
Steel	P18	$Amount	#3	80.19%	144,626.10	0.672919
Steel	C30		#3	86.26%	277,982.60	1.269631
Steel	D30		#3	78.05%	213,754.10	0.718368
Steel	R18	$Amount	#3	93.75%	122,253.10	0.957768

Steel	P20		#3	88.24%	167,095.10	1.473184
Fibreglass	C30		#1	80.10%	175,721.30	0.781768
Fibreglass	D30		#1	78.05%	213,754.10	0.718368
Fibreglass	U18	$Amount	#1	100.00%	364,482.30	1.414214
Fibreglass	S20		#1	100.00%	2,889.80	1.414214
Fibreglass	T20		#1	100.00%	86,659.27	1.732051
Fibreglass	S25		#1	100.00%	626,896.50	1.414214
Fibreglass	A15	No. of Claims	#2	74.60%	10.00	0.678374
Fibreglass	U18		#2	100.00%	52,430.07	1.414214
Fibreglass	P20		#2	100.00%	74,850.35	2.814533
Fibreglass	R20		#2	80.00%	312,213.70	0.885492
Fibreglass	D30		#2	76.09%	153,628.30	0.504459

6.8 Setting up the @RISK Model for vessels operating in West / East Africa

We used the same pattern for the vessels operating in West / East Africa as shown in sections 6.2 and 6.6. We only took into consideration the data for the vessels operating in these areas. The way the @RISK model was formed is shown on the following Table 6.9:

Table 6.9 – Modeling an uncertain number of events, each with uncertain parameters for the vessels operating in West / East Africa

No. of Claims
8

Claim#	*$Amount*	
1	$100 600	$76 029,45 $100 600
2	$100 600	$146 835,30 $146 835
3	$100 600	$3 220,00 $100 600
4	$100 600	$2 976,52 $100 600
5	$100 600	$102 485,95 $102 486
6	$100 600	$101 513,45 $101 513
7	$100 600	$185 504,18 $185 504
8	$100 600	$64 562,94 $100 600
9	$0	$4 497,84 $4 498
10	$0	$56 654,50 $56 655
11	$0	$113 850,00 $113 850
12	$0	$618 969,36 $618 969
13	$0	$15 789,69 $15 790
14	$0	$15 789,69 $15 790
15	$0	$9 611,42 $9 611
16	$0	$60 437,16 $60 437
17	$0	$877 776,71 $877 777
18	$0	$877 776,71 $877 777
19	$0	$20 350,00 $20 350
20	$0	$20 350,00 $20 350
21	$0	$156 087,52 $156 088
22	$0	$1 330 014,00 $1 330 014
23	$0	$858 600,00 $858 600
24	$0	$1 156,94 $1 157
25	$0	$378 670,54 $378 671
26	$0	$231 472,59 $231 473
27	$0	$189 456,69 $189 457
28	$0	$243 108,08 $243 108
29	$0	$46 606,81 $46 607
30	$0	$406 977,27 $406 977
31	$0	$78 665,77 $78 666
32	$0	$1 914 545,90 $1 914 546
33	$0	$156 850,90 $156 851
34	$0	$91 219,16 $91 219
35	$0	
36	$0	
37	$0	
38	$0	
39	$0	

$53 174,91
$100 600

Wooden Vessels' Average Claim Amount: $100 600

Steel Vessels' Average Claim Amount: $285 707

$24 990,00
$100 600

Fibreglass Vessels' Average Claim Amount: $100 600

6.9 Simulation Results

We followed the same methodology as shown in both sections 6.2 and 6.6. The results obtained are shown in both sub-sections 6.9.1 and 6.9.2:

6.9.1 Statistical results

The results obtained are shown on Table 6.10:

Table 6.10 – Detail statistics for the various types of vessels operating in West / East Africa

	Wooden Vessels Average Claim Amount Output	Steel Vessels Average Claim Amount	Fibreglass Vessels Average Claim Amount
Minimum	1.98E-06	256,065.000	3.28E-06
Maximum	1,152,719.000	400,071.700	2,204,674.000
Mean	68,008.950	283,154.400	53,968.190
Standard Deviation	113,015.000	13,070.110	152,629.800
Variance	12,772,380,000.000	170,827,700.000	23,295,860,000.000
Skewness	5.491362	2.971754	7.743478
Kurtosis	37.763010	16.519200	79.606640
Mode	53,174.910	278,188.600	24,990.000
5% Percentile	22.083	272,113.800	10.410
10% Percentile	516.961	273,811.500	285.557
15% Percentile	5,745.265	274,920.300	2,749.314
20% Percentile	36,288.800	275,490.400	10,365.540

25% Percentile	53,174.910	276,096.600	24,990.000
30% Percentile	53,174.910	276,877.600	24,990.000
35% Percentile	53,174.910	277,989.700	24,990.000
40% Percentile	53,174.910	278,108.500	24,990.000
45% Percentile	53,174.910	278,188.600	24,990.000
50% Percentile	53,174.910	278,517.900	24,990.000
55% Percentile	53,174.910	279,173.800	24,990.000
60% Percentile	53,174.910	280,304.600	24,990.000
65% Percentile	53,174.910	281,493.000	24,990.000
70% Percentile	53,174.910	283,510.100	24,990.000
75% Percentile	53,174.910	285,687.400	24,990.000
80% Percentile	53,174.910	288,382.300	24,990.000
85% Percentile	53,174.910	291,741.300	32,831,320
90% Percentile	53,174.910	297,949.700	79,770.340
95% Percentile	206,312.700	308,832.900	208,546.500

To explain the statistical information given by @RISK we obtain the following:

6.9.1.1 Expected / Mean Result:

The average claim for wooden vessels was estimated to be US$68,008.95, for steel vessels US$283,154.40 and for fiberglass vessels US$53,968.19. The result follows the same pattern as shown both in Table 5.18 and Graph 5.16 in as far as that the combined steel and fiberglass vessels operating in Mediterranean Sea are much riskier than wooden vessels operating in the same area.

6.9.1.2 Maximum Result:

The largest claim was estimated to be US$1,152,719.00 for wooden vessels, US$400,071.70 for steel and US$2,204,674.00 for fiberglass.

6.9.1.3 Minimum Result:

For the average claim the minimum amount was only US$1.98E-06 for wooden, US$256,065.00 for steel and US$3.28E-06 for fiberglass vessels.

6.9.1.4 Standard Deviation:

For the three types of vessels the sample standard deviation was 113,015.00 – 13,070.11 – 152,629.80 respectively. The wooden vessels have lower standard deviation than combined steel and fibreglass vessels. This fact together with the result on the mean claim figures makes the wooden vessels a better risk.

6.9.1.5 Skewness:

All distributions shown above are positively skewed with the fibreglass vessels to have the longest positive tail extending to the right.

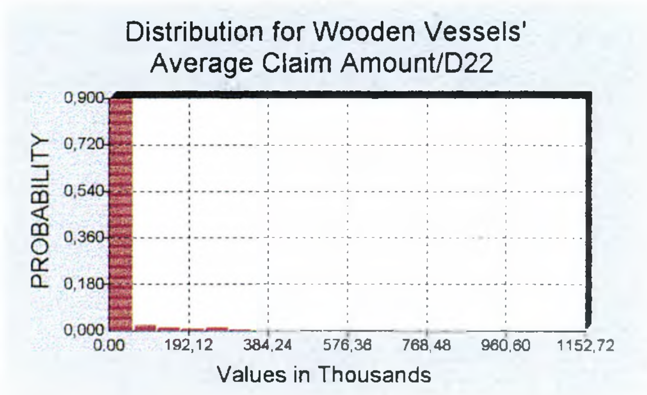
6.9.1.6 Percentile probabilities:

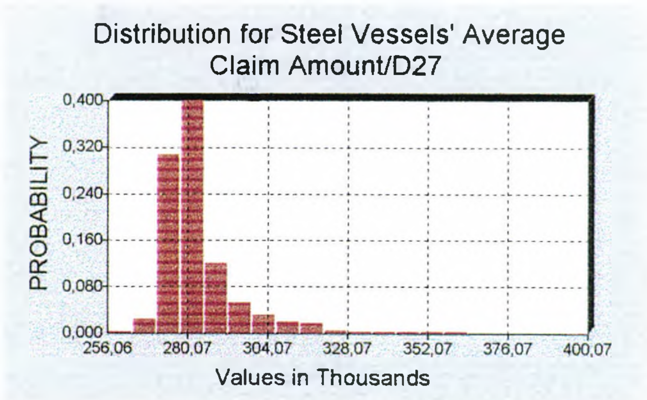
For a continuous random variable, such as average claim amount, percentile probability tells us, for example that for wooden vessels there is at exactly 95% probability that the average claim will be approximately US$206,312.70 or less.

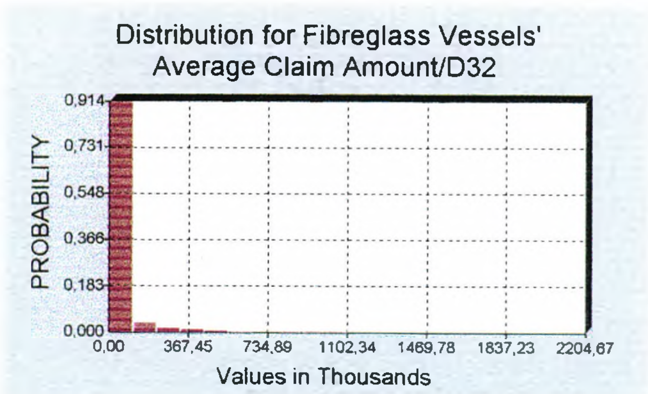
6.9.2 Summary Graph

The summary graphs for the three different types of construction are shown in Graph 6.5 that follows:

Graph 6.5 Summary Graph







6.10 Sensitivity Analysis with Scenarios

Table 6.11 shows the simulation sensitivities for the total claims of the various types of construction, whilst Table 6.12 shows the different scenarios:

Table 6.11 – Simulation Sensitivities

Simulation Sensitivities for Wooden Vessels' Average Claims Amount

Rank	Cell	Name	Sensitivity (RSqr=2.478824E-02)	Rank Correlation Coefficient
#1	C18	$Amount	0.14325	-0.28798
#2	P18	$Amount / 1995-99	6.04E-02	-1.58E-02
#3	A15	No. of Claims	0	-1.33E-02
#4	C18	$Amount / 1930-34	0	-3.16E-03
#5	D18	$Amount / 1935-39	0	0.034659
#6	E18	$Amount / 1940-44	0	4.29E-02
#7	F18	$Amount / 1945-49	0	-0.80894
#8	G18	$Amount / 1950-54	0	-3.88E-03
#9	H18	$Amount / 1955-59	0	0
#10	I18	$Amount / 1960-64	0	0
#11	J18	$Amount / 1965-69	0	0
#12	K18	$Amount / 1970-74	0	0
#13	L18	$Amount / 1975-79	0	0
#14	M18	$Amount / 1980-84	0	0
#15	N18	$Amount / 1985-89	0	0.82165
#16	O18	$Amount / 1990-94	0	-0.24237
#17	C20	1930-34	0	3.49E-04

#18	D20	1935-39	0	-0.10946
#19	E20	1940-44	0	0.126747
#20	F20	1945-49	0	0
#21	G20	1950-54	0	-0.22127
#22	H20	1955-59	0	0
#23	I20	1960-64	0	0
#24	J20	1965-69	0	0
#25	K20	1970-74	0	0
#26	L20	1975-79	0	0
#27	M20	1980-84	0	0
#28	N20	1985-89	0	0
#29	O20	1990-94	0	0
#30	P20	1995-99	0	2.60E-02

Simulation Sensitivities for Steel Vessels' Average Claims Amount

Rank	Cell	Name	Sensitivity (RSqr=4.246397E-02)	Rank Correlation Coefficient
#1	A15	No. of Claims	0.178022	9.73E-02
#2	C18	$Amount	7.76E-02	1.41E-02
#3	P20	1995-99	0.070043	3.62E-02
#4	A15	No. of Claims	0	5.52E-02
#5	C18	$Amount / 1930-34	0	-9.52E-03
#6	D18	$Amount / 1935-39	0	-6.78E-02
#7	E18	$Amount / 1940-44	0	0.064249
#8	F18	$Amount / 1945-49	0	-0.60031

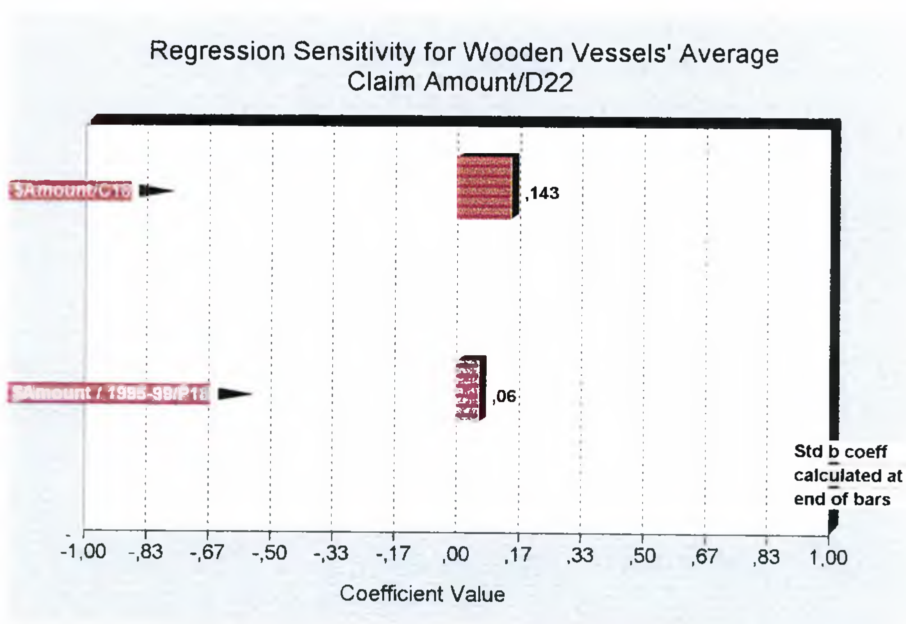
#9	G18	$Amount / 1950-54	0	8.23E-02
#10	H18	$Amount / 1955-59	0	0
#11	I18	$Amount / 1960-64	0	0
#12	J18	$Amount / 1965-69	0	0
#13	K18	$Amount / 1970-74	0	0
#14	L18	$Amount / 1975-79	0	0
#15	M18	$Amount / 1980-84	0	0
#16	N18	$Amount / 1985-89	0	-0.89544
#17	O18	$Amount / 1990-94	0	0.178436
#18	P18	$Amount / 1995-99	0	3.99E-03
#19	C20	1930-34	0	-3.92E-02
#20	D20	1935-39	0	-2.25E-02
#21	E20	1940-44	0	0.154696
#22	F20	1945-49	0	0
#23	G20	1950-54	0	0.173447
#24	H20	1955-59	0	0
#25	I20	1960-64	0	0
#26	J20	1965-69	0	0
#27	K20	1970-74	0	0
#28	L20	1975-79	0	0
#29	M20	1980-84	0	0
#30	N20	1985-89	0	0
#31	O20	1990-94	0	0

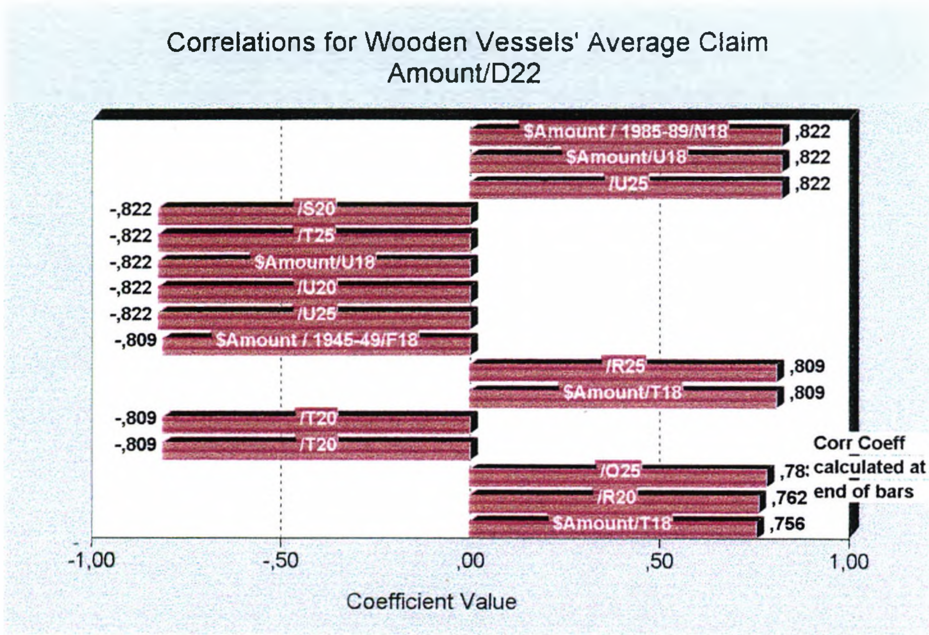
Simulation Sensitivities for Fibreglass Vessels' Average Claims Amount

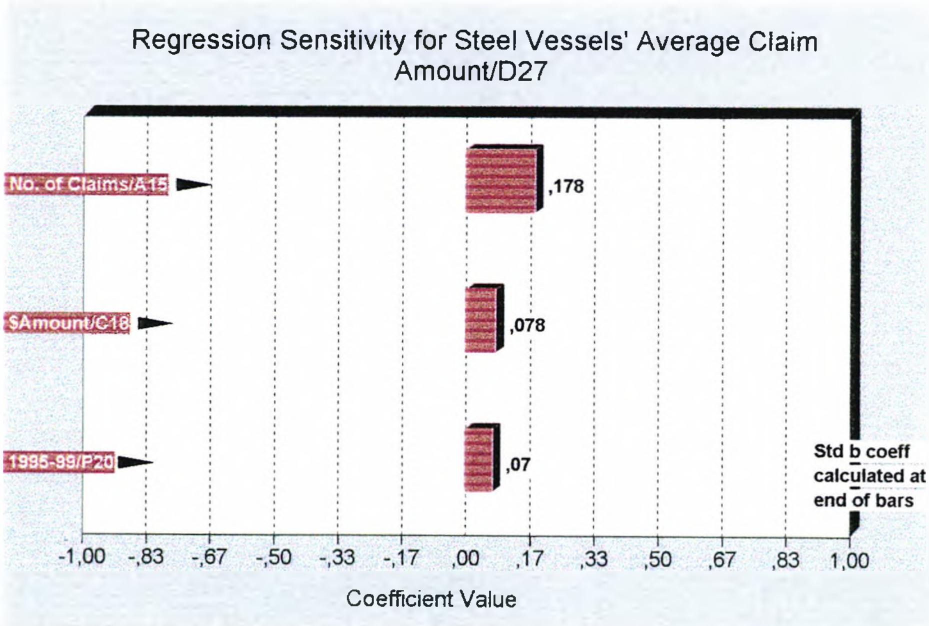
Rank	Cell	Name	Sensitivity (RSqr=2.836882E-02)	Rank Correlation Coefficient
#1	C18	$Amount	0.159597	-0.12695
#2	A15	No. of Claims	5.67E-02	3.05E-02
#3	A15	No. of Claims	0	-5.70E-02
#4	C18	$Amount / 1930-34	0	-1.56E-02
#5	D18	$Amount / 1935-39	0	1.39E-02
#6	E18	$Amount / 1940-44	0	-5.48E-02
#7	F18	$Amount / 1945-49	0	-0.99072
#8	G18	$Amount / 1950-54	0	7.82E-02
#9	H18	$Amount / 1955-59	0	0
#10	I18	$Amount / 1960-64	0	0
#11	J18	$Amount / 1965-69	0	0
#12	K18	$Amount / 1970-74	0	0
#13	L18	$Amount / 1975-79	0	0
#14	M18	$Amount / 1980-84	0	0
#15	N18	$Amount / 1985-89	0	0.774048
#16	O18	$Amount / 1990-94	0	-1.90E-02
#17	P18	$Amount / 1995-99	0	7.25E-03
#18	C20	1930-34	0	-8.81E-02
#19	D20	1935-39	0	-7.48E-03
#20	E20	1940-44	0	-6.72E-03
#21	F20	1945-49	0	0
#22	G20	1950-54	0	-3.72E-02

