Trends in Oil Spills from Tankers and ITOPF Non-tanker Attended Incidents

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Abstract

The number of oil spills from tankers has decreased significantly over the last 20 years. The average number of spills between 2002 and 2011 is approximately half of that in the period between 1992 and 2001. The trend in ITOPF attended incidents shows that the percentage of tanker incidents attended per year has decreased and the percentage of non-tanker incidents has increased.

There are many factors that contribute to the overall decline in the volume and frequency of spills, but it is most likely to be a combination of implementation and enforcement of conventions and regulations, training, assessments and communication, and development of technology.

This paper examines trends in tanker oil spills worldwide over a 20 year period from 1992 to 2011 and analyses potential influences on spill volumes and frequencies for incidents in the spill size groups 7-700 tonnes and >700 tonnes. ITOPF's attendance of incidents is also analysed to demonstrate trends in the complexity of oil spill response.

Factors that are used to identify trends include:

- Location, i.e. the countries where spills frequently occur;
- Oil type (crude and refined cargo, and bunker fuel);
- Causes, i.e. the vessel's operation at the time of the incident and the primary cause of the oil spill;
- Shipping legislation; and
- ITOPF attended incidents

1 Introduction

ITOPF maintains a database of oil spills from tankers, combined carriers and barges that contains information on accidental spillages since 1970, except those resulting from acts of war.

The data held includes the type of oil spilt, the spill amount, the cause and location of the incident and the vessel involved. For historical reasons, ITOPF categorises spills by size groups, <7 tonnes, 7-700 tonnes and >700 tonnes (<50 bbls, 50-5,000 bbls, >5,000 bbls).Where information is available the actual amount spilt is also recorded. Information is now held on nearly 10,000 incidents, the vast majority of which (81%) fall into the smallest category i.e. <7 tonnes.

Information is gathered from both published sources, such as the shipping press and other specialist publications, and also from vessel owners and their insurers. Unsurprisingly, large spills tend to be widely reported with information gathered from many sources, whereas the information for small spills is typically brief and not widely available. Due to the sporadic nature of reporting small spills it is not possible to determine whether the database provides a true representation of small spills; therefore this size category has not been included in sections 2 to 7 but has been included in section 8 of this paper, where information relates to spills attended by ITOPF.

It should be noted that the figures for the amount of oil spilt in an incident include all oil lost to the environment, including that which burnt or remained in a sunken vessel.

There is considerable annual variation in both the incidence of oil spills and the amounts of oil lost. Whilst we strive to maintain precise records for all spill information, we cannot guarantee the information taken from shipping press and other sources is complete or accurate. Consequently, the figures in the following tables, and any averages derived from them should be viewed with an element of caution.

2 Trends in the Frequency of Spills from Tankers

Over the past twenty years (1992-2011) there has been a steady decline in the number of spills from tankers per year. During this period, ITOPF has recorded a total of 452 tanker incidents where the quantity of oil spilt was 7 tonnes and over; of this total 79% of spills were between 7-700 tonnes in size, with the remaining 21% being larger than 700 tonnes.

Figure 1 shows the frequency of oil spills in the 7-700 tonnes and >700 tonnes categories and Figure 2 shows a five year average for the frequency of these spills. Both categories show an overall decline in the number of spills since 1992; with the average number of 7-700 tonne spills declining by 3.5 times (25.6 to 7.2 spills per year) and the average number of >700 tonne spills declining by approximately 3 times (7.2 to 2.2 spills per year), between 1992 and 2011.

In the past ten years (2002-2011) the average number of large (>700 tonnes) tanker incidents has almost halved (4 to 2.2 spills per year). Whilst these figures are encouraging and reflect improvements in the shipping industry and the efforts of organisations such as the International Maritime Organization (IMO) and national governments, it should be noted there were 4 incidents in 2010 showing there is deviation from this lower average.