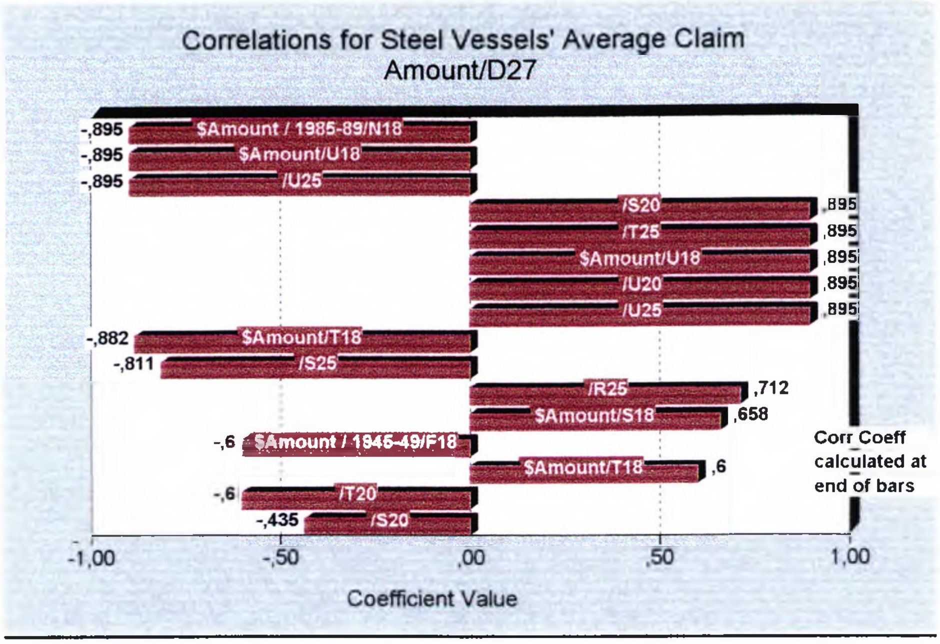
#23	H20	1955-59	0	0
#24	I20	1960-64	0	0
#25	J20	1965-69	0	0
#26	K20	1970-74	0	0
#27	L20	1975-79	0	0
#28	M20	1980-84	0	0
#29	N20	1985-89	0	0
#30	O20	1990-94	0	0

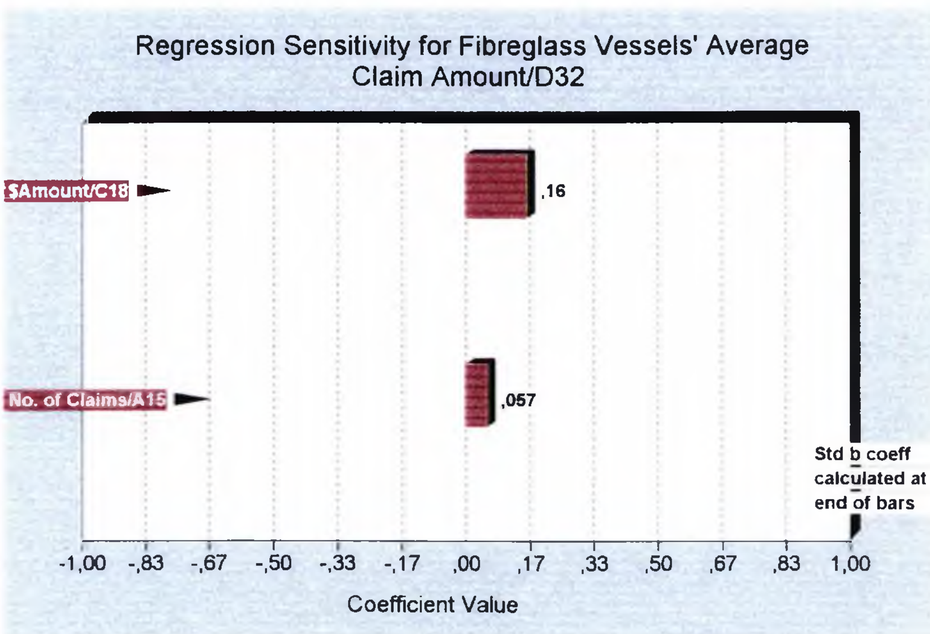
Graph 6.6 – Tornado Graphs




Correlations for Wooden Vessels' Average Claim Amount/D22
$Amount / 1985-89/N18
,822
$Amount/U18
,822
/U25
,822
-,822
/S20
-,822
/T25
-,822
$Amount/U18
-,822
/U20
-,822
/U25
-,809
$Amount / 1945-49/F18
/R25
,809
$Amount/T18
,809
-,809
/T20
-,809
/T20
Corr Coeff calculated at end of bars
/Q25
/R20
,762
$Amount/T18
,756
-1,00
-,50
,00
,50
1,00
Coefficient Value


Regression Sensitivity for Steel Vessels' Average Claim Amount/D27
No. of Claims/A15
,178
$Amount/C18
,078
1995-99/P20
,07
Std b coeff calculated at end of bars
-1,00
-,83
-,67
-,50
-,33
-,17
,00
,17
,33
,50
,67
,83
1,00
Coefficient Value


Correlations for Steel Vessels' Average Claim Amount/D27
-,895
$Amount / 1985-89/N18
-,895
$Amount/U18
-,895
/U25
/S20
,895
/T25
,895
$Amount/U18
,895
/U20
,895
/U25
,895
-,882
$Amount/T18
-,811
/S25
/R25
,712
$Amount/S18
,658
-,6
$Amount / 1945-49/F18
$Amount/T18
,6
-,6
/T20
-,435
/S20
Corr Coeff calculated at end of bars
-1,00
-,50
,00
,50
1,00
Coefficient Value


Regression Sensitivity for Fibreglass Vessels' Average Claim Amount/D32
$Amount/C18
,16
No. of Claims/A15
,057
Std b coeff calculated at end of bars
-1,00
-,83
-,67
-,50
-,33
-,17
,00
,17
,33
,50
,67
,83
1,00
Coefficient Value

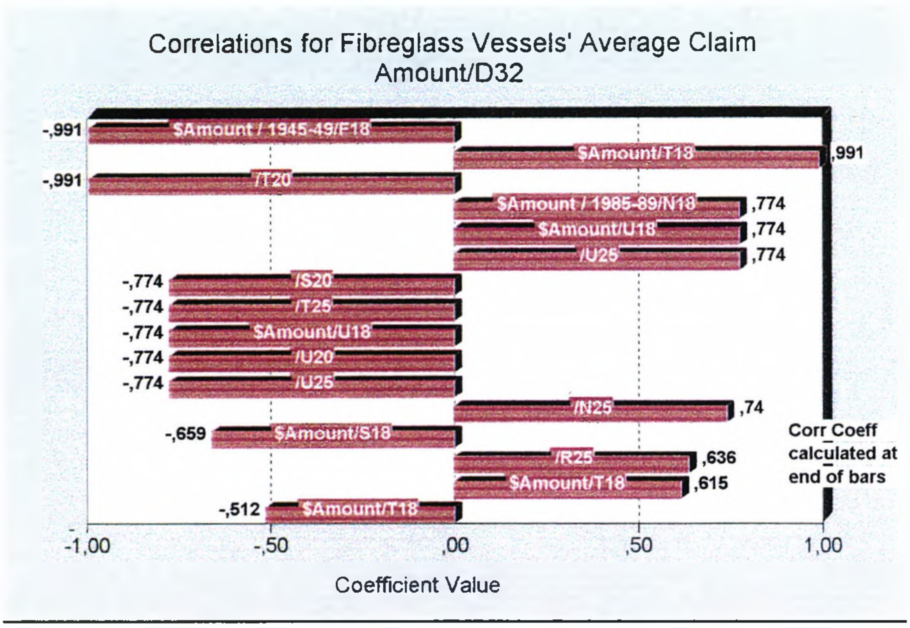


Table 6.12 - Scenarios

Output	Cell	Name	Target	Percentile	Actual	Ratio Median to Std. Deviation
Wooden	N18	$Amount	#1	100.00%	565,217.40	1.414214
Wooden	C20		#1	84.23%	200,967.00	0.977893
Wooden	T25		#1	100.00%	30,652.04	1.414214
Wooden	S20		#2	62.23%	9,503.87	0.793410
Wooden	N18	$Amount	#3	100.00%	565,217.40	1.414214
Wooden	C20		#3	84.23%	200,967.00	0.977893
Wooden	T25		#3	100.00%	30,652.04	1.414213
Steel	F18	$Amount	#1	100.00%	4,642.98	1.690143
Steel	A15	No. of Claims	#1	74.60%	10.00	0.678711
Steel	H25		#1	79.26%	113,371.00	0.564135
Steel	N25		#1	100.00%	1,416,620.00	2.527398

Steel	R20		#1	85.71%	86,534.74	0.611830
Steel	S20		#1	100.00%	8,124.90	1.414214
Steel	T20		#1	100.00%	166,421.00	1.674024
Steel	S20		#1	100.00%	20,977.81	1.797215
Steel	S25		#1	100.00%	537,569.10	2.039910
Steel	S18	$Amount	#2	100.00%	401,326.50	1.766014
Steel	F18	$Amount	#3	100.00%	4,642.98	1.690143
Steel	A15	No. of Claims	#3	74.60%	10.00	0.678711
Steel	S18	$Amount	#3	12.50%	6.68	-0.860850
Steel	F25		#3	82.18%	147,555.90	0.579657
Steel	N25		#3	100.00%	1,416,620.00	2.527398
Steel	O25		#3	79.49%	326,672.10	1.085940
Steel	P20		#3	83.33%	423,630.90	1.825626
Steel	R20		#3	85.71%	86,534.74	0.611830
Steel	S20		#3	100.00%	8,124.90	1.414214
Steel	T20		#3	100.00%	166,421.00	1.674024
Steel	R18	$Amount	#3	87.50%	641,102.60	1.308022
Fibreglass	N18	$Amount	#1	100.00%	565,217.40	1.414214
Fibreglass	S18	$Amount	#2	25.00%	8,206.69	-0.807180
Fibreglass	T25		#2	100.00%	30,652.04	1.414213
Fibreglass	C18	$Amount	#3	79.35%	125,327.70	0.511172
Fibreglass	S18	$Amount	#3	75.00%	218,094.00	0.566654
Fibreglass	R25		#3	100.00%	18,450.06	1.731907
Fibreglass	C30		#3	87.59%	203,368.50	0.821158

Fibreglass	T18	$Amount	#3	100.00%	633,641.40	1.643906
Fibreglass	Q20		#3	76.92%	99,634.45	0.787258
Fibreglass	O25		#3	76.65%	77,348.57	0.620051
Fibreglass	O25		#3	100.00%	208,096.60	2.253594

6.11 Conclusions

Following the above analysis we reach to the conclusions as under:

1. The expected amount of the average claim give us the risk premium income per vessel (see Beard et. al. (1969)[19]). Considering the results in Table 6.2 the risk premium for a wooden vessel is US$33,958.40, for a steel vessel is US$240,054.80 and for a fiberglass vessel is US$224,752.50. It can, therefore, be seen that wooden vessels are safer than steel.
2. If we compare the results from Tables 6.6 and 6.10 we see that both wooden and steel vessels operating in the Mediterranean Sea are safer than the vessels trading in West / East Africa. Hence, the risk premium is shown in Table 6.13 that follows:

Table 6.13 Risk Premium for vessels operating in Mediterranean Sea compared to Risk Premium for vessels operating in West / East Africa (amounts in US$)

	Mediterranean Sea	West / East Africa
Wooden Vessels	32,201.72	68,008.95
Steel Vessels	53,796.45	283,154.90
Fiberglass Vessels	315,728.20	53,968.19

3. The only change in this pattern concerns the fiberglass vessels, whereby the risk premium appears to be higher in the Mediterranean Sea vessels than those

[19] Beard, R.E., Pentikainen, T., Pesonen, E.(1969), *Risk Theory*, London : Methuen

operating in West / East Africa. We shall focus our analysis to both steel and wooden vessels, as these are the majority of the fishing vessels.

4. If we assume a safety loading of, say, 50% then the figures given for the average premium level are fairly reasonable compared to the current level of pricing (especially for both wooden and steel vessels operating in the Mediterranean Sea), while the steel vessels trading in West / East Africa are grossly underpriced. Of course, we take into consideration that the figures in Table 6.13 derive from aggregate claims for a 5-year period. Therefore, in order to obtain more precise figures for risk premium we must divide the figures shown in Table 6.13 by 5 to get the annual risk premium for each type of vessel / trading area. For years the Hull & Machinery etc. Marine insurances of Greek owned / managed fishing vessels were based on the following four (4) different Condition options:

   Conditions 1: Total and / or Constructive Total Loss of vessel only but including Salvage, Salvage Charges, Salvage under contract and Sue and Labour expenses in accordance with Institute Fishing Vessel Clauses 20.7.87 (Cl.346) in so far as they apply, with Clause 13 deleted.

   Conditions 2: Institute Fishing Vessel Clauses 20.7.87 (Cl.346) with Clause 13 deleted, including 4/4ths Collision Liability but free of any claim in respect of partial loss of and / or damage to the vessel unless caused by collision with another ship or vessel, fire, lightning and / or explosion.

   Conditions 3: Institute Fishing Vessel Clauses 20.7.87 (Cl.346) with Clause 13 deleted, including 4/4ths Collision Liability and fixed and floating objects but free of any claim in respect of partial loss of and / or damage to the vessel unless caused by collision and / or contact with all objects (ice included), grounding, stranding and / or striking the ground and / or by fire, lightning, explosion and / or sinking.

Conditions 4: Institute Fishing Vessel Clauses 20.7.87 (Cl.346) with Clause 13 deleted. Including, if required, Institute Additional Perils Clauses – Hulls (For use only with the Institute Fishing Vessel Clauses – Hulls 20.7.87 (Cl.347).

In 1999 London Underwriters were using the following formula for rating Greek fishing vessels (rating was based on above Conditions):

For amendment of Conditions from (1) to (2) a loading of 137.5%.

For amendment of Conditions from (1) to (3) a loading of 158.33%.

For amendment of Conditions from (1) to (4) a loading of 176.95%.

For vessels that were trading in Greek waters a minimum premium between 2 and 2.25% of insured value. A loading of 10% was used for vessels trading in Mediterranean Sea.

For vessels operating off West Africa coast a mean premium of US$125.00 per Gross Tonnage excluding Total Loss.

Finally, the Total Loss Only rate was 60% of the rate for Conditions (4).

5. It therefore, appears that the differential of 10% between Mediterranean vessels and West / East Africa ones is rather modest and it is kept by Underwriters for commercial reasons.
6. Turning now to the question whether reinsurance is required for the portfolio, the answer is simply yes, but not for the entire fleet. We carried out simulation analysis for vessels operating both in Mediterranean Sea and in West / East Africa assuming that no deductible was taken into consideration. The results showed that with the exception of the fiberglass vessels that operate in West / East Africa Sea in all other cases the variance of the average claim was

increased when nil deductible was taken into consideration. This is shown on the following table 6.14:

Table 6.14 Comparing Variances

6.1.a – Variances for vessels operating in Mediterranean Sea

	Existing data (i.e. with deductible)	Net of deductible
Wooden	248,205,000	255,990,400
Steel	623,804,400	727,692,600
Fiberglass	6,529,215,000	6,786,474,000

6.1.b – Variances for vessels operating in West / East Africa

	Existing data (i.e. with deductible)	Net of deductible
Wooden	12,772,380,000	17,890,100,000
Steel	170,827,700	171,607,900
Fiberglass	23,295,860,000	20,901,010,000

Therefore, and as shown in Borch (1990)[20] the optimum reinsurance is chosen when reduction in variance is maximized. For this reason reinsurance is only required for the fiberglass fishing vessels that operate in West / East Africa.

[20] Borch, Karl Henrik, (1990), *Economics of Insurance*, (Advanced Textbook in Economics), Witherby & Co., London, pp. 19-23.

CHAPTER 7 - CONCLUSION

While numbers have fallen, the new boats are bigger and better[21]. And complaints of EU-imposed cuts in boat numbers and fishing quotas ignore the extent to which EU money has actually built up the Spanish fishing fleet, the largest in the EU by far[22]. According to the Commission, some €1.1 billion ($1 billion) of public money subsidizes EU countries' fleets each year. Some comes direct from governments, most from the EU; and over half of that EU money goes to Spain.

According to data supplied by the Agricultural Bank of Greece S.A. we notice that the production in sea fishing is reducing, despite the increase in fishing effort through modern tonnage. The development of production for sea fishing is shown on table 7.1:

Table 7.1 – Development of Production in sea fishing

Year	Tons
1987	142,210
1988	151,650
1989	142,900
1990	147,290
1991	133,955

[21] The Economist, March 30th, 2002

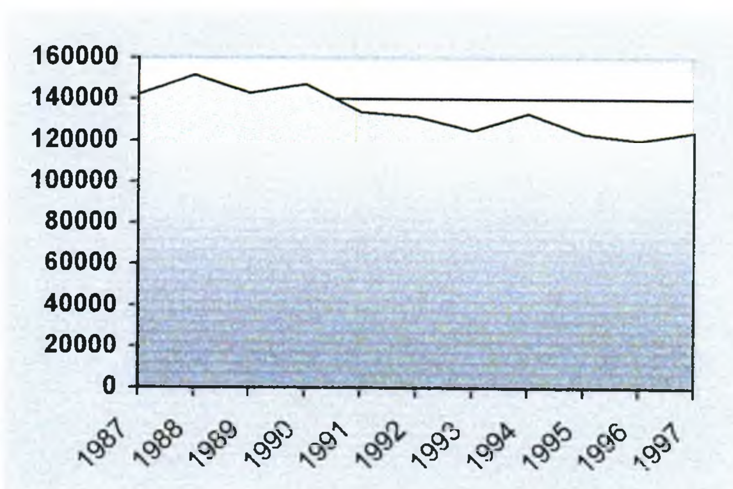
[22] This measurement applies to tonnage only, because in terms of number of vessels the Greek fishing fleet is the largest in the EU.

1992	131,703
1993	125,208
1994	133,268
1995	123,661
1996	120,490
1997	124,640

Source: Eleftherotypia 26/2/2000

Graph 7.1 was derived to show the trend:

Graph 7.1 – Development of Production in sea fishing



The development of the total production for the same years is shown on table 7.2:

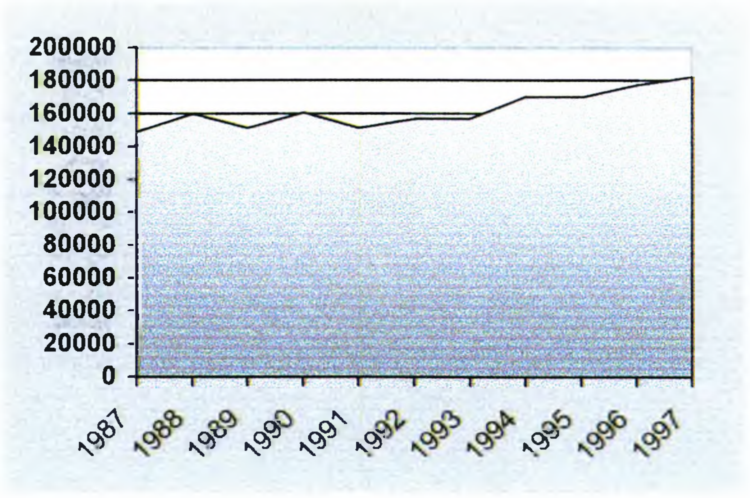
Table 7.2 – Development of the total production in sea fishing

Year	Tons
1987	149,195
1988	159,845
1989	151,260
1990	160,696
1991	151,184
1992	156,636
1993	157,250
1994	170,368
1995	170,076
1996	177,401
1997	182,488

Source: Eleftherotypia 26/2/2000

Graph 7.2 was derived to show the trend:

Graph 7.2 – Development of the total production in sea fishing



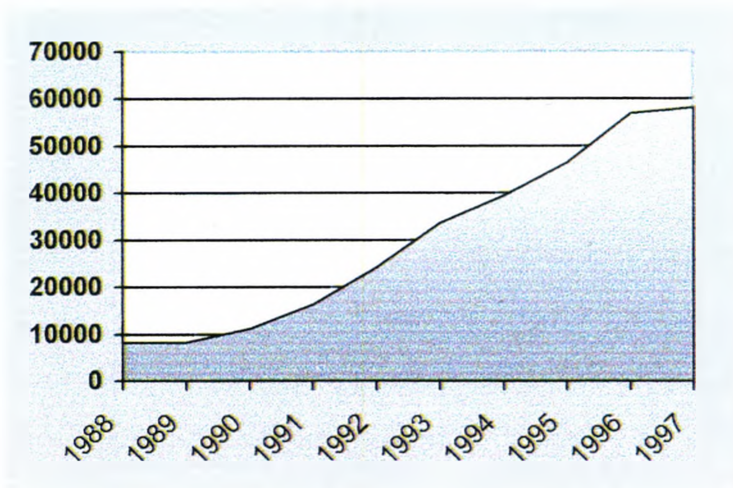
The difference between the two tables (i.e. 7.1 and 7.2) is related to fish farms as well as to fishing in rivers and lakes. In the '90s the annual production per vessel was either stable or showed a slight reduction. On the contrary, the production of both fish farms and that derived from fishing in rivers and lakes noted tremendous increase as shown on the following table 7.3:

Table 7.3 – Production of fishing in fish farms

Year	Tons
1988	8,195
1989	8,360
1990	11,196
1991	16,409
1992	24,253
1993	33,622
1994	39,545
1995	46,415
1996	56,911
1997	58,208

Or in terms of graph presentation as follows in graph 7.3:

Graph 7.3 – Production of fishing in fish farms



Based on data of 1995 year the "michanotrata" type fishing vessels had an average annual production of approximately 92 tons, the "gri-gri" type 106 tons and finally the small coastal fishing vessels 3 tons.

The reduction in production followed by new tax regulations for fishermen lead to unpleasant situations of port blockades, strikes etc. An article published on 16/1/1998 in Athens News reads as follows:

"*Striking fishermen and sponge divers blocked off island and mainland ports yesterday in protest against the new tax regulations which fishermen say will force them to install cash registers in their boats and keep accounts.*

"The harbour will remain closed until the ministers realize that they are making a mistake and allow us to be taxed like farmers", said a fisherman protesting at the Cretan port of Iraklio.

Prior to the new tax regulations, fishermen were exempted from paying value-added tax (VAT) on their catch. Fishermen argue that the new measures will bring them economic *hardship since they will have to pay an estimated one to two million drachmas a year in additional taxes, an amount they cannot afford.*

"Ministers and the government know nothing about the life of a seaman, despite the fact that this country has hundreds of boats. Are they trying to destroy us financially?" another fisherman complained.

An additional problem voiced by the protesters is that the cash registers they are expected to install in their boats will not take up too much space but will constantly break down.

"My boat is too small for a cash register and there is far too much humidity here. Even the instruments break down", said one man at the Iraklio blockade.

The Iraklio port entrance, blocked from 8pm on Wednesday night by angry fishermen, was briefly opened yesterday morning to allow two ships carrying 560 passengers from Piraeus to dock. But a research boat belonging to the Institute of Marine Biology in Crete was not so fortunate as fishermen manoeuvred their boats in front of the vessels to block its path.

The fishermen threatened to extend the protest to the rest of the island, blocking access to the ports of Hania and Rethymno.

Protesters also undertook action at harbours on the islands of Kalymons, Leros, Patmos and the mainland harbours of Patras and Piraeus.

The demonstrations coincided with a 24-hour seamen's strike, spelling havoc for hundreds of ship passengers yesterday.

A Leros resident, A.Tsakimos, who contacted the Athens News saying he was concerned by the new tax measure, argued that the island's economy does not solely depend on tourism but also on a strong fishing trade.

"It saddens me that the life of so many fishermen will be permanently altered by the new taxes... Already, traditional island life has all but disappeared – don't we have the right to protect our traditions?" he said."

7.1 The Future

The most recent Commission's proposals over a reform of the Common Fisheries Policy are presented on Memo 02/111 issued on 28th May 2002 in Brussels. Details of this report are shown on the Appendix "E".

The results of Chapter 6 prove that wooden fishing vessels are safer than steel trawlers, also that the vessels which operate within Greek waters are less risky than those operating off West / East Africa. The above can also be explained as the smaller vessels are still run by family-based operations, where the father may be the skipper of the vessel and his two sons could be the engineer and the fishing master. This traditional way of operation is inherited from generation to generation. The situation may be different with larger vessels as they remain for 30- 40 days at sea and they discharge catch either in reefers or in containers. The estimated claim severity for each policy of steel trawlers, i.e. exp (-1.45920) = 0.232422 for those operating in Med Sea compared with exp (-0.2544) = 0.775382 for those operating off West / East Africa in accordance with the relatively low pure premium calculations carried out in Chapter 5 indicate that the premium levels for vessels operating in Greek waters must be kept low.

The optimum deductible findings in Chapter 4 indicate that perhaps Underwriters might wish to re-consider the levels of deductibles. Perhaps the above measures might reduce the number of vessels that remain self-insured and increase the premium income, despite the adverse market conditions.

After all the recent deal at the Johannesburg World Summit on Sustainable Development to restore most of the major global fisheries to commercial health by 2015 is also a positive move. The deal will entail reducing catches to a level where the maximum sustainable yield can be taken indefinitely. The over-fishing problem is huge. The UN says more than 25% of the world's fisheries are over-exploited, 50% are being fished to their full capacity and 75% need immediate action to freeze or reduce fishing to ensure fishing supplies. Another section of the agreement provides for the establishment of marine protected areas across the planet by 2012, something which should give many endangered marine species a better chance of recovery.

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APPENDIX "A" – Institute Fishing Vessel Clauses

1/5/71

So far as they apply

INSTITUTE FISHING VESSEL CLAUSES

Navigation.

1. (*a*) The Vessel is covered subject to the provisions of this Policy at all times and has leave to sail or navigate with or without pilots, to go on trial trips and to assist and tow vessels or craft in distress, but it is warranted that the Vessel shall not be towed, except as is customary or when in need of assistance, or undertake towage or salvage services under a contract previously arranged by the Assured and/or Owners and/or Managers and/or Charterers. This clause shall not exclude customary towage in connection with loading and discharging.

Removals Ashore.

(*b*) Any part or parts of the subject matter insured are covered subject to the provisions of this Policy whilst ashore for the purpose of repair, overhaul or refitting, including transit from and to the Vessel.

Continuation.

2. Should the Vessel at the expiration of this Policy be at sea or in distress or at a port of refuge or of call, she shall, provided previous notice be given to the Underwriters, be held covered at a pro rata monthly premium to her port of destination.

Breach of Warranty.

3. Held covered in case of any breach of warranty as to cargo, trade, locality, towage, salvage services or date of sailing, provided notice be given to the Underwriters immediately after receipt of advices and any amended terms of cover and any additional premium required by them be agreed.

Additional Damage.

4. This insurance includes loss of or damage to the subject matter insured directly caused by:—

Accidents in loading discharging or shifting catch cargo fuel or stores
Explosions on shipboard or elsewhere
Breakdown of or accident to nuclear installations or reactors on shipboard or elsewhere
Bursting of boilers breakage of shafts or any latent defect in the machinery or hull
Negligence of Master Officers Crew or Pilots
Negligence of repairers
Contact with aircraft
Contact with any land conveyance, dock or harbour equipment or installation
Earthquake, volcanic eruption or lightning

provided such loss or damage has not resulted from want of due diligence by the Assured, Owners or Managers.

Masters Officers Crew or Pilots not to be considered as part Owners within the meaning of this clause should they hold shares in the Vessel.

Machinery Co-insurance.

5. In the event of a claim for loss of or damage to any boiler, shaft, machinery or associated equipment, arising from any of the causes enumerated in Clause 4, attributable in part or in whole to negligence of Master Officers or Crew and recoverable under this insurance only by reason of Clause 4, then the Assured shall, in addition to the deductible, also bear in respect of each accident or occurrence an amount equal to 10% of the balance of such claim. This clause shall not apply to a claim for total or constructive total loss of the Vessel.

General Average and Salvage.

6. Any claim for general average and salvage to be on the basis of an adjustment according to York-Antwerp Rules if so required by the Underwriters but the insured value of Hull and Machinery to be taken as the contributory value without deduction.

Wages and Maintenance.

7. The Underwriters to pay the cost of wages and maintenance of members of crew necessarily retained whilst the Vessel is undergoing repairs for which the Underwriters are liable under this Policy.

Salvage Expenses.

8. Where a claim for total loss of the Vessel is admitted under this Policy and expenses have been reasonably incurred in salving or attempting to salve the Vessel and other property and there are no proceeds, or the expenses exceed the proceeds, then the Underwriters shall pay the expenses, or the expenses in excess of the proceeds, as the case may be.

Average No Thirds.

9. Average payable without deduction new for old, whether the average be particular or general.

Deductible.

10. No claim arising from a peril insured against shall be payable under this insurance unless the aggregate of all such claims arising out of each separate accident or occurrence (including claims under the Suing and Labouring Clause and under Clauses 16, 17, 18 and 19 of these clauses) exceeds.............................. in which case this sum shall be deducted. Nevertheless the expense of sighting the bottom after stranding, if reasonably incurred specially for that purpose, shall be paid even if no damage be found. This paragraph shall not apply to a claim for total or constructive total loss of the Vessel.

Excluding any interest comprised therein, recoveries against any claim which is subject to the above deductible shall be credited to the Underwriters in full to the extent of the sum by which the aggregate of the claim unreduced by any recoveries exceeds the above deductible.

Interest comprised in recoveries shall be apportioned between the Assured and the Underwriters, taking into account the sums paid by Underwriters and the dates when such payments were made, notwithstanding that by the addition of interest the Underwriters may receive a larger sum than they have paid.

Painting Bottom.

11. No claim shall in any case be allowed in respect of scraping or painting the Vessel's bottom.

Fishing Gear.

12. No claim to attach hereto for loss of or damage to fishing gear during and as a result of fishing operations.

Unrepaired Damage.

13. In no case shall the Underwriters be liable for unrepaired damage in addition to a subsequent total loss sustained during the period covered by this Policy or any extension thereof under Clause 2.

Constructive Total Loss.

14. In ascertaining whether the Vessel is a constructive total loss the insured value shall be taken as the repaired value and nothing in respect of the damaged or break-up value of the Vessel or wreck shall be taken into account.

No claim for constructive total loss based upon the cost of recovery and/or

(*c*) Loss of or damage to any harbour, dock (graving or otherwise), slipway, way, gridiron, pontoon, pier, quay, jetty, stage, buoy, telegraph cable or other fixed or moveable thing whatsoever (not being the Vessel hereby insured),

(*d*) Any attempted or actual raising, removal, or destruction of the wreck of the Vessel hereby insured, or the cargo, catch or fishing gear thereof, or any neglect or failure to raise, remove or destroy the same,

(*e*) Loss of life, personal injury, illness or life salvage,

(ii) shall pay any sum or sums consequent upon any event or happening during the period covered by this Policy but not specified in (i) above, and which would be recoverable absolutely or conditionally under that part, described as "Protection Clause", of the standard terms of entry of the United Kingdom Trawlers Mutual Insurance Company Limited in force at the inception of this Policy,

the Underwriters will pay the Assured such proportion of such sum or sums so paid, or which may be required to indemnify the Assured for such loss, as their respective subscriptions hereto bear to the insured value of the Vessel hereby insured, provided always that their liability under this clause, together with any liability there may be under Clause 19, in respect of any one accident or series of accidents arising out of the same event or happening, shall not exceed their proportionate part of the insured value of the Vessel hereby insured, and in cases in which, with the prior consent in writing of the Underwriters, the liability of the Assured has been contested or proceedings have been taken to limit liability, they will also pay a like proportion of the costs which the Assured shall thereby incur or be compelled to pay.

Removal of Wreck from own Premises.

19. This insurance also to pay the expenses, after deduction of the proceeds of the salvage, not recoverable under Clause 18, of the removal of the wreck of the Vessel hereby insured, or the cargo, catch or fishing gear thereof, from any place owned, leased or occupied by the Assured. Underwriters' liability under this clause is subject to the limitations in amount provided in Clause 18. The provisions of that clause regarding the payment of legal costs shall also apply hereto.

Protection and Indemnity Exclusions.

20. (i) The cover provided by this insurance under Clauses 18 and 19 shall in no case extend or be deemed to extend to include any claim arising:—

(*a*) directly or indirectly under Workmen's Compensation or Employers' Liability Acts and any other Statutory or Common Law Liability in respect of loss of life of or personal injury to or illness of any person employed in any capacity whatsoever by the Assured in on or about or in connection with the Vessel hereby insured or her cargo catch materials or repairs.

This sub-clause shall not exclude a claim for which the Assured shall become liable under Sections 34, 35, 40, 41 and 42 of the Merchant Shipping Act, 1906, or any statutory modification thereof, except so far as such claim is for wages or remuneration in the nature of wages.

(*b*) from strikes, lock-outs, labour disturbances, riots or civil commotions,

(*c*) from liability assumed by the Assured under agreement expressed or implied in respect of death or illness of or injury to any person employed under a contract of service or apprenticeship by the other party to such agreement except to the extent that the Assured is or would be liable independently of such agreement.

(ii) The cover provided by Clause 18 shall not extend to collision liability covered by Clause 16 nor to any sum or sums paid by the Assured which are not recoverable by the Assured from the Underwriters in the terms of Clause 16 because the total of the sum or sums paid by the Assured exceeds the insured value of the Vessel hereby insured.

Catch etc., Exclusion.

21. Notwithstanding the provisions of Clauses 16 and 18 no liability shall attach thereunder for any claim in respect of goods, catch, fishing gear, merchandise, freight, or other things or interests whatsoever on board the Vessel hereby insured or in respect of the engagements of the Vessel hereby insured.

Notice of Claim and Tender Clause.

22. In the event of accident whereby loss or damage may result in a claim under this Policy, notice shall be given to the Underwriters prior to survey and also, if the Vessel is abroad, to the nearest Lloyd's Agent so that a surveyor may be appointed to represent the Underwriters should they so desire. The Underwriters shall be entitled to decide the port to which the Vessel shall proceed for docking or repair (the actual additional expense of the voyage arising from compliance with the Underwriters' requirements being refunded to the Assured) and shall have a right of veto concerning a place of repair or a repairing firm. The Underwriters may also take tenders or may require further tenders to be taken for the repair of the Vessel. Where a tender so taken is accepted with the approval of the Underwriters an allowance shall be made at the rate of 30% per annum on the insured value for time lost between the despatch of the invitations to tender and the acceptance of a tender to the extent that such time is lost solely as the result of tenders having been taken and provided that the tender is accepted without delay after receipt of the Underwriters' approval.

Due credit shall be given against the allowance as above for any amount recovered:—

(*a*) in respect of fuel and stores and wages and maintenance of the master officers and crew or any member thereof allowed in general or particular average,

(*b*) from third parties in respect of damages for detention and/or loss of profit and/or running expenses,

for the period covered by the tender allowance or any part thereof.

Where a part of the cost of average repairs other than a fixed deductible is not recoverable from the Underwriters the allowance shall be reduced by a similar proportion.

In the event of failure to comply with the conditions of this clause, 15% shall be deducted from the amount of the ascertained claim.

Returns for Lying up and Cancelling.

23. To return as follows:—

per cent. net for each uncommenced month if this Policy be cancelled by agreement,

and for each period of 30 consecutive days the Vessel may be laid up in a port or in a lay-up area provided such port or lay-up area is approved by the Underwriters (with special liberties as hereinafter allowed):—

(*a*) per cent. net not under repair

(*b*) per cent. net under repair.

If the Vessel is under repair during part only of a period for which a return is claimable, the return payable shall be calculated pro rata to the number of days under (a) and (b) respectively.

repair of the Vessel shall be recoverable hereunder unless such cost would exceed the insured value.

No Claim for Freight.

15. In the event of total or constructive total loss no claim to be made by the Underwriters for freight whether notice of abandonment has been given or not.

4/4ths Collision Liability.

16. It is further agreed that if the Vessel hereby insured shall come into collision with any other vessel and the Assured shall in consequence thereof become liable to pay and shall pay by way of damages to any other person or persons any sum or sums in respect of such collision for

- (i) loss of or damage to any other vessel or property on any other vessel,
- (ii) delay to or loss of use of any such other vessel or property thereon, or
- (iii) general average of, salvage of, or salvage under contract of, any such other vessel or property thereon,

the Underwriters will pay the Assured such proportion of such sum or sums so paid as their respective subscriptions hereto bear to the value of the Vessel hereby insured, provided always that their liability in respect of any one such collision shall not exceed their proportionate part of the value of the Vessel hereby insured, and in cases in which, with the prior consent in writing of the Underwriters, the liability of the Vessel has been contested or proceedings have been taken to limit liability, they will also pay a like proportion of the costs which the Assured shall thereby incur or be compelled to pay; but when both vessels are to blame, then unless the liability of the Owners of one or both of such vessels becomes limited by law, claims under this clause shall be settled on the principle of cross-liabilities as if the Owners of each vessel had been compelled to pay to the Owners of the other of such vessels such one-half or other proportion of the latter's damages as may have been properly allowed in ascertaining the balance or sum payable by or to the Assured in consequence of such collision.

Provided always that this clause shall in no case extend or be deemed to extend to any sum which the Assured may become liable to pay or shall pay for or in respect of:—

- *(a) removal or disposal, under statutory powers or otherwise, of obstructions, wrecks, cargoes or any other thing whatsoever,*
- *(b) any real or personal property or thing whatsoever except other vessels or property on other vessels,*
- *(c) the cargo or other property on or the engagements of the insured Vessel,*
- *(d) loss of life, personal injury or illness.*

Sister Ship.

17. Should the Vessel hereby insured come into collision with or receive salvage services from another vessel belonging wholly or in part to the same Owners or under the same management, the Assured shall have the same rights under this Policy as they would have were the other vessel entirely the property of Owners not interested in the Vessel hereby insured; but in such cases the liability for the collision or the amount payable for the services rendered shall be referred to a sole arbitrator to be agreed upon between the Underwriters and the Assured.

Protection and Indemnity.

18. It is further agreed that if by reason of interest in the Vessel during the period covered by this Policy, the Assured:—

- (i) shall become liable to pay and shall pay any sum or sums in respect of any liability, claim, demand, damages or expenses arising from or occasioned by any of the following events or happenings which occur during the period covered by this Policy:—
  - (a) Loss of or damage to any other vessel or goods, merchandise, freight, or other things or interests whatsoever, on board such other vessel, caused proximately or otherwise by the Vessel hereby insured,
  - (b) Loss of or damage to any goods, merchandise, freight, or other things or interests whatsoever, other than as aforesaid (not being the Vessel hereby insured).

Provided always that

- (i) in no case shall a return be allowed when the Vessel is lying in exposed or unprotected waters, or in a port or lay-up area not approved by the Underwriters but, provided the Underwriters agree that such non-approved lay-up area is deemed to be within the vicinity of the approved port or lay-up area, days during which the Vessel is laid up in such non-approved lay-up area may be added to days in the approved port or lay-up area to calculate a period of 30 consecutive days and a return shall be allowed for the proportion of such period during which the Vessel is actually laid up in the approved port or lay-up area
- (ii) loading or discharging operations or the presence of catch or cargo on board shall not debar returns but no return shall be allowed for any period during which the Vessel is being used for the storage of catch or cargo
- (iii) in the event of a return for special trade or any other reason being recoverable, the above rates of return of premium shall be reduced accordingly.

In the event of any return recoverable under this clause being based on 30 consecutive days which fall on successive policies, effected for the same Assured, this Policy shall only be liable for an amount calculated at pro rata of the period rates (a) and/or (b) above for the number of days which come within the period of this Policy and to which a return is actually applicable. Such overlapping period shall run, at the option of the Assured, either from the first day on which the Vessel is laid up or the first day of a period of 30 consecutive days as provided under (a) or (b) or (i) above.