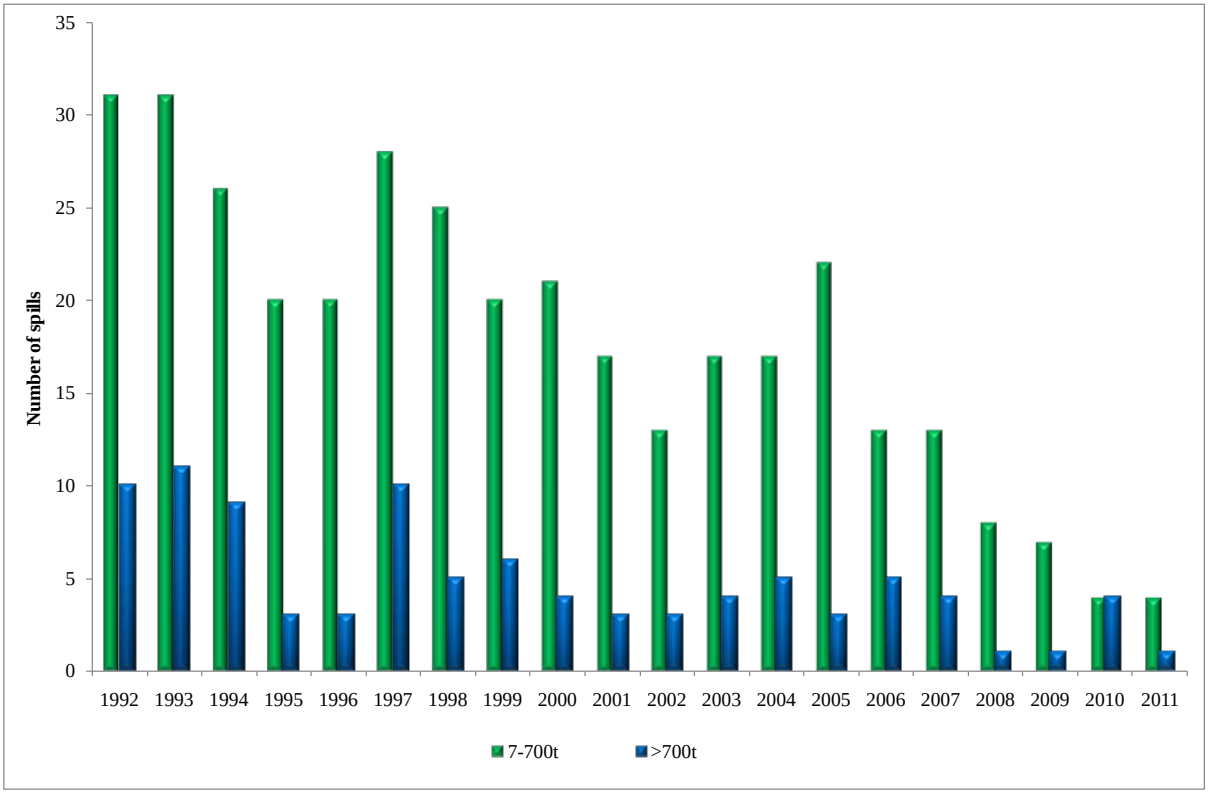

Figure 1: Frequency of tanker spills 7 tonnes and over, 1992 to 2011

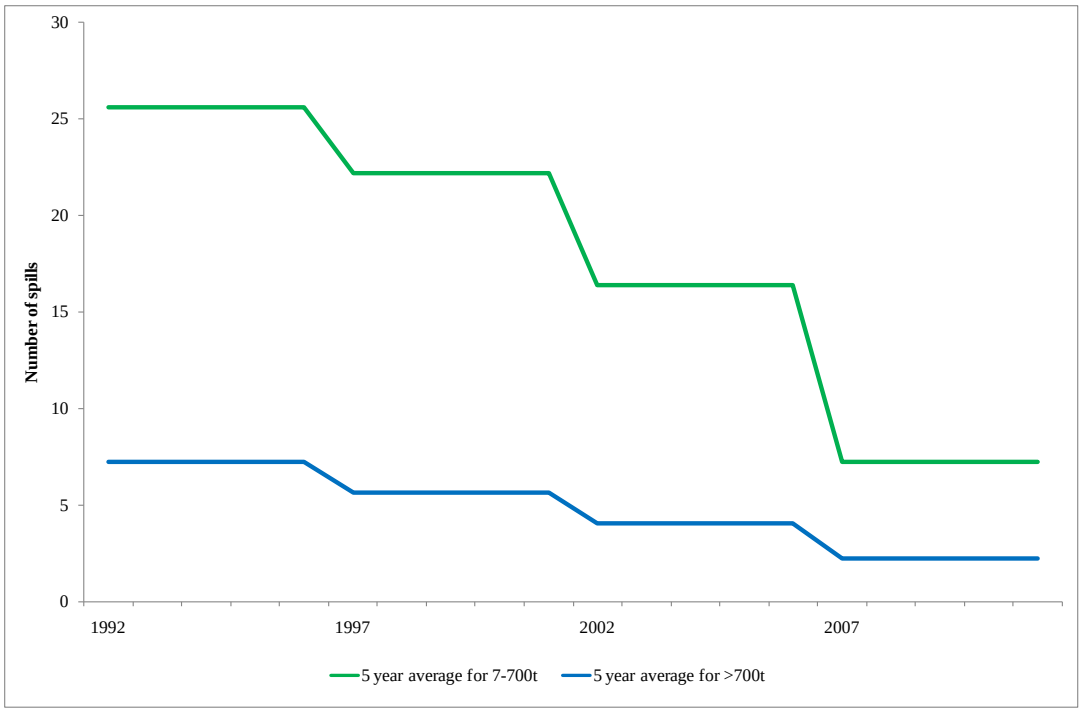

Figure 2: Five year average for frequency of spills 7 tonnes and over from tankers, 1992 to 2011

3 Trends in Spill Volume from Tankers

In the twenty year period 1992-2011, approximately 870,000 tonnes of oil was spilt; this quantity equates to only 15% of the total quantity of oil spilt since ITOPF's records began in 1970 (5.7 million tonnes). Figure 3 shows the quantity of oil spilt each year since 1992, which along with Figure 4 demonstrates the significant reduction in the quantity of oil spilt. From the five year average (Figure 4) it can be seen that the quantity spilt between 2007-2011 is almost 15 times less than that spilt between 1992-1996.