Disbursements Warranty.

24. Warranted that no insurance is or shall be effected to operate during the currency of this Policy by or for account of the Assured, Owners, Managers or Mortgagees on:—

- (a) disbursements, commissions or similar interests, P.P.I., F.I.A. or subject to any other like term,
- (b) excess or increased value of hull and machinery however described

Provided always that a breach of this warranty shall not afford the Underwriters any defence to a claim by a Mortgagee who has accepted this Policy without knowledge of such breach.

Sale or Transfer of Vessel.

25. If the Vessel is sold or transferred to new management then unless the Underwriters agree in writing to continue the insurance this Policy shall become cancelled from the time of sale or transfer, unless the Vessel is at sea, in which case such cancellation shall, if required, be suspended until arrival at final port of discharge or at port of destination. A pro rata daily return of premium shall be made.

This clause shall prevail notwithstanding any provision whether written, typed or printed in the Policy inconsistent therewith.

Assignment.

26. No assignment of or interest in this Policy or in any moneys which may be or become payable thereunder is to be binding on or recognised by the Underwriters unless a dated notice of such assignment or interest signed by the Assured, and by the assignor in the case of subsequent assignment, is endorsed on this Policy and the Policy with such endorsement is produced before payment of any claim or return of premium thereunder; but nothing in this clause is to have effect as an agreement by the Underwriters to a sale or transfer to new management.

Strikes and Riots Exclusion.

27. Warranted free of loss or damage caused by strikers, locked-out workmen, or persons taking part in labour disturbances, riots or civil commotions.

Unless deleted by the Underwriters the following clauses shall be paramount and shall override anything contained in this insurance inconsistent therewith.

War Exclusion.

28. Warranted free of capture, seizure, arrest, restraint or detainment, and the consequences thereof or of any attempt thereat; also from the consequences of hostilities or warlike operations, whether there be a declaration of war or not; but this warranty shall not exclude collision, contact with any fixed or floating object (other than a mine or torpedo), stranding, heavy weather or fire unless caused directly (and independently of the nature of the voyage or service which the Vessel concerned or, in the case of a collision, any other vessel involved therein, is performing) by a hostile act by or against a belligerent power; and for the purpose of this warranty "power" includes any authority maintaining naval, military or air forces in association with a power.

Further warranted free from the consequences of civil war, revolution, rebellion, insurrection, or civil strife arising therefrom, or piracy.

Malicious Acts.

29. Warranted free of claim arising from:—

- (a) the detonation of an explosive
- (b) any weapon of war

and caused by any person acting maliciously or from a political motive.

Nuclear Exclusion.

30. Warranted free of claim arising from any weapon of war employing atomic or nuclear fission and/or fusion or other like reaction or radioactive force or matter.

So far as they apply

1/10/71

INSTITUTE FISHING VESSEL CLAUSES (1/5/71)

1/10/71 AMENDMENT

Clauses 16 and 20 are hereby deleted and the following clauses included in this insurance.

4/4ths Collision Liability.

(A) It is further agreed that if the Vessel hereby insured shall come into collision with any other vessel and the Assured shall in consequence thereof become liable to pay and shall pay by way of damages to any other person or persons any sum or sums in respect of such collision for

(i) loss of or damage to any other vessel or property on any other vessel,
(ii) delay to or loss of use of any such other vessel or property thereon, or
(iii) general average of, salvage of, or salvage under contract of, any such other vessel or property thereon,

the Underwriters will pay the Assured such proportion of such sum or sums so paid as their respective subscriptions hereto bear to the value of the Vessel hereby insured, provided always that their liability in respect of any one such collision shall not exceed their proportionate part of the value of the Vessel hereby insured, and in cases in which, with the prior consent in writing of the Underwriters, the liability of the Vessel has been contested or proceedings have been taken to limit liability, they will also pay a like proportion of the costs which the Assured shall thereby incur or be compelled to pay; but when both vessels are to blame, then unless the liability of the Owners of one or both of such vessels becomes limited by law, claims under this clause shall be settled on the principle of cross-liabilities as if the Owners of each vessel had been compelled to pay to the Owners of the other of such vessels such one-half or other proportion of the latter's damages as may have been properly allowed in ascertaining the balance or sum payable by or to the Assured in consequence of such collision.

Provided always that this clause shall in no case extend or be deemed to extend to any sum which the Assured may become liable to pay or shall pay for or in respect of—

(a) *removal or disposal, under statutory powers or otherwise, of obstructions, wrecks, cargoes or any other thing whatsoever,*
(b) *any real or personal property or thing whatsoever except other vessels or property on other vessels,*
(c) *pollution or contamination of any real or personal property or thing whatsoever (except other vessels with which the insured Vessel is in collision or property on such other vessels),*
(d) *the cargo or other property on or the engagements of the insured Vessel,*
(e) *loss of life, personal injury or illness.*

Protection and Indemnity Exclusions.

(B) (i) The cover provided by this insurance under Clauses 18 and 19 shall in no case extend or be deemed to extend to include any claim arising:—

(a) directly or indirectly under Workmen's Compensation or Employers' Liability Acts and any other Statutory or Common Law Liability in respect of loss of life of or personal injury to or illness of any person employed in any capacity whatsoever by the Assured in on or about or in connection with the Vessel hereby insured or her cargo catch materials or repairs.

This sub-clause shall not exclude a claim for which the Assured shall become liable under Sections 34, 35, 40, 41 and 42 of the Merchant Shipping Act, 1906, or any statutory modification thereof, except so far as such claim is for wages or remuneration in the nature of wages.

(b) from strikes, lock-outs, labour disturbances, riots or civil commotions.

(c) from liability assumed by the Assured under agreement expressed or implied in respect of death or illness of or injury to any person employed under a contract of service or apprenticeship by the other party to such agreement except to the extent that the Assured is or would be liable independently of such agreement.

(ii) The cover provided by Clause 18 shall not extend to collision liability covered by Clause (A) nor to any sum or sums paid by the Assured which are not recoverable by the Assured from the Underwriters in the terms of Clause (A) because the total of the sum or sums paid by the Assured exceeds the insured value of the Vessel hereby insured.

(iii) The cover provided by this insurance under Clauses 18 and 19 shall in no case extend or be deemed to extend to include any claim in respect of or arising directly or indirectly from

(a) pollution or contamination of any real or personal property or any person or thing whatsoever (other than property on the insured Vessel),

(b) any measures taken by any person (including measures taken by, on behalf of, or on the direction of any government or authority) to avert or minimise such pollution or contamination arising from any discharge or escape (whether actual or apprehended).

INSTITUTE FISHING VESSEL CLAUSES

This insurance is subject to English law and practice

1 NAVIGATION AND REMOVALS ASHORE

1.1 The Vessel is covered subject to the provisions of this insurance at all times and has leave to sail or navigate with or without pilots, to go on trial trips and to assist and tow vessels or craft in distress, but it is warranted that with the exception of catch the Vessel shall not carry cargo or containers for the carriage of cargo and shall not be towed, except as is customary or to the first safe port or place when in need of assistance, or undertake towage or salvage services under a contract previously arranged by the Assured and/or Owners and/or Managers and/or Charterers. This Clause 1.1 shall not exclude customary towage in connection with loading and discharging.

1.2 Any part or parts of the subject-matter insured are covered subject to the provisions of this insurance whilst ashore for the purpose of repair, overhaul or refitting, including transit from and to the Vessel.

1.3 In the event of the Vessel sailing with an intention of being (a) broken up, or (b) sold for breaking up, any claim for loss of or damage to the Vessel occurring subsequent to such sailing shall be limited to the market value of the Vessel as scrap at the time when the loss or damage is sustained, unless previous notice has been given to the Underwriters and any amendments to the terms of cover, insured value and premium required by them have been agreed. Nothing in this Clause 1.3 shall affect claims under Clauses 8, 18 or 20.

2 CONTINUATION

Should the Vessel at the expiration of this insurance be at sea or in distress or at a port of refuge or of call, she shall, provided previous notice be given to the Underwriters, be held covered at a pro rata monthly premium to her port of destination.

3 BREACH OF WARRANTY

Held covered in case of any breach of warranty as to locality, towage, salvage services or date of sailing, provided notice be given to the Underwriters immediately after receipt of advices and any amended terms of cover and any additional premium required by them be agreed.

4 TERMINATION

This Clause 4 shall prevail notwithstanding any provision whether written typed or printed in this insurance inconsistent therewith.

Unless the Underwriters agree to the contrary in writing, this insurance shall terminate automatically at the time of

4.1 change of the Classification Society of the Vessel, or change, suspension, discontinuance, withdrawal or expiry of her Class therein provided that if the Vessel is at sea such automatic termination shall be deferred until arrival at her next port or until the expiry of fifteen days, whichever shall first occur. However where such change, suspension, discontinuance or withdrawal of her Class has resulted from loss or damage covered by Clause 6 of this insurance or which would be covered by an insurance of the Vessel subject to the current Institute War and Strikes Clauses Hulls — Time such automatic termination shall only operate should the Vessel sail from her next port without the prior approval of the Classification Society.

4.2 any change, voluntary or otherwise, in the ownership or flag, transfer to new management, or charter on a bareboat basis, provided that if the Vessel is at sea such automatic termination shall, if required, be deferred until arrival at her next port or until the expiry of fifteen days, whichever shall first occur.

4.3 requisition for title or use of the Vessel. However, in the event of requisition for title or use without the prior execution of a written agreement by the Assured, such automatic termination shall occur fifteen days after such requisition whether the Vessel is at sea or in port.

5 ASSIGNMENT

No assignment of or interest in this insurance or in any moneys which may be or become payable thereunder is to be binding on or recognised by the Underwriters unless a dated notice of such assignment or interest signed by the Assured, and by the assignor in the case of subsequent assignment, is endorsed on the Policy and the Policy with such endorsement is produced before payment of any claim or return of premium thereunder.

6 PERILS

6.1 This insurance covers loss of or damage to the subject-matter insured caused by

- 6.1.1 perils of the seas rivers lakes or other navigable waters
- 6.1.2 fire, explosion
- 6.1.3 violent theft by persons from outside the Vessel
- 6.1.4 jettison
- 6.1.5 piracy
- 6.1.6 breakdown of or accident to nuclear installations or reactors
- 6.1.7 contact with aircraft or similar objects, or objects falling therefrom, land conveyance, dock or harbour equipment or installation
- 6.1.8 earthquake volcanic eruption or lightning.

6.2 This insurance covers loss of or damage to the subject-matter insured caused by

- 6.2.1 accidents in loading discharging or shifting catch fuel or stores
- 6.2.2 bursting of boilers breakage of shafts or any latent defect in the machinery or hull
- 6.2.3 negligence of Master Officers Crew or Pilots
- 6.2.4 negligence of repairers or charterers provided such repairers or charterers are not an Assured hereunder
- 6.2.5 barratry of Master Officers or Crew,

provided such loss or damage has not resulted from want of due diligence by the Assured, Owners or Managers.

6.3 Master Officers Crew or Pilots not to be considered Owners within the meaning of this Clause 6 should they hold shares in the Vessel.

(Continued)

7 POLLUTION HAZARD

This insurance covers loss of or damage to the Vessel caused by any governmental authority acting under the powers vested in it to prevent or mitigate a pollution hazard, or threat thereof, resulting directly from damage to the Vessel for which the Underwriters are liable under this insurance, provided such act of governmental authority has not resulted from want of due diligence by the Assured, the Owners, or Managers of the Vessel or any of them to prevent or mitigate such hazard or threat. Master, Officers, Crew or Pilots not to be considered Owners within the meaning of this Clause 7 should they hold shares in the Vessel.

8 GENERAL AVERAGE AND SALVAGE

8.1 Any claim for general average and salvage to be on the basis of an adjustment according to the York-Antwerp Rules 1974 if so required by the Underwriters but the insured value of Hull and Machinery to be taken as the contributory value without deduction.

8.2 No claim under this Clause 8 shall in any case be allowed where the loss was not incurred to avoid or in connection with the avoidance of a peril insured against.

9 WAGES AND MAINTENANCE

The Underwriters to pay the cost of wages and maintenance of members of crew necessarily retained whilst the Vessel is undergoing repairs for which the Underwriters are liable under this insurance.

10 DUTY OF ASSURED (SUE AND LABOUR)

10.1 In case of any loss or misfortune it is the duty of the Assured and their servants and agents to take such measures as may be reasonable for the purpose of averting or minimising a loss which would be recoverable under this insurance.

10.2 Subject to the provisions below and to Clause 12 the Underwriters will contribute to charges properly and reasonably incurred by the Assured their servants or agents for such measures. General average, salvage charges (except as provided for in Clause 10.5) collision defence or attack costs and costs incurred by the Assured in avoiding minimising or contesting liability covered by Clause 20 are not recoverable under this Clause 10.

10.3 Measures taken by the Assured or the Underwriters with the object of saving, protecting or recovering the subject-matter insured shall not be considered as a waiver or acceptance of abandonment or otherwise prejudice the rights of either party.

10.4 When expenses are incurred pursuant to this Clause 10 the liability under this insurance shall not exceed the proportion of such expenses that the amount insured hereunder bears to the value of the Vessel as stated herein.

10.5 Where a claim for total loss of the Vessel is admitted under this insurance and expenses have been reasonably incurred in saving or attempting to save the Vessel and other property and there are no proceeds, or the expenses exceed the proceeds, then the Underwriters shall pay the expenses, or the expenses in excess of the proceeds, as the case may be.

10.6 The sum recoverable under this Clause 10 shall be in addition to the loss otherwise recoverable under this insurance but shall in no circumstances exceed the amount insured under this insurance in respect of the Vessel.

11 NEW FOR OLD

Claims payable without deduction new for old.

12 DEDUCTIBLE

12.1 No claim arising from a peril insured against shall be payable under this insurance unless the aggregate of all such claims arising out of each separate accident or occurrence (including claims under Clauses 8, 10, 18 and 20) exceeds..

in which case this sum shall be deducted. Nevertheless the expense of sighting the bottom after stranding, if reasonably incurred specially for that purpose, shall be paid even if no damage be found. This Clause 12.1 shall not apply to a claim for total or constructive total loss of the Vessel or, in the event of such a claim, to any associated claim under Clause 10 arising from the same accident or occurrence.

12.2 Excluding any interest comprised therein, recoveries against any claim which is subject to the above deductible shall be credited to the Underwriters in full to the extent of the sum by which the aggregate of the claim unreduced by any recoveries exceeds the above deductible.

12.3 Interest comprised in recoveries shall be apportioned between the Assured and the Underwriters, taking into account the sums paid by the Underwriters and the dates when such payments were made, notwithstanding that by the addition of interest the Underwriters may receive a larger sum than they have paid.

13 MACHINERY DAMAGE ADDITIONAL DEDUCTIBLE

Notwithstanding any provision to the contrary in this insurance a claim for loss of or damage to any machinery, shaft, electrical equipment or wiring, boiler condenser heating coil or associated pipework, arising from any of the perils enumerated in Clauses 6.2.2 to 6.2.5 inclusive above or from fire or explosion when either has originated in a machinery space, shall be subject to a deductible of..

Any balance remaining, after application of this deductible, with any other claim arising from the same accident or occurrence, shall then be subject to the deductible in Clause 12.1.

The provisions of Clauses 12.2 and 12.3 shall apply to recoveries and interest comprised in recoveries against any claim which is subject to this Clause.

This Clause shall not apply to a claim for total or constructive total loss of the Vessel.

14 BOTTOM TREATMENT

In no case shall a claim be allowed in respect of scraping gritblasting and/or other surface preparation or painting of the Vessel's bottom except that

14.1 gritblasting and/or other surface preparation of new bottom plates ashore and supplying and applying any "shop" primer thereto,

14.2 gritblasting and/or other surface preparation of:

the butts or area of plating immediately adjacent to any renewed or refitted plating damaged during the course of welding and/or repairs,

areas of plating damaged during the course of fairing, either in place or ashore,

14.3 supplying and applying the first coat of primer/anti-corrosive to those particular areas mentioned in 14.1 and 14.2 above,

shall be allowed as part of the reasonable cost of repairs in respect of bottom plating damaged by an insured peril.

15 FISHING GEAR

No claim to attach hereto for loss of or damage to fishing gear unless

15.1 caused by fire lightning or violent theft by persons from outside the Vessel

15.2 totally lost as a result of the total loss of the Vessel by insured perils.

16 UNREPAIRED DAMAGE

16.1 The measure of indemnity in respect of claims for unrepaired damage shall be the reasonable depreciation in the market value of the Vessel at the time this insurance terminates arising from such unrepaired damage but not exceeding the reasonable cost of repairs.

16.2 In no case shall the Underwriters be liable for unrepaired damage in the event of a subsequent total loss (whether or not covered under this insurance) sustained during the period covered by this insurance or any extension thereof.

16.3 The Underwriters shall not be liable in respect of unrepaired damage for more than the insured value at the time this insurance terminates.

17 CONSTRUCTIVE TOTAL LOSS

17.1 In ascertaining whether the Vessel is a constructive total loss, the insured value shall be taken as the repaired value and nothing in respect of the damaged or break-up value of the Vessel or wreck shall be taken into account.

17.2 No claim for constructive total loss based upon the cost of recovery and/or repair of the Vessel shall be recoverable hereunder unless such cost would exceed the insured value. In making this determination, only the cost relating to a single accident or sequence of damages arising from the same accident shall be taken into account.

18 COLLISION LIABILITY

18.1 The Underwriters agree to indemnify the Assured for any sum or sums paid by the Assured to any other person or persons by reason of the Assured becoming legally liable by way of damages for

18.1.1 loss of or damage to any other vessel or property on any other vessel

18.1.2 delay to or loss of use of any such other vessel or property thereon

18.1.3 general average of, salvage of, or salvage under contract of, any such other vessel or property thereon,

where such payment by the Assured is in consequence of the Vessel hereby insured coming into collision with any other vessel.

18.2 The indemnity provided by this Clause 18 shall be in addition to the indemnity provided by the other terms and conditions of this insurance and shall be subject to the following provisions:

18.2.1 Where the insured Vessel is in collision with another vessel and both vessels are to blame then, unless the liability of one or both vessels becomes limited by law, the indemnity under this Clause 18 shall be calculated on the principle of cross-liabilities as if the respective Owners had been compelled to pay to each other such proportion of each other's damages as may have been properly allowed in ascertaining the balance or sum payable by or to the Assured in consequence of the collision.

18.2.2 In no case shall the Underwriters' total liability under Clauses 18.1 and 18.2 exceed their proportionate part of the insured value of the Vessel hereby insured in respect of any one such collision.

18.3 The Underwriters will also pay the legal costs incurred by the Assured or which the Assured may be compelled to pay in contesting liability or taking proceedings to limit liability, with the prior written consent of the Underwriters.

EXCLUSIONS

18.4 Provided always that this Clause 18 shall in no case extend to any sum which the Assured shall pay for or in respect of

18.4.1 removal or disposal of obstructions, wrecks, cargoes or any other thing whatsoever

18.4.2 any real or personal property or thing whatsoever except other vessels or property on other vessels

18.4.3 the cargo or other property on, or the engagements of, the insured Vessel

18.4.4 loss of life, personal injury or illness

18.4.5 pollution or contamination of any real or personal property or thing whatsoever (except other vessels with which the insured Vessel is in collision or property on such other vessels).

19 SISTERSHIP

Should the Vessel hereby insured come into collision with or receive salvage services from another vessel belonging wholly or in part to the same Owners or under the same management, the Assured shall have the same rights under this insurance as they would have were the other vessel entirely the property of Owners not interested in the Vessel hereby insured; but in such cases the liability for the collision or the amount payable for the services rendered shall be referred to a sole arbitrator to be agreed upon between the Underwriters and the Assured.