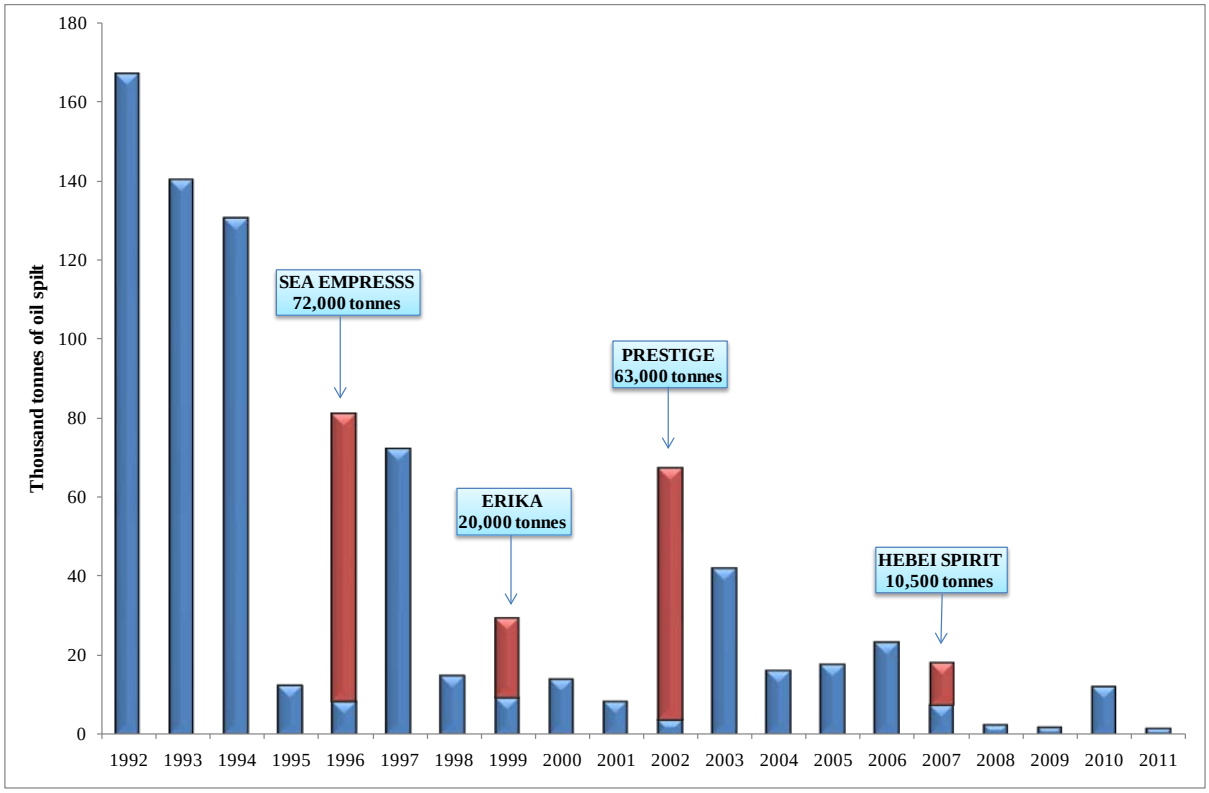

Figure 3: Quantity of oil spilt 7 tonnes and over from tankers, including significant spills, 1992-2011

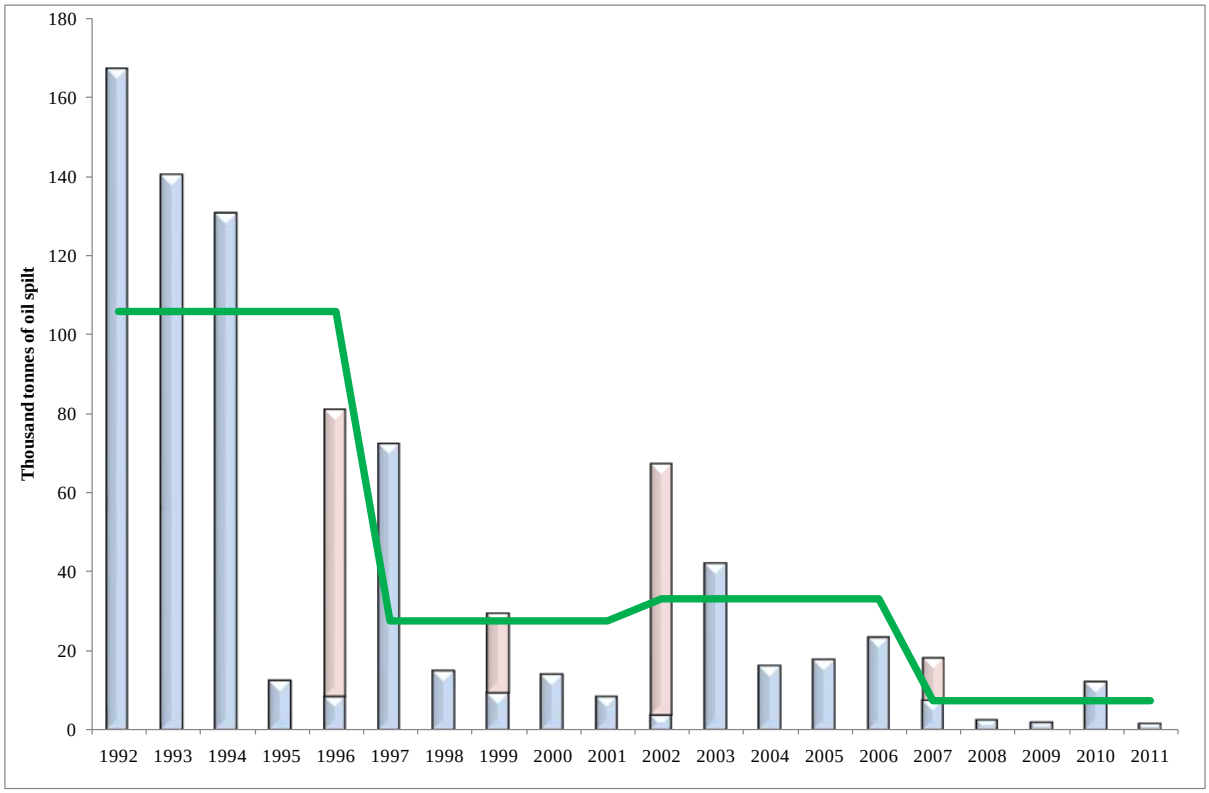

Figure 4: Five year average of the quantity of oil spilt 7 tonnes and over from tankers, 1992 to 2011

When looking at the quantities of oil spilt between 1992 and 2011 it is consistently shown that a few very large spills account for a high percentage of oil spilt. In the period

1992-1996, of the approximate 529,000 tonnes of oil that was spilt from 164 incidents, 84% was from just 10 incidents. This trend continues in the period 2007-2011, of the approximate 36,000 tonnes spilt from 46 incidents, 69% was from just 5 incidents (Figure 5).