20 PROTECTION AND INDEMNITY

20.1 The Underwriters agree to indemnify the Assured for any sum or sums paid by the Assured to any other person or persons by reason of the Assured becoming legally liable, as owner of the Vessel, for any claim, demand, damages and/or expenses, where such liability is in consequence of any of the following matters or things and arises from an accident or occurrence during the period of this insurance:

20.1.1 loss of or damage to any fixed or movable object or property or other thing or interest whatsoever, other than the Vessel, arising from any cause whatsoever in so far as such loss or damage is not covered by Clause 18

20.1.2 any attempted or actual raising, removal or destruction of any fixed or movable object or property or other thing, including the wreck of the Vessel, or any neglect or failure to raise, remove or destroy the same

20.1.3 liability assumed by the Assured under contracts of customary towage for the purpose of entering or leaving port or manoeuvring within the port during the ordinary course of trading

20.1.4 loss of life, personal injury, illness or payments made for life salvage

20.1.5 (a) hospital medical and burial expenses of Master Officers or Crew

(b) repatriation expenses of Master Officers or Crew (other than wages, remuneration in the nature of wages, or any expenses which ensue from the termination of an agreement, sale of the Vessel or any other act of the Assured).

20.2 The Underwriters agree to indemnify the Assured for any of the following arising from an accident or occurrence during the period of this insurance:

20.2.1 the additional cost of fuel, insurance, wages, stores, provisions and port charges reasonably incurred solely for the purpose of landing from the Vessel sick or injured persons or stowaways, refugees, or persons saved at sea

20.2.2 additional expenses brought about by the outbreak of infectious disease on board the Vessel or ashore

20.2.3 fines imposed on the Vessel, on the Assured, or on any Master Officer crew member or agent of the Vessel who is reimbursed by the Assured, for any act or neglect or breach of any statute or regulation relating to the operation of the Vessel, provided that the Underwriters shall not be liable to indemnify the Assured for any fines which result from any act neglect failure or default of the Assured their agents or servants other than Master Officer or crew member

20.2.4 the expenses of the removal of the wreck of the Vessel from any place owned, leased or occupied by the Assured

20.2.5 legal costs incurred by the Assured, or which the Assured may be compelled to pay, in avoiding, minimising or contesting liability with the prior written consent of the Underwriters.

EXCLUSIONS

20.3 Notwithstanding the provisions of Clauses 20.1 and 20.2 this Clause 20 does not cover any liability cost or expense arising in respect of:

20.3.1 any direct or indirect payment by the Assured under workmen's compensation or employers' liability acts and any other statutory or common law, general maritime law or other liability whatsoever in respect of accidents to or illness of workmen or any other persons employed in any capacity whatsoever by the Assured or others in on or about or in connection with the Vessel or her catch, materials or repairs

20.3.2 liability assumed by the Assured under agreement expressed or implied in respect of death or illness of or injury to any persons employed under a contract of service or apprenticeship by the other party to such agreement

20.3.3 punitive or exemplary damages, however described

20.3.4 passengers

20.3.5 catch, fishing gear or other things or interests whatsoever on board the insured Vessel or the engagements of the insured Vessel but this Clause 20.3.5 shall not exclude any claim in respect of the extra cost of removing catch or property from the wreck of the Vessel

20.3.6 property, owned by builders or repairers or for which they are responsible, which is on board the Vessel

20.3.7 liability arising under a contract or indemnity in respect of containers, equipment fuel or other property on board the Vessel and which is owned or leased by the Assured

20.3.8 cash, negotiable instruments, precious metals or stones, valuables or objects of a rare or precious nature, belonging to persons on board the Vessel, or non-essential personal effects of any Master Officer or crew member

20.3.9 fuel, insurance, wages, stores, provisions and port charges arising from delay to the Vessel while awaiting a substitute for any Master Officer or crew member

20.3.10 fines or penalties arising from overloading or illegal fishing

20.3.11 pollution or contamination of any real or personal property or thing whatsoever

20.3.12 general average, sue and labour and salvage charges, salvage, and/or collision liability to any extent that they are not recoverable under Clauses 8, 10 and 18 by reason of the agreed value and/or the amount insured in respect of the Vessel being inadequate.

20.4 The indemnity provided by this Clause 20 shall be in addition to the indemnity provided by the other terms and conditions of this insurance.

20.5 Where the Assured or the Underwriters may or could have limited their liability the indemnity under this Clause 20 in respect of such liability shall not exceed Underwriters' proportionate part of the amount of such limitation.

20.6 In no case shall the Underwriters' liability under this Clause 20 in respect of each separate accident or occurrence or series of accidents arising out of the same event, exceed their proportionate part of the insured value of the Vessel.

(Continued)

20.7 PROVIDED ALWAYS THAT

20.7.1 Prompt notice must be given to the Underwriters of every casualty event or claim upon the Assured which may give rise to a claim under this Clause 20 and of every event or matter which may cause the Assured to incur liability costs or expense for which he may be insured under this Clause 20.

20.7.2 the Assured shall not admit liability for or settle any claim for which he may be insured under this Clause 20 without the prior written consent of the Underwriters.

21 NOTICE OF CLAIM AND TENDERS

21.1 In the event of accident whereby loss or damage may result in a claim under this insurance, notice shall be given to the Underwriters prior to survey and also, if the Vessel is abroad, to the nearest Lloyd's Agent so that a surveyor may be appointed to represent the Underwriters should they so desire.

21.2 The Underwriters shall be entitled to decide the port to which the Vessel shall proceed for docking or repair (the actual additional expense of the voyage arising from compliance with the Underwriters' requirements being refunded to the Assured) and shall have a right of veto concerning a place of repair or a repairing firm.

21.3 The Underwriters may also take tenders or may require further tenders to be taken for the repair of the Vessel. Where such a tender has been taken and a tender is accepted with the approval of the Underwriters, an allowance shall be made at the rate of 30% per annum on the insured value for time lost between the despatch of the invitations to tender required by Underwriters and the acceptance of a tender to the extent that such time is lost solely as the result of tenders having been taken and provided that the tender is accepted without delay after receipt of the Underwriters' approval.

Due credit shall be given against the allowance as above for any amounts recovered in respect of fuel and stores and wages and maintenance of the Master Officers and Crew or any member thereof, including amounts allowed in general average, and for any amounts recovered from third parties in respect of damages for detention and/or loss of profit and/or running expenses, for the period covered by the tender allowance or any part thereof.

Where a part of the cost of the repair of damage other than a fixed deductible is not recoverable from the Underwriters the allowance shall be reduced by a similar proportion.

21.4 In the event of failure to comply with the conditions of this Clause 21 a deduction of 15% shall be made from the amount of the ascertained claim.

22 DISBURSEMENTS WARRANTY

Warranted that no insurance is or shall be effected to operate during the currency of this insurance by or for account of the Assured, Owners, Managers or Mortgagees on

22.1 disbursements, commissions or similar interests, P.P.I., F.I.A. or subject to any other like term,

22.2 excess or increased value of hull and machinery however described.

Provided always that a breach of this warranty shall not afford the Underwriters any defence to a claim by a Mortgagee who has accepted this insurance without knowledge of such breach.

23 RETURNS FOR LAY-UP AND CANCELLATION

23.1 To return as follows

23.1.1 Pro rata monthly net for each uncommenced month if this insurance be cancelled by agreement or by the operation of Clause 4.

23.1.2 For each period of 30 consecutive days the vessel may be laid up in a port or in a lay-up area provided such port or lay-up area is approved by the Underwriters (with special liberties as hereinafter allowed)

(1) .... per cent net not under repair

(2) .... per cent net under repair.

If the Vessel is under repair during part only of a period for which a return is claimable, the return shall be calculated pro rata to the number of days under (1) and (2) respectively.

23.2 PROVIDED ALWAYS THAT

23.2.1 a total loss of the Vessel, whether by insured perils or otherwise, has not occurred during the period covered by this insurance or any extension thereof

23.2.2 in no case shall a return be allowed when the Vessel is lying in exposed or unprotected waters, or in a port or lay-up area not approved by the Underwriters but, provided the Underwriters agree that such non-approved lay-up area is deemed to be within the vicinity of the approved port or lay-up area, days during which the Vessel is laid up in such non-approved lay-up area may be added to days in the approved port or lay-up area to calculate a period of 30 consecutive days and a return shall be allowed for the proportion of such period during which the Vessel is actually laid up in the approved port or lay-up area

23.2.3 loading or discharging operations or the presence of catch on board shall not debar returns but no return shall be allowed for any period during which the Vessel is being used for the storage of catch or for lightering purposes

23.2.4 in the event of any amendment of the annual rate, the above rates of return shall be adjusted accordingly

23.2.5 in the event of any return recoverable under this Clause 23 being based on 30 consecutive days which fall on successive insurances effected for the same Assured, this insurance shall only be liable for an amount calculated at pro rata of the period rates 23.1.2(1) and/or (2) above for the number of days which come within the period of this insurance and to which a return is actually applicable. Such overlapping period shall run, at the option of the Assured, either from the first day on which the Vessel is laid up or the first day of a period of 30 consecutive days as provided under 23.1.2(1), (2) or 23.2.2 above.

The following clauses shall be paramount and shall override anything contained in this insurance inconsistent therewith.

24 WAR EXCLUSION

In no case shall this insurance cover loss damage liability or expense caused by

24.1 war civil war revolution rebellion insurrection, or civil strife arising therefrom, or any hostile act by or against a belligerent power

24.2 capture seizure arrest restraint or detainment (barratry and piracy excepted), and the consequences thereof or any attempt thereat

24.3 derelict mines torpedoes bombs or other derelict weapons of war.

25 STRIKES EXCLUSION

In no case shall this insurance cover loss damage liability or expense

25.1 caused by strikers, locked-out workmen, or persons taking part in labour disturbances, riots or civil commotions

25.2 caused by any terrorist or any person acting from a political motive.

26 MALICIOUS ACTS EXCLUSION

In no case shall this insurance cover loss damage liability or expense arising from

26.1 the detonation of an explosive

26.2 any weapon of war

and caused by any person acting maliciously or from a political motive.

27 NUCLEAR EXCLUSION

In no case shall this insurance cover loss damage liability or expense arising from any weapon of war employing atomic or nuclear fission and/or fusion or other like reaction or radioactive force or matter.

The Institute of London Underwriters

49 Leadenhall Street London EC3A 2BE

PRIVATE AND CONFIDENTIAL

Underwriters & Claims 13
30th January, 1987

INSTITUTE FISHING VESSEL CLAUSES

... The attached draft 21/11/86 of the Institute Fishing Vessel Clauses has been approved by both the Technical and Clauses and Joint Hull Committees following consultation with Fishing Vessel Leaders.

As compared with the current clauses, the following main points should be noted.

Navigation and Removals Ashore - Clause 1
Clause 1.1

This clause now warrants that the vessel will not carry cargo, containers or catch taken from another vessel. Towage when in need of assistance has been restricted to the first safe port or place, as in the I.T.C.

Clause 1.3

A "break-up" clause as in the I.T.C. (but omitting the bracketed words "with or without cargo") has been incorporated.

Clause 3 - Breach of Warranty

"Cargo" and "trade" have been removed in view of underwriters' wish not to find themselves holding covered if the vessel carries cargo without express permission.

Clause 4 - Termination

This clause takes the place of Clause 25 of the current Fishing Vessel Clauses. It differs from its I.T.C. counterpart in that provision is made for termination on the expiry of 15 days in the event of any change of classification society, ownership or management etc.

Clause 6 - Perils

This clause follows the I.T.C. - Hulls except for 6.2.1. which retains the current reference to "catch, fuel or stores".

Clauses 8 and 10 - General Average and Salvage; Duty of Assured (Sue and Labour)

These clauses now treat under-insurance in the same manner as the I.T.C.

Clause 12 - Deductible

Clause 12.1 follows the new I.T.C. save for interior clause number references. Clauses 12.2. and 12.3 are unchanged from the current clause.

Clause 13 - Machinery Damage Additional Deductible

This clause has been introduced in place of the Machinery Co-insurance Clause.

Clause 15 - Fishing Gear

Cover has been restricted to specific perils and total loss consequent upon total loss of the vessel.

Clauses 16-19

These are identical to clauses agreed for adoption in other new sets of clauses. (The Collision Clause continues to be for 4/4th liability.)

Protection and Indemnity - Clause 20

This clause is essentially the same as Clause 9 of the new Port Risks Clauses, with the following differences:

Clause 20.1.5

Whereas the equivalent Port Risks Clause 9.1.5 deals with (tankers') liability under the Lloyd's Open Form, which isinappropriate for fishing vessels, Clause 20.1.5 reinstates the cover originally intended under the provisions of the current 20(i)(a).

Clause 20.3.1

This specifically excludes liability under General Maritime Law as, in the opinion of American lawyers, maintenance and cure is a remedy based not on statutory law but on case law or usage and "common law" may not be a term recognised by a U.S. court.

The word 'catch' replaces 'cargo' at the end of the clause.

Clause 20.4

This clause inter alia expressly restricts underwriters' liability to the amount of any statutory limitation.

It should be noted that the amendments embodied in Clauses 20.3.1. and 20.4 will also be incorporated in the Port Risks Clauses themselves, which it is planned to reissue.

Clause 23 - Returns for lay-up and cancellation

This is as per the new Port Risks Clauses, without the references to "cargo".

Freight Waiver Clause

This clause has been omitted as inconsistent with a warranty not to carry cargo.

Other points

Elsewhere clauses are either identical to those recently adopted in other new sets of clauses or have been retained from the current Fishing Vessel Clauses.

The word 'insurance' replaces the previous 'Policy' throughout.

Anyone wishing to comment on the attached clauses is requested to contact the undersigned no later than 4.00 p.m. on Friday, 27th February, 1987. Should no objections be received by that time the clauses will be issued under a date to be advised.

G.J. CONNELL
Executive Assistant

APPENDIX “B” – Poisson (λ)

Applications: *Number of individual events that occur in a given unit of time, such as a number of customers arriving in a queue, number of accidents on a road, number of imperfections per yard of carpet.*

Density: $f(x) = \frac{e^{-\lambda}\lambda^{x}}{x!}$

Distribution: $F(x) = e^{-\lambda}\sum_{i=0}^{\lfloor x \rfloor}\frac{\lambda^{i}}{i!}$

Parameters: $\lambda > 0$

Domain: $x \in \{0, 1, 2, \ldots\}$

Mean: λ

Mode: $\lambda, \lambda-1$ if λ is an integer

$\lfloor \lambda \rfloor$ otherwise

Variance: λ

APPENDIX "C" – Gamma (α,β)

Applications: *Time to complete some task, such as building a facility, serving a request.*

Density: $$\oint x = \frac{\beta^{-\alpha} x^{a-1} exp(-\frac{x}{\beta})}{\Gamma(\alpha)}$$

Distribution: *No closed form*

Parameters: $\alpha > 0,\ \beta > 0$

Domain: $x \geq 0$

Mean: $\alpha\beta$

Mode: $\beta(\alpha - 1)$ if $\alpha \geq 1$

0 if $\alpha < 1$

Variance: $\alpha\beta^2$

APPENDIX "D" – Data used in Chapter 5

Table 5.1 – Number of reported damage incidents and aggregate months service by Ship type, year of construction and period of operation

Ship Type	Year of Construction	Period of Operation	Aggregate months service	Number of Damage Incidents
Wooden	1925 – 1929	1970 – 1974	0	0
Wooden		1975 – 1979	45	0
Wooden		1980 – 1984	12	0
Wooden		1985 – 1989	12	0
Wooden		1990 – 1994	0	0
Wooden		1995 – 1999	0	0
Wooden	1930 – 1934	1970 – 1974	72	0
Wooden		1975 – 1979	188	2
Wooden		1980 – 1984	268	1
Wooden		1985 – 1989	168	0
Wooden		1990 – 1994	0	0
Wooden		1995 – 1999	0	0
Wooden	1935 – 1939	1970 – 1974	135	0
Wooden		1975 – 1979	410	1
Wooden		1980 – 1984	315	3
Wooden		1985 – 1989	144	1
Wooden		1990 – 1994	0	0
Wooden		1995 – 1999	0	0
Wooden	1940 – 1944	1970 – 1974	125	0
Wooden		1975 – 1979	252	0
Wooden		1980 – 1984	272	0
Wooden		1985 – 1989	248	0
Wooden		1990 – 1994	16	0

Wooden		1995 – 1999	0	0
Wooden	1945 – 1949	1970 – 1974	598	2
Wooden		1975 – 1979	1,338	3
Wooden		1980 – 1984	1,694	1
Wooden		1985 – 1989	788	1
Wooden		1990 – 1994	48	0
Wooden		1995 – 1999	0	0
Wooden	1950 – 1954	1970 – 1974	634	2
Wooden		1975 – 1979	1,944	1
Wooden		1980 – 1984	1,890	3
Wooden		1985 – 1989	875	3
Wooden		1990 – 1994	8	0
Wooden		1995 – 1999	0	0
Wooden	1955 – 1959	1970 – 1974	688	0
Wooden		1975 – 1979	2,232	1
Wooden		1980 – 1984	2,011	5
Wooden		1985 – 1989	932	4
Wooden		1990 – 1994	104	0
Wooden		1995 – 1999	16	0
Wooden	1960 – 1964	1970 – 1974	984	1
Wooden		1975 – 1979	2,644	4
Wooden		1980 – 1984	1,932	3
Wooden		1985 – 1989	672	1
Wooden		1990 – 1994	32	0
Wooden		1995 – 1999	0	0
Wooden	1965 – 1969	1970 – 1974	1,327	1
Wooden		1975 – 1979	3,578	6
Wooden		1980 – 1984	3,452	5
Wooden		1985 – 1989	1,850	1
Wooden		1990 – 1994	44	1
Wooden		1995 – 1999	0	0

Wooden	1970 – 1974	1970 – 1974	1,564	2
Wooden		1975 – 1979	5,124	6
Wooden		1980 – 1984	4,229	7
Wooden		1985 – 1989	2,476	12
Wooden		1990 – 1994	132	0
Wooden		1995 – 1999	12	1
Wooden	1975 – 1979	1975 – 1979	3,415	2
Wooden		1980 – 1984	6,479	3
Wooden		1985 – 1989	4,236	4
Wooden		1990 – 1994	44	1
Wooden		1995 – 1999	0	0
Wooden	1980 – 1984	1980 – 1984	3,191	2
Wooden		1985 – 1989	4,520	11
Wooden		1990 – 1994	0	0
Wooden		1995 – 1999	0	0
Wooden	1985 – 1989	1985 – 1989	2,256	6
Wooden		1990 – 1994	240	1
Wooden		1995 – 1999	0	0
Wooden	1990 – 1994	1990 – 1994	55	0
Wooden		1995 – 1999	0	0
Wooden	1995 – 1999	1995 – 1999	0	0
Steel	1925 – 1929	1970 – 1974	0	0
Steel		1975 – 1979	0	0
Steel		1980 – 1984	12	0
Steel		1985 – 1989	36	0
Steel		1990 – 1994	0	0
Steel		1995 – 1999	0	0
Steel	1930 – 1934	1970 – 1974	0	0
Steel		1975 – 1979	0	0
Steel		1980 – 1984	72	0
Steel		1985 – 1989	84	0

Steel		1990 – 1994	36	0
Steel		1995 – 1999	0	0
Steel	1935 – 1939	1970 – 1974	0	0
Steel		1975 – 1979	0	0
Steel		1980 – 1984	0	0
Steel		1985 – 1989	0	0
Steel		1990 – 1994	0	0
Steel		1995 – 1999	0	0
Steel	1940 – 1944	1970 – 1974	48	0
Steel		1975 – 1979	132	3
Steel		1980 – 1984	168	3
Steel		1985 – 1989	120	0
Steel		1990 – 1994	0	1
Steel		1995 – 1999	0	0
Steel	1945 – 1949	1970 – 1974	95	1
Steel		1975 – 1979	181	1
Steel		1980 – 1984	192	3
Steel		1985 – 1989	102	3
Steel		1990 – 1994	32	3
Steel		1995 – 1999	0	0
Steel	1950 – 1954	1970 – 1974	0	0
Steel		1975 – 1979	60	1
Steel		1980 – 1984	104	2
Steel		1985 – 1989	148	0
Steel		1990 – 1994	23	0
Steel		1995 – 1999	0	0
Steel	1955 – 1959	1970 – 1974	12	0
Steel		1975 – 1979	216	2
Steel		1980 – 1984	390	4
Steel		1985 – 1989	377	1
Steel		1990 – 1994	187	2

Steel		1995 – 1999	36	0
Steel	1960 – 1964	1970 – 1974	139	5
Steel		1975 – 1979	207	3
Steel		1980 – 1984	329	2
Steel		1985 – 1989	642	1
Steel		1990 – 1994	313	6
Steel		1995 – 1999	119	0
Steel	1965 – 1969	1970 – 1974	12	0
Steel		1975 – 1979	12	0
Steel		1980 – 1984	28	0
Steel		1985 – 1989	452	8
Steel		1990 – 1994	400	9
Steel		1995 – 1999	120	2
Steel	1970 – 1974	1970 – 1974	305	1
Steel		1975 – 1979	374	5
Steel		1980 – 1984	346	2
Steel		1985 – 1989	364	2
Steel		1990 – 1994	343	5
Steel		1995 – 1999	120	0
Steel	1975 – 1979	1975 – 1979	211	1
Steel		1980 – 1984	317	1
Steel		1985 – 1989	453	5
Steel		1990 – 1994	217	3
Steel		1995 – 1999	23	1
Steel	1980 – 1984	1980 – 1984	380	0
Steel		1985 – 1989	837	9
Steel		1990 – 1994	320	3
Steel		1995 – 1999	68	0
Steel	1985 – 1989	1985 – 1989	1,464	10
Steel		1990 – 1994	1,602	11
Steel		1995 – 1999	290	0

Steel	1990 – 1994	1990 – 1994	869	3
Steel		1995 – 1999	314	1
Steel	1995 – 1999	1995 – 1999	36	0
Fibreglass	1925 – 1929	1970 – 1974	0	0
Fibreglass		1975 – 1979	0	0
Fibreglass		1980 – 1984	0	0
Fibreglass		1985 – 1989	0	0
Fibreglass		1990 – 1994	0	0
Fibreglass		1995 – 1999	0	0
Fibreglass	1930 – 1934	1970 – 1974	0	0
Fibreglass		1975 – 1979	0	0
Fibreglass		1980 – 1984	0	0
Fibreglass		1985 – 1989	0	0
Fibreglass		1990 – 1994	0	0
Fibreglass		1995 – 1999	0	0
Fibreglass	1935 – 1939	1970 – 1974	0	0
Fibreglass		1975 – 1979	0	0
Fibreglass		1980 – 1984	0	0
Fibreglass		1985 – 1989	0	0
Fibreglass		1990 – 1994	0	0
Fibreglass		1995 – 1999	0	0
Fibreglass	1940 – 1944	1970 – 1974	0	0
Fibreglass		1975 – 1979	0	0
Fibreglass		1980 – 1984	0	0
Fibreglass		1985 – 1989	0	0
Fibreglass		1990 – 1994	0	0
Fibreglass		1995 – 1999	0	0
Fibreglass	1945 – 1949	1970 – 1974	0	0
Fibreglass		1975 – 1979	0	0
Fibreglass		1980 – 1984	0	0
Fibreglass		1985 – 1989	0	0

Fibreglass		1990 – 1994	0	0
Fibreglass		1995 – 1999	0	0
Fibreglass	1950 – 1954	1970 – 1974	0	0
Fibreglass		1975 – 1979	0	0
Fibreglass		1980 – 1984	0	0
Fibreglass		1985 – 1989	0	0
Fibreglass		1990 – 1994	0	0
Fibreglass		1995 – 1999	0	0
Fibreglass	1955 – 1959	1970 – 1974	0	0
Fibreglass		1975 – 1979	0	0
Fibreglass		1980 – 1984	0	0
Fibreglass		1985 – 1989	0	0
Fibreglass		1990 – 1994	0	0
Fibreglass		1995 – 1999	0	0
Fibreglass	1960 – 1964	1970 – 1974	0	0
Fibreglass		1975 – 1979	0	0
Fibreglass		1980 – 1984	0	0
Fibreglass		1985 – 1989	0	0
Fibreglass		1990 – 1994	0	0
Fibreglass		1995 – 1999	0	0
Fibreglass	1965 – 1969	1970 – 1974	0	0
Fibreglass		1975 – 1979	0	0
Fibreglass		1980 – 1984	0	0
Fibreglass		1985 – 1989	0	0
Fibreglass		1990 – 1994	0	0
Fibreglass		1995 – 1999	0	0
Fibreglass	1970 – 1974	1970 – 1974	0	0
Fibreglass		1975 – 1979	12	0
Fibreglass		1980 – 1984	65	0
Fibreglass		1985 – 1989	12	0
Fibreglass		1990 – 1994	0	0

Fibreglass		1995 – 1999	0	0
Fibreglass	1975 – 1979	1975 – 1979	60	0
Fibreglass		1980 – 1984	36	1
Fibreglass		1985 – 1989	24	0
Fibreglass		1990 – 1994	0	0
Fibreglass		1995 – 1999	0	0
Fibreglass	1980 – 1984	1980 – 1984	372	0
Fibreglass		1985 – 1989	336	2
Fibreglass		1990 – 1994	7	0
Fibreglass		1995 – 1999	0	0
Fibreglass	1985 – 1989	1985 – 1989	540	0
Fibreglass		1990 – 1994	198	2
Fibreglass		1995 – 1999	0	0
Fibreglass	1990 – 1994	1990 – 1994	12	0
Fibreglass		1995 – 1999	0	0
Fibreglass	1995 – 1999	1995 – 1999	0	0
TOTAL				**249**

Note: Data includes 249 instead of 251 claims. The two missing claims both occurred in 1973 refer to Wooden Fishing Vessels, for which the year of construction is not known.

Table 5.8 – Average claims of fishing vessels between 1970 and 1999 (adjusted for inflation)

Ship Type	Year of Construction	Period of Operation	Average Amount of Claim
Wooden	1925 – 1929	1970 – 1974	0.00
Wooden		1975 – 1979	0.00
Wooden		1980 – 1984	0.00
Wooden		1985 – 1989	0.00
Wooden		1990 – 1994	0.00

Wooden		1995 – 1999	0.00
Wooden	1930 – 1934	1970 – 1974	0.00
Wooden		1975 – 1979	597.07
Wooden		1980 – 1984	247.52
Wooden		1985 – 1989	0.00
Wooden		1990 – 1994	0.00
Wooden		1995 – 1999	0.00
Wooden	1935 – 1939	1970 – 1974	22.14
Wooden		1975 – 1979	3,044.71
Wooden		1980 – 1984	2,384.74
Wooden		1985 – 1989	6,014.02
Wooden		1990 – 1994	0.00
Wooden		1995 – 1999	0.00
Wooden	1940 – 1944	1970 – 1974	0.00
Wooden		1975 – 1979	0.00
Wooden		1980 – 1984	0.00
Wooden		1985 – 1989	0.00
Wooden		1990 – 1994	0.00
Wooden		1995 – 1999	0.00
Wooden	1945 – 1949	1970 – 1974	349.71
Wooden		1975 – 1979	3,185.87
Wooden		1980 – 1984	451.03
Wooden		1985 – 1989	2,707.88
Wooden		1990 – 1994	0.00
Wooden		1995 – 1999	0.00
Wooden	1950 – 1954	1970 – 1974	66.73
Wooden		1975 – 1979	34.89
Wooden		1980 – 1984	895.87
Wooden		1985 – 1989	27,278.23
Wooden		1990 – 1994	0.00
Wooden		1995 – 1999	0.00

Wooden	1955 – 1959	1970 – 1974	0.00
Wooden		1975 – 1979	141.03
Wooden		1980 – 1984	4,697.41
Wooden		1985 – 1989	20,458.67
Wooden		1990 – 1994	0.00
Wooden		1995 – 1999	0.00
Wooden	1960 – 1964	1970 – 1974	17.70
Wooden		1975 – 1979	77.76
Wooden		1980 – 1984	2,407.02
Wooden		1985 – 1989	1,350.48
Wooden		1990 – 1994	0.00
Wooden		1995 – 1999	0.00
Wooden	1965 – 1969	1970 – 1974	0.00
Wooden		1975 – 1979	235.28
Wooden		1980 – 1984	279.18
Wooden		1985 – 1989	3,111.22
Wooden		1990 – 1994	39,142.50
Wooden		1995 – 1999	0.00
Wooden	1970 – 1974	1970 – 1974	174.57
Wooden		1975 – 1979	82.84
Wooden		1980 – 1984	2,302.63
Wooden		1985 – 1989	4,695.35
Wooden		1990 – 1994	0.00
Wooden		1995 – 1999	80,815.32
Wooden	1975 – 1979	1975 – 1979	3,014.90
Wooden		1980 – 1984	438.60
Wooden		1985 – 1989	11,594.18
Wooden		1990 – 1994	3,586.62
Wooden		1995 – 1999	0.00
Wooden	1980 – 1984	1980 – 1984	6,452.17
Wooden		1985 – 1989	4,781.57

Wooden		1990 – 1994	0.00
Wooden		1995 – 1999	0.00
Wooden	1985 – 1989	1985 – 1989	15,190.36
Wooden		1990 – 1994	45,237.37
Wooden		1995 – 1999	0.00
Wooden	1990 – 1994	1990 – 1994	0.00
Wooden		1995 – 1999	0.00
Wooden	1995 – 1999	1995 – 1999	0.00
Steel	1925 – 1929	1970 – 1974	0.00
Steel		1975 – 1979	0.00
Steel		1980 – 1984	0.00
Steel		1985 – 1989	0.00
Steel		1990 – 1994	0.00
Steel		1995 – 1999	0.00
Steel	1930 – 1934	1970 – 1974	0.00
Steel		1975 – 1979	0.00
Steel		1980 – 1984	0.00
Steel		1985 – 1989	0.00
Steel		1990 – 1994	0.00
Steel		1995 – 1999	0.00
Steel	1935 – 1939	1970 – 1974	0.00
Steel		1975 – 1979	0.00
Steel		1980 – 1984	0.00
Steel		1985 – 1989	0.00
Steel		1990 – 1994	0.00
Steel		1995 – 1999	0.00
Steel	1940 – 1944	1970 – 1974	0.00
Steel		1975 – 1979	19,007.36
Steel		1980 – 1984	48,945.10
Steel		1985 – 1989	0.00
Steel		1990 – 1994	211,680.00

Steel		1995 – 1999	0.00
Steel	1945 – 1949	1970 – 1974	3,220.00
Steel		1975 – 1979	2,976.52
Steel		1980 – 1984	34,161.98
Steel		1985 – 1989	33,837.82
Steel		1990 – 1994	67,923.56
Steel		1995 – 1999	0.00
Steel	1950 – 1954	1970 – 1974	0.00
Steel		1975 – 1979	0.00
Steel		1980 – 1984	32,281.47
Steel		1985 – 1989	0.00
Steel		1990 – 1994	0.00
Steel		1995 – 1999	0.00
Steel	1955 – 1959	1970 – 1974	0.00
Steel		1975 – 1979	2,248.92
Steel		1980 – 1984	20,873.53
Steel		1985 – 1989	113,850.00
Steel		1990 – 1994	309,484.68
Steel		1995 – 1999	0.00
Steel	1960 – 1964	1970 – 1974	3,157.94
Steel		1975 – 1979	513.50
Steel		1980 – 1984	4,805.71
Steel		1985 – 1989	60,437.16
Steel		1990 – 1994	146,296.12
Steel		1995 – 1999	0.00
Steel	1965 – 1969	1970 – 1974	106.04
Steel		1975 – 1979	20,350.00
Steel		1980 – 1984	0.00
Steel		1985 – 1989	17,365.50
Steel		1990 – 1994	152,762.86
Steel		1995 – 1999	514,100.19

Steel	1970 – 1974	1970 – 1974	101.20
Steel		1975 – 1979	409.80
Steel		1980 – 1984	1,304.68
Steel		1985 – 1989	51,965.50
Steel		1990 – 1994	79,584.61
Steel		1995 – 1999	0.00
Steel	1975 – 1979	1975 – 1979	1,409.46
Steel		1980 – 1984	1,627.30
Steel		1985 – 1989	58,624.16
Steel		1990 – 1994	63,152.23
Steel		1995 – 1999	73,507.71
Steel	1980 – 1984	1980 – 1984	0.00
Steel		1985 – 1989	9,587.86
Steel		1990 – 1994	135,659.09
Steel		1995 – 1999	0.00
Steel	1985 – 1989	1985 – 1989	16,188.12
Steel		1990 – 1994	172,793.16
Steel		1995 – 1999	0.00
Steel	1990 – 1994	1990 – 1994	61,014.00
Steel		1995 – 1999	91,219.16
Steel	1995 – 1999	1995 – 1999	0.00
Fibreglass	1925 – 1929	1970 – 1974	0.00
Fibreglass		1975 – 1979	0.00
Fibreglass		1980 – 1984	0.00
Fibreglass		1985 – 1989	0.00
Fibreglass		1990 – 1994	0.00
Fibreglass		1995 – 1999	0.00
Fibreglass	1930 – 1934	1970 – 1974	0.00
Fibreglass		1975 – 1979	0.00
Fibreglass		1980 – 1984	0.00
Fibreglass		1985 – 1989	0.00

Fibreglass		1990 – 1994	0.00
Fibreglass		1995 – 1999	0.00
Fibreglass	1935 – 1939	1970 – 1974	0.00
Fibreglass		1975 – 1979	0.00
Fibreglass		1980 – 1984	0.00
Fibreglass		1985 – 1989	0.00
Fibreglass		1990 – 1994	0.00
Fibreglass		1995 – 1999	0.00
Fibreglass	1940 – 1944	1970 – 1974	0.00
Fibreglass		1975 – 1979	0.00
Fibreglass		1980 – 1984	0.00
Fibreglass		1985 – 1989	0.00
Fibreglass		1990 – 1994	0.00
Fibreglass		1995 – 1999	0.00
Fibreglass	1945 – 1949	1970 – 1974	0.00
Fibreglass		1975 – 1979	0.00
Fibreglass		1980 – 1984	0.00
Fibreglass		1985 – 1989	0.00
Fibreglass		1990 – 1994	0.00
Fibreglass		1995 – 1999	0.00
Fibreglass	1950 – 1954	1970 – 1974	0.00
Fibreglass		1975 – 1979	0.00
Fibreglass		1980 – 1984	0.00
Fibreglass		1985 – 1989	0.00
Fibreglass		1990 – 1994	0.00
Fibreglass		1995 – 1999	0.00
Fibreglass	1955 – 1959	1970 – 1974	0.00
Fibreglass		1975 – 1979	0.00
Fibreglass		1980 – 1984	0.00
Fibreglass		1985 – 1989	0.00
Fibreglass		1990 – 1994	0.00

Fibreglass		1995 – 1999	0.00
Fibreglass	1960 – 1964	1970 – 1974	0.00
Fibreglass		1975 – 1979	0.00
Fibreglass		1980 – 1984	0.00
Fibreglass		1985 – 1989	0.00
Fibreglass		1990 – 1994	0.00
Fibreglass		1995 – 1999	0.00
Fibreglass	1965 – 1969	1970 – 1974	0.00
Fibreglass		1975 – 1979	0.00
Fibreglass		1980 – 1984	0.00
Fibreglass		1985 – 1989	0.00
Fibreglass		1990 – 1994	0.00
Fibreglass		1995 – 1999	0.00
Fibreglass	1970 – 1974	1970 – 1974	0.00
Fibreglass		1975 – 1979	0.00
Fibreglass		1980 – 1984	0.00
Fibreglass		1985 – 1989	0.00
Fibreglass		1990 – 1994	0.00
Fibreglass		1995 – 1999	0.00
Fibreglass	1975 – 1979	1975 – 1979	0.00
Fibreglass		1980 – 1984	24,990.00
Fibreglass		1985 – 1989	0.00
Fibreglass		1990 – 1994	0.00
Fibreglass		1995 – 1999	0.00
Fibreglass	1980 – 1984	1980 – 1984	0.00
Fibreglass		1985 – 1989	15,544.72
Fibreglass		1990 – 1994	0.00
Fibreglass		1995 – 1999	0.00
Fibreglass	1985 – 1989	1985 – 1989	0.00
Fibreglass		1990 – 1994	293,581.88
Fibreglass		1995 – 1999	0.00

Fibreglass	1990 – 1994	1990 – 1994	0.00
Fibreglass		1995 – 1999	0.00
Fibreglass	1995 – 1999	1995 – 1999	0.00

Table 5.15 – Number of reported damage incidents and average amount of claim by ship type, year of construction and period of operation (for vessels trading in Mediterranean Sea)

Ship Type	Year of Construction	Period of Operation	Number of Damage Incidents	Average Amount of Claim
Wooden	1925 – 1929	1970 – 1974	0	0.00
Wooden		1975 – 1979	0	0.00
Wooden		1980 – 1984	0	0.00
Wooden		1985 – 1989	0	0.00
Wooden		1990 – 1994	0	0.00
Wooden		1995 – 1999	0	0.00
Wooden	1930 – 1934	1970 – 1974	0	0.00
Wooden		1975 – 1979	2	597.07
Wooden		1980 – 1984	1	247.52
Wooden		1985 – 1989	0	0.00
Wooden		1990 – 1994	0	0.00
Wooden		1995 – 1999	0	0.00
Wooden	1935 – 1939	1970 – 1974	1	22.14
Wooden		1975 – 1979	1	3,044.71
Wooden		1980 – 1984	3	2,384.74
Wooden		1985 – 1989	1	6,014.02
Wooden		1990 – 1994	0	0.00
Wooden		1995 – 1999	0	0.00
Wooden	1940 – 1944	1970 – 1974	0	0.00

Wooden		1975 – 1979	0	0.00
Wooden		1980 – 1984	0	0.00
Wooden		1985 – 1989	0	0.00
Wooden		1990 – 1994	0	0.00
Wooden		1995 – 1999	0	0.00
Wooden	1945 – 1949	1970 – 1974	2	349.71
Wooden		1975 – 1979	3	3,185.87
Wooden		1980 – 1984	1	451.03
Wooden		1985 – 1989	1	2,707.88
Wooden		1990 – 1994	0	0.00
Wooden		1995 – 1999	0	0.00
Wooden	1950 – 1954	1970 – 1974	2	66.73
Wooden		1975 – 1979	1	34.89
Wooden		1980 – 1984	3	895.87
Wooden		1985 – 1989	3	27,278.23
Wooden		1990 – 1994	0	0.00
Wooden		1995 – 1999	0	0.00
Wooden	1955 – 1959	1970 – 1974	0	0.00
Wooden		1975 – 1979	1	141.03
Wooden		1980 – 1984	6	4,697.41
Wooden		1985 – 1989	3	9,553.56
Wooden		1990 – 1994	0	0.00
Wooden		1995 – 1999	0	0.00
Wooden	1960 – 1964	1970 – 1974	1	17.70
Wooden		1975 – 1979	4	77.76
Wooden		1980 – 1984	4	2,407.02
Wooden		1985 – 1989	1	1,350.48
Wooden		1990 – 1994	0	0.00
Wooden		1995 – 1999	0	0.00
Wooden	1965 – 1969	1970 – 1974	0	0.00
Wooden		1975 – 1979	6	235.28

Wooden		1980 – 1984	3	279.18
Wooden		1985 – 1989	1	3,111.22
Wooden		1990 – 1994	1	39,142.50
Wooden		1995 – 1999	0	0.00
Wooden	1970 – 1974	1970 – 1974	1	174.57
Wooden		1975 – 1979	6	82.84
Wooden		1980 – 1984	8	2,302.63
Wooden		1985 – 1989	12	4,695.35
Wooden		1990 – 1994	0	0.00
Wooden		1995 – 1999	1	80,815.32
Wooden	1975 – 1979	1975 – 1979	2	3,014.90
Wooden		1980 – 1984	3	438.60
Wooden		1985 – 1989	4	11,594.18
Wooden		1990 – 1994	1	3,586.62
Wooden		1995 – 1999	0	0.00
Wooden	1980 – 1984	1980 – 1984	2	6,452.17
Wooden		1985 – 1989	11	4,781.57
Wooden		1990 – 1994	0	0.00
Wooden		1995 – 1999	0	0.00
Wooden	1985 – 1989	1985 – 1989	6	15,190.36
Wooden		1990 – 1994	1	45,237.37
Wooden		1995 – 1999	0	0.00
Wooden	1990 – 1994	1990 – 1994	0	0.00
Wooden		1995 – 1999	0	0.00
Wooden	1995 – 1999	1995 – 1999	0	0.00
Steel	1925 – 1929	1970 – 1974	0	0.00
Steel		1975 – 1979	0	0.00
Steel		1980 – 1984	0	0.00
Steel		1985 – 1989	0	0.00
Steel		1990 – 1994	0	0.00
Steel		1995 – 1999	0	0.00