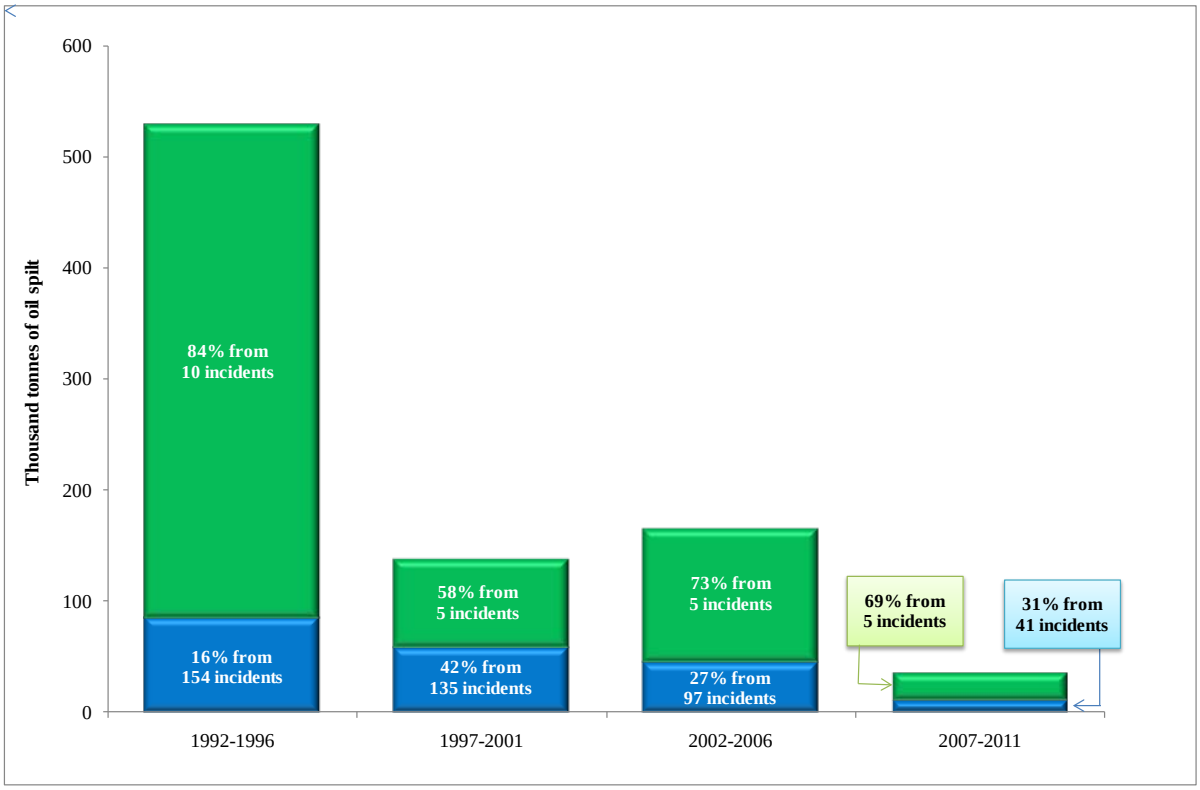

Figure 5: Spills 7 tonnes and over from tankers showing the influence of a relatively small number of comparatively large spills on the overall figure, 1992-2011

The quantity of oil spilt will be influenced by the specific circumstances of the incident, of which the initial cause (i.e. grounding, collision, etc.) can be the most significant contributing factor. For example, the data shows that greater quantities of oil are released in the event of an allision, collision, grounding (see Definitions section) or hull failure compared to other causes such as equipment failure, which mostly occur during loading, discharging and ballasting operations. In these latter situations, the oil releases can often be controlled and halted quickly. However, in the event of allisions, collisions, groundings or hull failures, the ability to quickly control any release of oil may be less straightforward.

Of these causes, groundings and hull failures resulted in the release of greater amounts of oil than allisions and collisions, despite the fewer number of groundings and hull failures recorded (Figure 6). There are many possible factors that could contribute to this trend, including the severity of the damage. Whilst allisions and collisions, by their nature, result in damage to the side of the vessel, this often results in localised damage to a small number of the cargo tanks on-board, often with the possibility to transfer oil internally. Conversely, grounded vessels, for example hard aground on rocks or reefs can be exposed to harsh weather conditions and wave movements, which can result in extensive damage to the hull and tanks, sometimes resulting in catastrophic structural failure and a large release of oil.

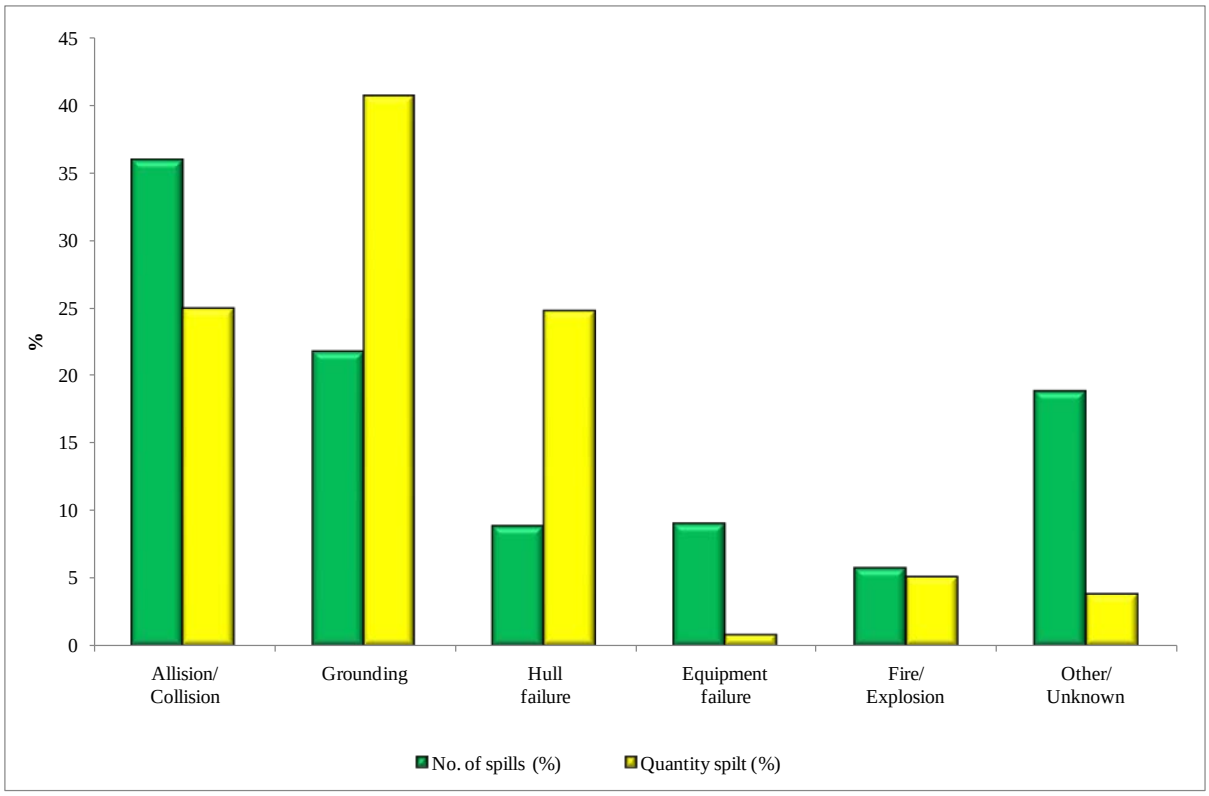

Figure 6: Quantity of oil spilt from tankers and number of spills 7 tonnes and over by cause, 1992-2011

4 Spill Incidents from Tankers by Country

From 1992 to 2011, ITOPF has recorded 452 tanker spills over 7 tonnes in 76 different countries. Figure 7 shows the number of spills by country divided into five year periods: 1992-1996, 1997-2001, 2002-2006 and 2007-2011 for countries experiencing 10 or more spills in total over the twenty year period. The decline in the number of oil spills in these countries can be seen, with the lowest figures for the period 2007-2011 particularly notable.