Steel	1930 – 1934	1970 – 1974	0	0.00
Steel		1975 – 1979	0	0.00
Steel		1980 – 1984	0	0.00
Steel		1985 – 1989	0	0.00
Steel		1990 – 1994	0	0.00
Steel		1995 – 1999	0	0.00
Steel	1935 – 1939	1970 – 1974	0	0.00
Steel		1975 – 1979	0	0.00
Steel		1980 – 1984	0	0.00
Steel		1985 – 1989	0	0.00
Steel		1990 – 1994	0	0.00
Steel		1995 – 1999	0	0.00
Steel	1940 – 1944	1970 – 1974	0	0.00
Steel		1975 – 1979	0	0.00
Steel		1980 – 1984	0	0.00
Steel		1985 – 1989	0	0.00
Steel		1990 – 1994	1	211,680.00
Steel		1995 – 1999	0	0.00
Steel	1945 – 1949	1970 – 1974	0	0.00
Steel		1975 – 1979	0	0.00
Steel		1980 – 1984	0	0.00
Steel		1985 – 1989	0	0.00
Steel		1990 – 1994	1	18,266.50
Steel		1995 – 1999	0	0.00
Steel	1950 – 1954	1970 – 1974	0	0.00
Steel		1975 – 1979	0	0.00
Steel		1980 – 1984	0	0.00
Steel		1985 – 1989	0	0.00
Steel		1990 – 1994	0	0.00
Steel		1995 – 1999	0	0.00
Steel	1955 – 1959	1970 – 1974	0	0.00

Steel		1975 – 1979	0	0.00
Steel		1980 – 1984	2	13,419.82
Steel		1985 – 1989	0	0.00
Steel		1990 – 1994	0	0.00
Steel		1995 – 1999	0	0.00
Steel	1960 – 1964	1970 – 1974	0	0.00
Steel		1975 – 1979	2	513.50
Steel		1980 – 1984	0	0.00
Steel		1985 – 1989	0	0.00
Steel		1990 – 1994	0	0.00
Steel		1995 – 1999	0	0.00
Steel	1965 – 1969	1970 – 1974	1	106.04
Steel		1975 – 1979	0	0.00
Steel		1980 – 1984	0	0.00
Steel		1985 – 1989	1	202.00
Steel		1990 – 1994	1	44,851.72
Steel		1995 – 1999	0	0.00
Steel	1970 – 1974	1970 – 1974	1	101.20
Steel		1975 – 1979	4	223.02
Steel		1980 – 1984	1	1,304.68
Steel		1985 – 1989	1	51,965.50
Steel		1990 – 1994	3	6,417.50
Steel		1995 – 1999	0	0.00
Steel	1975 – 1979	1975 – 1979	1	1,409.46
Steel		1980 – 1984	1	1,627.30
Steel		1985 – 1989	1	3,024.05
Steel		1990 – 1994	0	0.00
Steel		1995 – 1999	0	0.00
Steel	1980 – 1984	1980 – 1984	0	0.00
Steel		1985 – 1989	8	4,960.49
Steel		1990 – 1994	0	0.00

Steel		1995 – 1999	0	0.00
Steel	1985 – 1989	1985 – 1989	9	9,246.16
Steel		1990 – 1994	5	31,794.40
Steel		1995 – 1999	0	0.00
Steel	1990 – 1994	1990 – 1994	2	13,095.55
Steel		1995 – 1999	0	5,224.17
Steel	1995 – 1999	1995 – 1999	0	0.00
Fibreglass	1925 – 1929	1970 – 1974	0	0.00
Fibreglass		1975 – 1979	0	0.00
Fibreglass		1980 – 1984	0	0.00
Fibreglass		1985 – 1989	0	0.00
Fibreglass		1990 – 1994	0	0.00
Fibreglass		1995 – 1999	0	0.00
Fibreglass	1930 – 1934	1970 – 1974	0	0.00
Fibreglass		1975 – 1979	0	0.00
Fibreglass		1980 – 1984	0	0.00
Fibreglass		1985 – 1989	0	0.00
Fibreglass		1990 – 1994	0	0.00
Fibreglass		1995 – 1999	0	0.00
Fibreglass	1935 – 1939	1970 – 1974	0	0.00
Fibreglass		1975 – 1979	0	0.00
Fibreglass		1980 – 1984	0	0.00
Fibreglass		1985 – 1989	0	0.00
Fibreglass		1990 – 1994	0	0.00
Fibreglass		1995 – 1999	0	0.00
Fibreglass	1940 – 1944	1970 – 1974	0	0.00
Fibreglass		1975 – 1979	0	0.00
Fibreglass		1980 – 1984	0	0.00
Fibreglass		1985 – 1989	0	0.00
Fibreglass		1990 – 1994	0	0.00
Fibreglass		1995 – 1999	0	0.00

Fibreglass	1945 – 1949	1970 – 1974	0	0.00
Fibreglass		1975 – 1979	0	0.00
Fibreglass		1980 – 1984	0	0.00
Fibreglass		1985 – 1989	0	0.00
Fibreglass		1990 – 1994	0	0.00
Fibreglass		1995 – 1999	0	0.00
Fibreglass	1950 – 1954	1970 – 1974	0	0.00
Fibreglass		1975 – 1979	0	0.00
Fibreglass		1980 – 1984	0	0.00
Fibreglass		1985 – 1989	0	0.00
Fibreglass		1990 – 1994	0	0.00
Fibreglass		1995 – 1999	0	0.00
Fibreglass	1955 – 1959	1970 – 1974	0	0.00
Fibreglass		1975 – 1979	0	0.00
Fibreglass		1980 – 1984	0	0.00
Fibreglass		1985 – 1989	0	0.00
Fibreglass		1990 – 1994	0	0.00
Fibreglass		1995 – 1999	0	0.00
Fibreglass	1960 – 1964	1970 – 1974	0	0.00
Fibreglass		1975 – 1979	0	0.00
Fibreglass		1980 – 1984	0	0.00
Fibreglass		1985 – 1989	0	0.00
Fibreglass		1990 – 1994	0	0.00
Fibreglass		1995 – 1999	0	0.00
Fibreglass	1965 – 1969	1970 – 1974	0	0.00
Fibreglass		1975 – 1979	0	0.00
Fibreglass		1980 – 1984	0	0.00
Fibreglass		1985 – 1989	0	0.00
Fibreglass		1990 – 1994	0	0.00
Fibreglass		1995 – 1999	0	0.00
Fibreglass	1970 – 1974	1970 – 1974	0	0.00

Fibreglass		1975 – 1979	0	0.00
Fibreglass		1980 – 1984	0	0.00
Fibreglass		1985 – 1989	0	0.00
Fibreglass		1990 – 1994	0	0.00
Fibreglass		1995 – 1999	0	0.00
Fibreglass	1975 – 1979	1975 – 1979	0	0.00
Fibreglass		1980 – 1984	0	0.00
Fibreglass		1985 – 1989	0	0.00
Fibreglass		1990 – 1994	0	0.00
Fibreglass		1995 – 1999	0	0.00
Fibreglass	1980 – 1984	1980 – 1984	0	0.00
Fibreglass		1985 – 1989	2	15,544.72
Fibreglass		1990 – 1994	0	0.00
Fibreglass		1995 – 1999	0	0.00
Fibreglass	1985 – 1989	1985 – 1989	0	0.00
Fibreglass		1990 – 1994	2	293,581.88
Fibreglass		1995 – 1999	0	0.00
Fibreglass	1990 – 1994	1990 – 1994	0	0.00
Fibreglass		1995 – 1999	0	0.00
Fibreglass	1995 – 1999	1995 – 1999	0	0.00
TOTAL			**164.00**	**1,015,219.69**

Table 5.17 Number of reported damage incidents and average amount of claim by ship type, year of construction and period of operation (for vessels trading off West / East Sea)

Ship Type	Year of Construction	Period of Operation	Number of Damage Incidents	Average Amount of Claim
Wooden	1925 – 1929	1970 – 1974	0	0.00
Wooden		1975 – 1979	0	0.00

Wooden		1980 – 1984	0	0.00
Wooden		1985 – 1989	0	0.00
Wooden		1990 – 1994	0	0.00
Wooden		1995 – 1999	0	0.00
Wooden	1930 – 1934	1970 – 1974	0	0.00
Wooden		1975 – 1979	0	0.00
Wooden		1980 – 1984	0	0.00
Wooden		1985 – 1989	0	0.00
Wooden		1990 – 1994	0	0.00
Wooden		1995 – 1999	0	0.00
Wooden	1935 – 1939	1970 – 1974	0	0.00
Wooden		1975 – 1979	0	0.00
Wooden		1980 – 1984	0	0.00
Wooden		1985 – 1989	0	0.00
Wooden		1990 – 1994	0	0.00
Wooden		1995 – 1999	0	0.00
Wooden	1940 – 1944	1970 – 1974	0	0.00
Wooden		1975 – 1979	0	0.00
Wooden		1980 – 1984	0	0.00
Wooden		1985 – 1989	0	0.00
Wooden		1990 – 1994	0	0.00
Wooden		1995 – 1999	0	0.00
Wooden	1945 – 1949	1970 – 1974	0	0.00
Wooden		1975 – 1979	0	0.00
Wooden		1980 – 1984	0	0.00
Wooden		1985 – 1989	0	0.00
Wooden		1990 – 1994	0	0.00
Wooden		1995 – 1999	0	0.00
Wooden	1950 – 1954	1970 – 1974	0	0.00
Wooden		1975 – 1979	0	0.00
Wooden		1980 – 1984	0	0.00

Wooden		1985 – 1989	0	0.00
Wooden		1990 – 1994	0	0.00
Wooden		1995 – 1999	0	0.00
Wooden	1955 – 1959	1970 – 1974	0	0.00
Wooden		1975 – 1979	0	0.00
Wooden		1980 – 1984	0	0.00
Wooden		1985 – 1989	1	53,174.91
Wooden		1990 – 1994	0	0.00
Wooden		1995 – 1999	0	0.00
Wooden	1960 – 1964	1970 – 1974	0	0.00
Wooden		1975 – 1979	0	0.00
Wooden		1980 – 1984	0	0.00
Wooden		1985 – 1989	0	0.00
Wooden		1990 – 1994	0	0.00
Wooden		1995 – 1999	0	0.00
Wooden	1965 – 1969	1970 – 1974	0	0.00
Wooden		1975 – 1979	0	0.00
Wooden		1980 – 1984	0	0.00
Wooden		1985 – 1989	0	0.00
Wooden		1990 – 1994	0	0.00
Wooden		1995 – 1999	0	0.00
Wooden	1970 – 1974	1970 – 1974	0	0.00
Wooden		1975 – 1979	0	0.00
Wooden		1980 – 1984	0	0.00
Wooden		1985 – 1989	0	0.00
Wooden		1990 – 1994	0	0.00
Wooden		1995 – 1999	0	0.00
Wooden	1975 – 1979	1975 – 1979	0	0.00
Wooden		1980 – 1984	0	0.00
Wooden		1985 – 1989	0	0.00
Wooden		1990 – 1994	0	0.00

Wooden		1995 – 1999	0	0.00
Wooden	1980 – 1984	1980 – 1984	0	0.00
Wooden		1985 – 1989	0	0.00
Wooden		1990 – 1994	0	0.00
Wooden		1995 – 1999	0	0.00
Wooden	1985 – 1989	1985 – 1989	0	0.00
Wooden		1990 – 1994	0	0.00
Wooden		1995 – 1999	0	0.00
Wooden	1990 – 1994	1990 – 1994	0	0.00
Wooden		1995 – 1999	0	0.00
Wooden	1995 – 1999	1995 – 1999	0	0.00
Steel	1925 – 1929	1970 – 1974	0	0.00
Steel		1975 – 1979	0	0.00
Steel		1980 – 1984	0	0.00
Steel		1985 – 1989	0	0.00
Steel		1990 – 1994	0	0.00
Steel		1995 – 1999	0	0.00
Steel	1930 – 1934	1970 – 1974	0	0.00
Steel		1975 – 1979	0	0.00
Steel		1980 – 1984	0	0.00
Steel		1985 – 1989	0	0.00
Steel		1990 – 1994	0	0.00
Steel		1995 – 1999	0	0.00
Steel	1935 – 1939	1970 – 1974	0	0.00
Steel		1975 – 1979	0	0.00
Steel		1980 – 1984	0	0.00
Steel		1985 – 1989	0	0.00
Steel		1990 – 1994	0	0.00
Steel		1995 – 1999	0	0.00
Steel	1940 – 1944	1970 – 1974	0	0.00
Steel		1975 – 1979	4	19,007.36

Steel		1980 – 1984	3	48,945.10
Steel		1985 – 1989	0	0.00
Steel		1990 – 1994	0	0.00
Steel		1995 – 1999	0	0.00
Steel	1945 – 1949	1970 – 1974	1	3,220.00
Steel		1975 – 1979	1	2,976.52
Steel		1980 – 1984	3	34,161.98
Steel		1985 – 1989	3	33,837.82
Steel		1990 – 1994	2	92,752.09
Steel		1995 – 1999	0	0.00
Steel	1950 – 1954	1970 – 1974	0	0.00
Steel		1975 – 1979	0	0.00
Steel		1980 – 1984	2	32,281.47
Steel		1985 – 1989	0	0.00
Steel		1990 – 1994	0	0.00
Steel		1995 – 1999	0	0.00
Steel	1955 – 1959	1970 – 1974	0	0.00
Steel		1975 – 1979	2	2,248.92
Steel		1980 – 1984	2	28,327.25
Steel		1985 – 1989	1	113,850.00
Steel		1990 – 1994	2	309,484.68
Steel		1995 – 1999	0	0.00
Steel	1960 – 1964	1970 – 1974	5	3,157.94
Steel		1975 – 1979	0	0.00
Steel		1980 – 1984	2	4,805.71
Steel		1985 – 1989	1	60,437.16
Steel		1990 – 1994	6	146,296.12
Steel		1995 – 1999	0	0.00
Steel	1965 – 1969	1970 – 1974	0	0.00
Steel		1975 – 1979	1	20,350.00
Steel		1980 – 1984	0	0.00

Steel		1985 – 1989	8	19,510.94
Steel		1990 – 1994	8	166,251.75
Steel		1995 – 1999	1	858,600.00
Steel	1970 – 1974	1970 – 1974	0	0.00
Steel		1975 – 1979	1	1,156.94
Steel		1980 – 1984	0	0.00
Steel		1985 – 1989	0	0.00
Steel		1990 – 1994	2	189,335.27
Steel		1995 – 1999	0	0.00
Steel	1975 – 1979	1975 – 1979	0	0.00
Steel		1980 – 1984	0	0.00
Steel		1985 – 1989	3	77,157.53
Steel		1990 – 1994	3	63,152.23
Steel		1995 – 1999	2	121,554.04
Steel	1980 – 1984	1980 – 1984	0	0.00
Steel		1985 – 1989	1	46,606.81
Steel		1990 – 1994	3	135,659.09
Steel		1995 – 1999	0	0.00
Steel	1985 – 1989	1985 – 1989	1	78,665.77
Steel		1990 – 1994	7	273,506.55
Steel		1995 – 1999	0	0.00
Steel	1990 – 1994	1990 – 1994	1	156,850.90
Steel		1995 – 1999	1	91,219.16
Steel	1995 – 1999	1995 – 1999	0	0.00
Fibreglass	1925 – 1929	1970 – 1974	0	0.00
Fibreglass		1975 – 1979	0	0.00
Fibreglass		1980 – 1984	0	0.00
Fibreglass		1985 – 1989	0	0.00
Fibreglass		1990 – 1994	0	0.00
Fibreglass		1995 – 1999	0	0.00
Fibreglass	1930 – 1934	1970 – 1974	0	0.00

Fibreglass		1975 – 1979	0	0.00
Fibreglass		1980 – 1984	0	0.00
Fibreglass		1985 – 1989	0	0.00
Fibreglass		1990 – 1994	0	0.00
Fibreglass		1995 – 1999	0	0.00
Fibreglass	1935 – 1939	1970 – 1974	0	0.00
Fibreglass		1975 – 1979	0	0.00
Fibreglass		1980 – 1984	0	0.00
Fibreglass		1985 – 1989	0	0.00
Fibreglass		1990 – 1994	0	0.00
Fibreglass		1995 – 1999	0	0.00
Fibreglass	1940 – 1944	1970 – 1974	0	0.00
Fibreglass		1975 – 1979	0	0.00
Fibreglass		1980 – 1984	0	0.00
Fibreglass		1985 – 1989	0	0.00
Fibreglass		1990 – 1994	0	0.00
Fibreglass		1995 – 1999	0	0.00
Fibreglass	1945 – 1949	1970 – 1974	0	0.00
Fibreglass		1975 – 1979	0	0.00
Fibreglass		1980 – 1984	0	0.00
Fibreglass		1985 – 1989	0	0.00
Fibreglass		1990 – 1994	0	0.00
Fibreglass		1995 – 1999	0	0.00
Fibreglass	1950 – 1954	1970 – 1974	0	0.00
Fibreglass		1975 – 1979	0	0.00
Fibreglass		1980 – 1984	0	0.00
Fibreglass		1985 – 1989	0	0.00
Fibreglass		1990 – 1994	0	0.00
Fibreglass		1995 – 1999	0	0.00
Fibreglass	1955 – 1959	1970 – 1974	0	0.00
Fibreglass		1975 – 1979	0	0.00

Fibreglass		1980 – 1984	0	0.00
Fibreglass		1985 – 1989	0	0.00
Fibreglass		1990 – 1994	0	0.00
Fibreglass		1995 – 1999	0	0.00
Fibreglass	1960 – 1964	1970 – 1974	0	0.00
Fibreglass		1975 – 1979	0	0.00
Fibreglass		1980 – 1984	0	0.00
Fibreglass		1985 – 1989	0	0.00
Fibreglass		1990 – 1994	0	0.00
Fibreglass		1995 – 1999	0	0.00
Fibreglass	1965 – 1969	1970 – 1974	0	0.00
Fibreglass		1975 – 1979	0	0.00
Fibreglass		1980 – 1984	0	0.00
Fibreglass		1985 – 1989	0	0.00
Fibreglass		1990 – 1994	0	0.00
Fibreglass		1995 – 1999	0	0.00
Fibreglass	1970 – 1974	1970 – 1974	0	0.00
Fibreglass		1975 – 1979	0	0.00
Fibreglass		1980 – 1984	0	0.00
Fibreglass		1985 – 1989	0	0.00
Fibreglass		1990 – 1994	0	0.00
Fibreglass		1995 – 1999	0	0.00
Fibreglass	1975 – 1979	1975 – 1979	0	0.00
Fibreglass		1980 – 1984	1	24,990.00
Fibreglass		1985 – 1989	0	0.00
Fibreglass		1990 – 1994	0	0.00
Fibreglass		1995 – 1999	0	0.00
Fibreglass	1980 – 1984	1980 – 1984	0	0.00
Fibreglass		1985 – 1989	0	0.00
Fibreglass		1990 – 1994	0	0.00
Fibreglass		1995 – 1999	0	0.00

Fibreglass	1985 – 1989	1985 – 1989	0	0.00
Fibreglass		1990 – 1994	0	0.00
Fibreglass		1995 – 1999	0	0.00
Fibreglass	1990 – 1994	1990 – 1994	0	0.00
Fibreglass		1995 – 1999	0	0.00
Fibreglass	1995 – 1999	1995 – 1999	0	0.00
TOTAL			**85.00**	**3,313,531.09**

APPENDIX “E” – MEMO/02/111

MEMO/02/111

Brussels, 28 May 2002

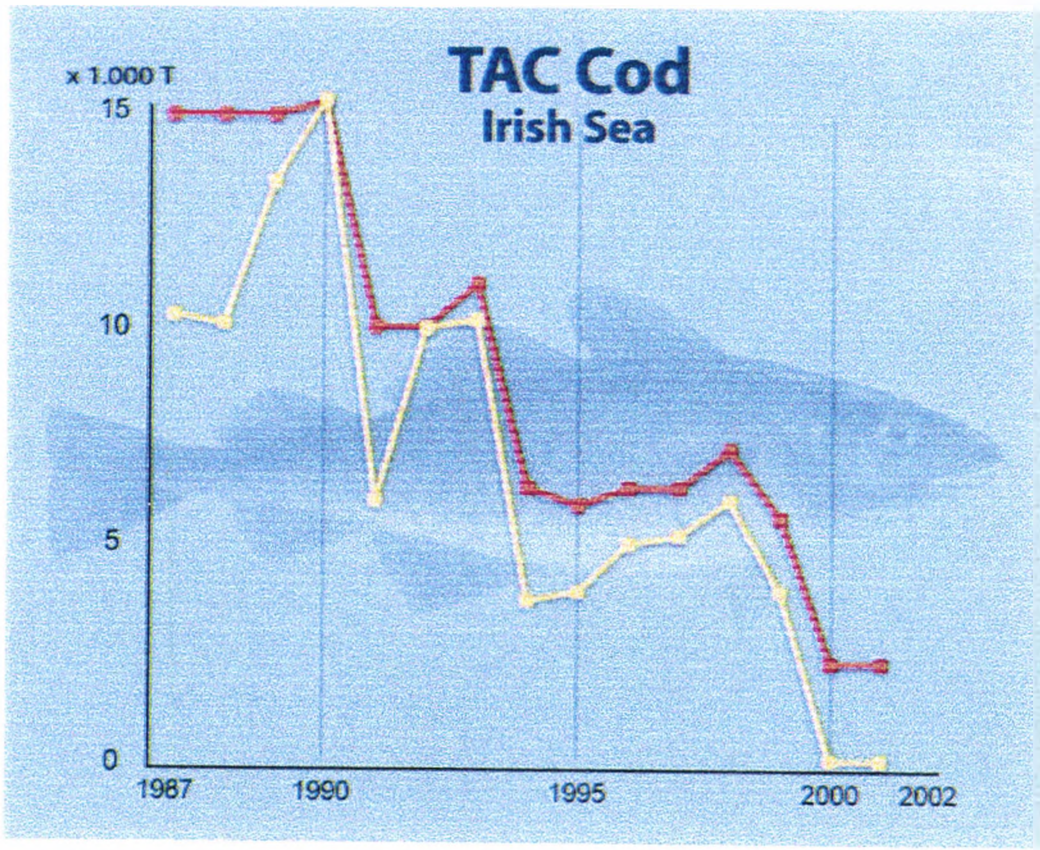
The reform of the common fisheries policy "giving the eu fisheries sector a future"

The main elements of the Commission's proposals to reform the Common Fisheries Policy (CFP).

1. Better conservation of fish stocks

Problem:

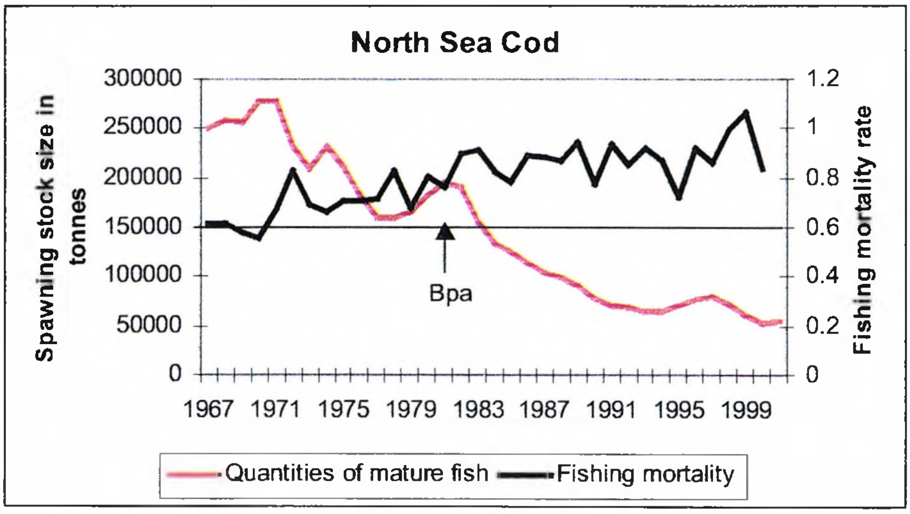
Annual quota setting at levels well above scientific recommendations



yellow line — TACs recommended by scientists
red line — TACs decided by Council of Ministers

Cod stocks in the North Sea have been reduced by 60% in the last 20 years.

The fishing mortality of North Sea cod has been increasing since the late 1960s to unsustainable levels resulting in a declining stock size to levels were the risk of stock collapse is high.



Bpa is a conservation reference point for stock size. If the stock is above this level it is considered to be within safe biological limits

Proposed solution:

Long-term management plans for fish stocks based on sound scientific advice. These plans will end the annual political horse-trading about total allowable catches and quotas and replace it with multi-annual catch targets set within safe biological limits and a fishing effort adapted to these targets. The Council will fix the catch and fishing effort limits for the first fishing year on the basis of the targets set in the plan and the most recent scientific advice about the state of the stocks. In subsequent years, the operation of the plan will be undertaken by the Commission, assisted by a Management Committee on the basis of the most recent scientific advice.

In practical terms this means that catches will be calculated in relation to the maximum amount of fish that can be removed by fishing to ensure that a set quantity of adult fish well above the minimum biological acceptable limits remains in the stock concerned.

2. Better protection for dolphins and sharks

Problem:

By-catches and discards negatively impact the marine ecosystem. Juvenile fish and vulnerable species such as dolphins, sharks or marine birds have particularly been affected by fishing activities.

Proposed solution:

1) new measures to reduce catches of younger fish, by-catches in mixed fisheries and discards and 2) a strategy to promote the protection of vulnerable species.

1. Such measures will include the introduction of more selective fishing gear, such as nets with larger meshes or fitted with square-meshed panels, restrictions on fishing to protect juvenile fish, sensitive non-target species and habitats, minimum landing sizes in line with the selectivity of the gear concerned, "discard ban trials" in which representative samples of fishing vessels would be encouraged through economic incentives to retain their entire catch and the development of economic incentives for the use of more selective fishing practices.
2. A strategy to promote the protection of vulnerable species will include restrictions on certain fishing gears and closed areas and seasons. Measures will shortly be proposed to ensure the protection of sharks, including the prohibition of "finning" - involving the removal of fins and discarding of carcasses - of sharks in EU waters, measures to reduce by-catch of dolphins and a conservation programme concerning sea-birds.

3. Tackling the over-capacity of the EU fleet

Problem:

The EU fleet is too large. EU and national aid have contributed to the over-capacity, which in turn has led to a fishing effort at levels that the stocks cannot sustain.

Proposed solution:

The Commission wants to make public aid work for conservation, not against it. Public aid will no longer be allocated for the renewal and modernisation of the fleet which is already too large. Aid will be restricted to measures concerning safety on board vessels which do not involve capacity in terms of tonnage or power. This means that instead of allocating money to build new vessels to add to a fleet which is already too large the Commission would use aid to eliminate this excess fishing capacity and to help the fishermen who leave the sector find alternative employment or retire.

To encourage the necessary scrapping of vessels, the Commission proposes a reprogramming of funds currently available for building up capacity, the export of vessels or the establishment of joint enterprises under the Financial Instrument for Fisheries Guidance (FIFG) and the addition of € 272 million for emergency scrapping for the period 2003 to 2006 to supplement the FIFG funds.

The new management system proposed by the Commission gives full flexibility to the Member States concerning the distribution of any reduction in fishing effort, and therefore the number and type of vessels to be withdrawn to achieve this reduction.

On the basis of current scientific advice about the main EU fish stocks and estimates of the activities of the fleets concerned, the necessary cut in fishing effort under multi-annual plans would result in an estimated withdrawal of some 8,600 vessels which represents 8.5% of the number of EU fishing vessels and about 350,000 GT or 18% in tonnage.

Problem:

We are in a situation where 10 vessels are chasing fish that 5 or 6 could catch without damaging the stocks or harming the environment. Think of the amount of over-fishing as the 10 vessels compete to catch enough fish to make a living. With fleet reduction targets not ambitious enough and rules too complicated, the EU's "MAGP IV" fleet reduction programme has not worked.

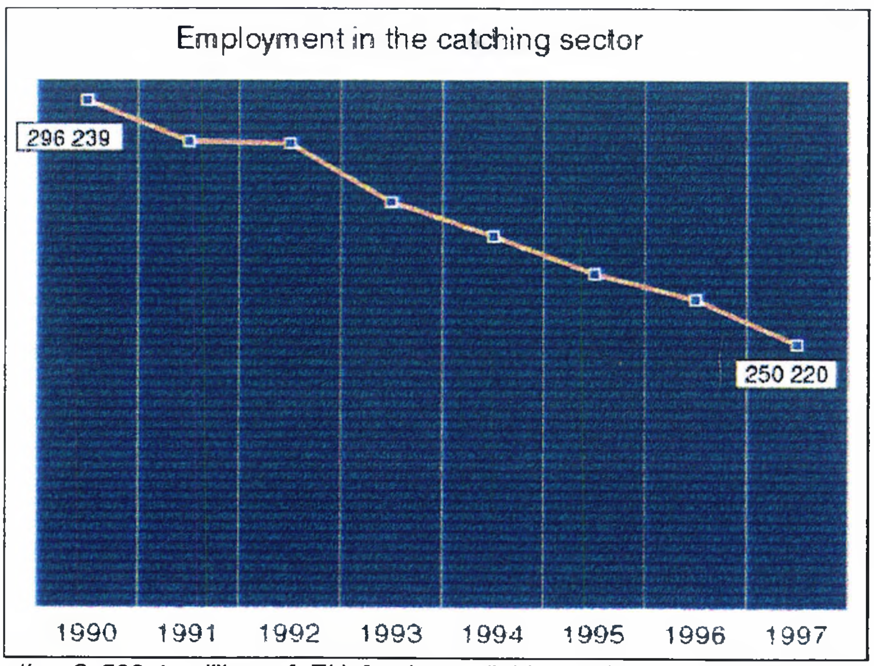
Proposed solution:

The Commission proposes a simpler system than MAGPs for limiting fishing capacity. To prevent the expansion of EU fishing fleets and ensure that Member States have complied with their obligations under MAGP IV, Member States will be required to keep the capacity of the fleet within reference limits fixed on the basis of the final objectives of MAGPIV. Before new capacity may be introduced, at least an equivalent capacity would have to be withdrawn without public aid. When capacity is withdrawn with public aid the reference levels will be automatically be adjusted by the amount of capacity of capacity withdrawn.

4. Addressing the social problems of fishermen who have to leave fishing

Problem:

The fishing sector has been declining for several years. Besides a shrinking resource base and fleet over-capacity, most of the EU fisheries sector faces economic fragility, poor financial profitability and steadily declining employment. Over the period 1990-1998, 66,000 jobs were lost in the catching sector, an overall decrease of 22%.



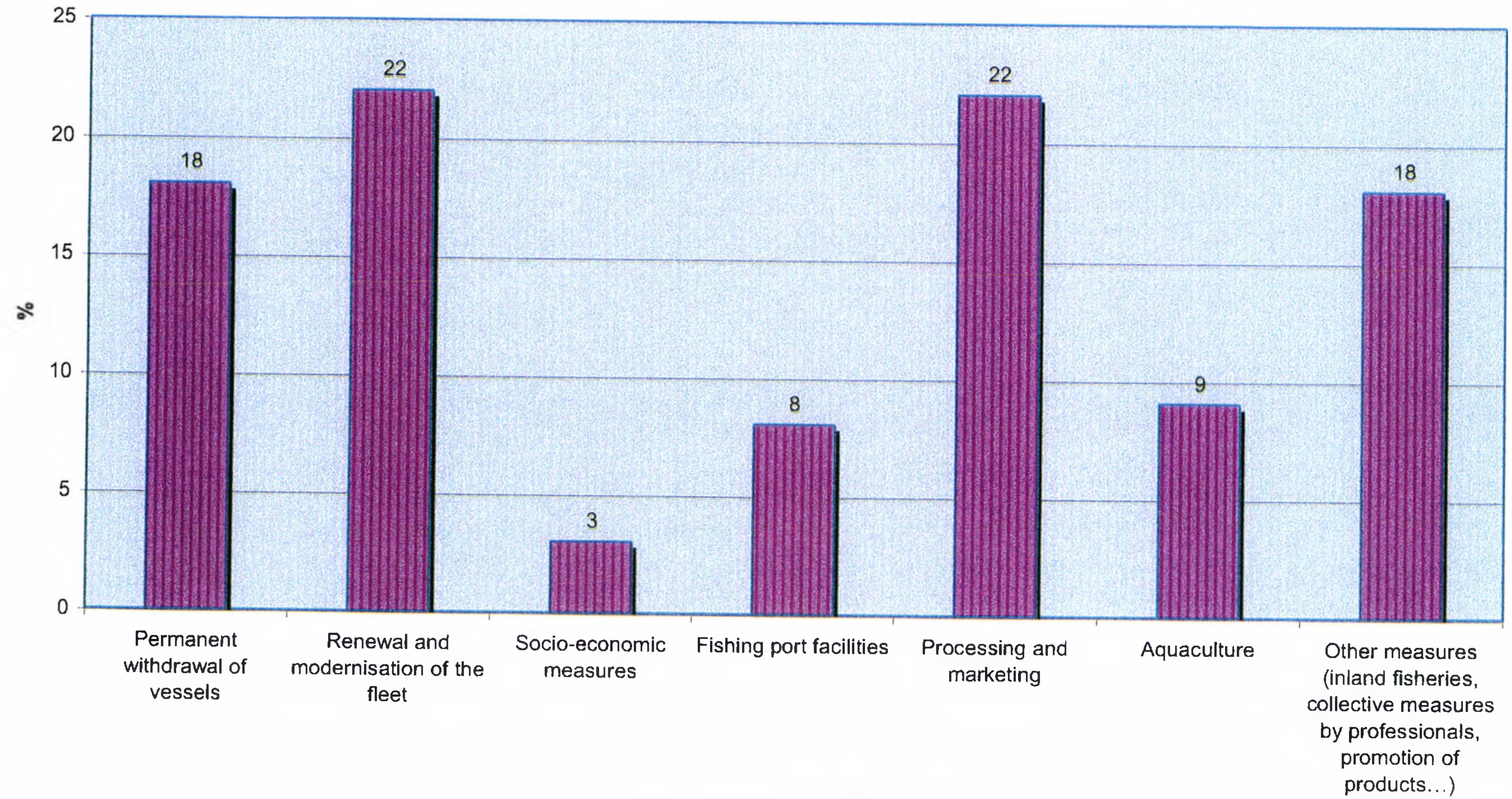
So far, the € 538.4 million of EU funds available each year from the Financial Instrument for Fisheries Guidance (FIFG), have been used to a significant extent for fleet renewal and only to a limited extent for alternatives for the fishermen who have to leave the sector.

Funds available for financial assistance to the fisheries sector under FIFG for the period 2000-2006

(including funds not yet programmed)

Country	Amount (in Million €)
Austria	5.3
Belgium	38.5
Denmark	213.3
Finland	40.4
France	284.6
Germany	221.2
Greece	211.1
Ireland	70.5
Italy	390.3
Netherlands	39.5
Portugal	234.8
Spain	1721.2
Sweden	76.8
United Kingdom	221.2
TOTAL	**3768.7**

PLANNED ALLOCATION OF FIFG FUNDING (2000-2006) BY MEASURES (%)



Total amount of aid €3.7 billion

Proposed solution:

The proposal to exclude, as from 2003, public aid for the transfer of fishing vessels, including in the context of joint enterprises, aid for constructing new fishing vessels and to restrict the aid to modernisation of fishing vessels to improve safety on board would free up € 600 million of EU money to address the social hardship caused to fishermen. Member States, which are responsible for fixing priorities in respect of the use of all EU structural funds, could decide to re-programme this amount in whole or in part to social measures. Thus, more funds would be available for

- co-financing of national early retirement schemes,
- individual compensatory payments to fishermen in case of permanent withdrawal of their vessel,
- payments to fishermen to help them retrain or diversify their activities outside marine fisheries or
- the introduction by Member States of nationally financed accompanying social measures for fishermen in order to facilitate temporary cessation of fishing activities in the framework of plans for the protection of aquatic resources.

Some 80% of fisheries-dependent areas are located in Objective 1 or 2 regions. This means that financial support is programmed at regional level to help productive investment (in particular in SMEs and craft sector or for tourism) in these regions or retraining for professional re-conversion under the European Regional Development Fund (ERDF) and the European Social Fund (ESF). ESF also provides funding to help adapt and modernise policies and systems of education, training and employment in all EU regions.

The Commission will organise bilateral discussions with the Member States to assess the likely employment impact of the proposed measures, identify the regions in which fishermen may require special assistance to find new jobs and examine the scope for adaptation of existing Community aid regimes (FIFG, ERDF and ESF). Appropriate account will be taken of the need of the outermost regions.

The Commission will also present a Action Plan to counter the socio-economic consequences of fisheries restructuring on the basis of these consultations and as soon as the Commission has received all the necessary information from Member States. This Action Plan will complement and fine-tune the provisional estimate of lost jobs and will also address the financial needs in order to accompany the reform of the CFP.

In case further amounts are found to be necessary after reprogramming and the outcome of the mid-term review, the Commission will seek to identify possible sources of additional assistance from the Community budget for 2004 or subsequent years.

Finally, given the lengthy time period over which stock recovery will be needed, a long-term strategy for integrated coastal development of areas currently dependent on fishing should be considered for implementation after 2006.

5. Tighter and more effective controls

Problem:

Current control and enforcement arrangements are insufficient to ensure a level-playing field across the Union undermining the credibility of the CFP. Detection of infringements and sanctions vary according to where a vessel is fishing.

Proposed solution:

To strengthen uniformity in this field, the Commission proposes the creation of a joint inspection structure to co-ordinate national and EU inspection policies and activity and to pool the means and resources for control purposes. This would include the operation of multinational inspection teams in EU and international waters. New technologies such as the satellite vessel monitoring system or VMS will be extended to small vessels. We owe it to all those fishermen who respect the rules to ensure that their efforts are not constantly undermined by those who infringe the rules.

6. Severe and uniform sanctions for infringing the CFP rules

Problem:

Similar breaches seldom result in similar penalties in the different Member States. Fishermen cannot be sure that wrongdoers are adequately sanctioned for acting against the interests of the sector as a whole.

Proposed solution:

The aim is to achieve a level-playing field by introducing more uniform rules for the enforcement of the Common Fisheries Policy including recommended levels for sanctions as well as measures to prevent the repetition of serious infringements.

Given that more effective and uniform enforcement also depends on Member States taking adequate measures, the Commission proposes that Member States which fail to comply with the rules be penalised by, for example, reducing their fishing quotas.

7. Better involvement of stakeholders in the CFP

Problem:

Stakeholders feel alienated from the CFP process. Fishermen, the industry, NGOs or regional authorities have not been sufficiently involved in policy shaping. This lack of involvement undermines support for and compliance with the conservation measures adopted.

Proposed solution:

Participation brings responsibility and a commitment to make common measures work. This is why the Commission proposes the creation of Regional Advisory Councils to ensure the involvement of relevant stakeholders at the local and regional levels in the framing and implementation of measures that concern them.

A better understanding of the basis of scientific advice would encourage fishermen and other relevant players to contribute better to data collection. Their expertise would be useful in the decision-making process. The Regional Advisory Councils would submit suggestions to the Commission or the Member States concerned on fisheries management plans and on the implementation of CFP legislation.

The CFP also needs more flexibility to allow for rapid response in local and emergency circumstances. This is why the Commission proposes to decentralise some management powers to the national level for problems arising within Member States' territorial waters, insofar as they do not contravene EU law.