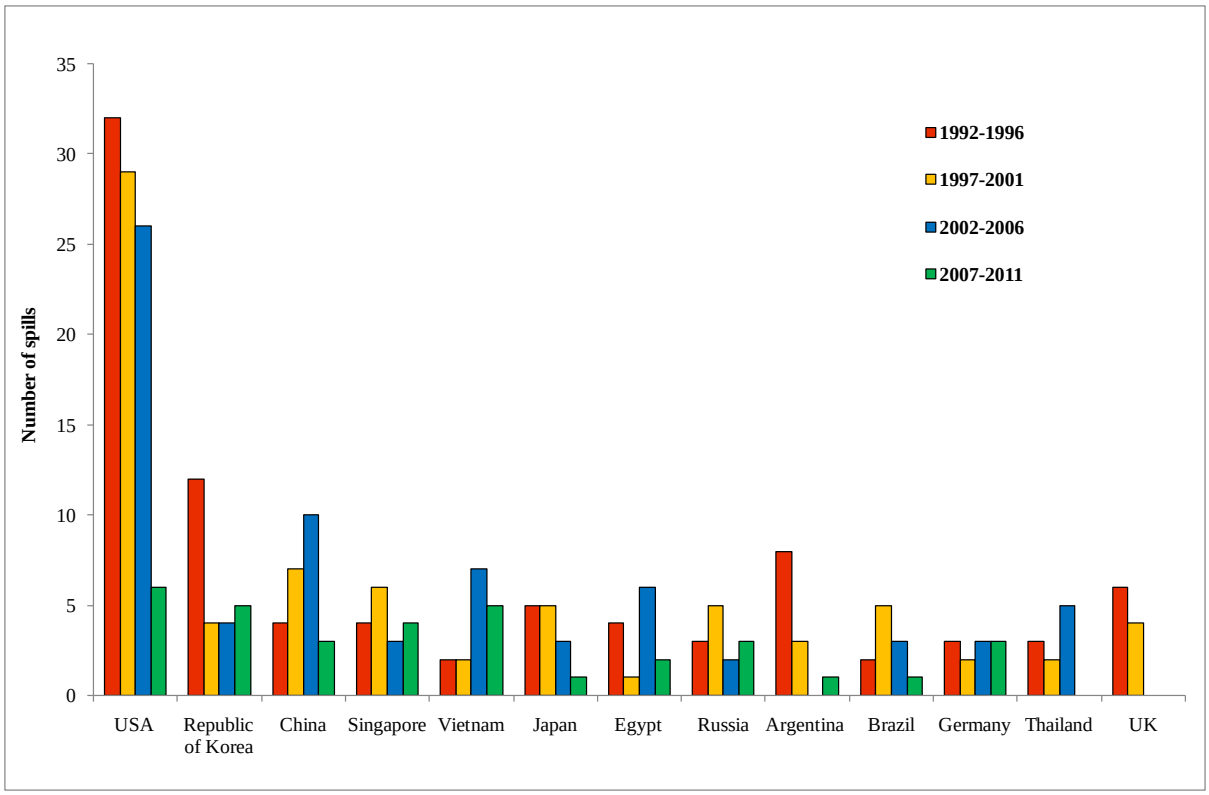

Figure 7: Number of tanker spills by country (countries that experienced 10 or more tanker oil spills between 1992 and 2011).

The USA experienced the highest reported frequency of oil spill incidents, with 21% (93 incidents) of the 452 incidents between 1992 and 2011. However, these figures show that the number of tanker spills occurring in the USA has reduced considerably, with the number of spills between 2007-2011 being five times less than that recorded between 1992-1996. The reduction in the number of spills is likely to be linked to the implementation and enforcement of the Oil Pollution Act of 1990 (see Reasons for Trends section).

The Republic of Korea and China experienced the second and third highest frequencies, with 6% (25 incidents) and 5% (24 incidents) respectively. In comparison to the USA, the number of tanker spills in China has not shown a progressive decline but rather has fluctuated between 3 and 11 spills within these five year periods. The number of spills in the Republic of Korea between 1992-1996 and 1997-2001 has decreased by a third and remained at a total of 4 and 5 spills in the subsequent five year periods.

Excluding the USA, the countries experiencing the highest number of tanker spills (14 or more), in the past twenty years tend to be in Asia where, as shown in Figure 8, high volumes of tanker traffic are present. Of note is Singapore, one of the world's busiest shipping ports, where there have only been 17 incidents in this time period, ranging from 3 to 6 spills in each five year period. This again may be due to enforcement of national legislation such as the Prevention of Pollution of the Sea Act (1999) and use of navigational technology including Vessel Traffic Information Service (VTIS) (Heah Eng Siang, 2000).

Vietnam shows a peak in the number of tanker spills in the 2002-2006 period, which coincides with a 37% average growth rate in port traffic between 2003 and 2006 (ISL, 2011).

Countries such as Egypt, Russia, Brazil, Germany, Thailand and the UK have experienced a higher number of spills (10 or more) in the past twenty years. Almost 60% of the total number of spills occurring in these countries was between 1992 and 2001. When the location of these spills is compared with oil tanker traffic data in 2001 (Figure 8), it can be

seen that they were located on busy shipping routes. This could be a factor affecting the frequency of spills in these areas.

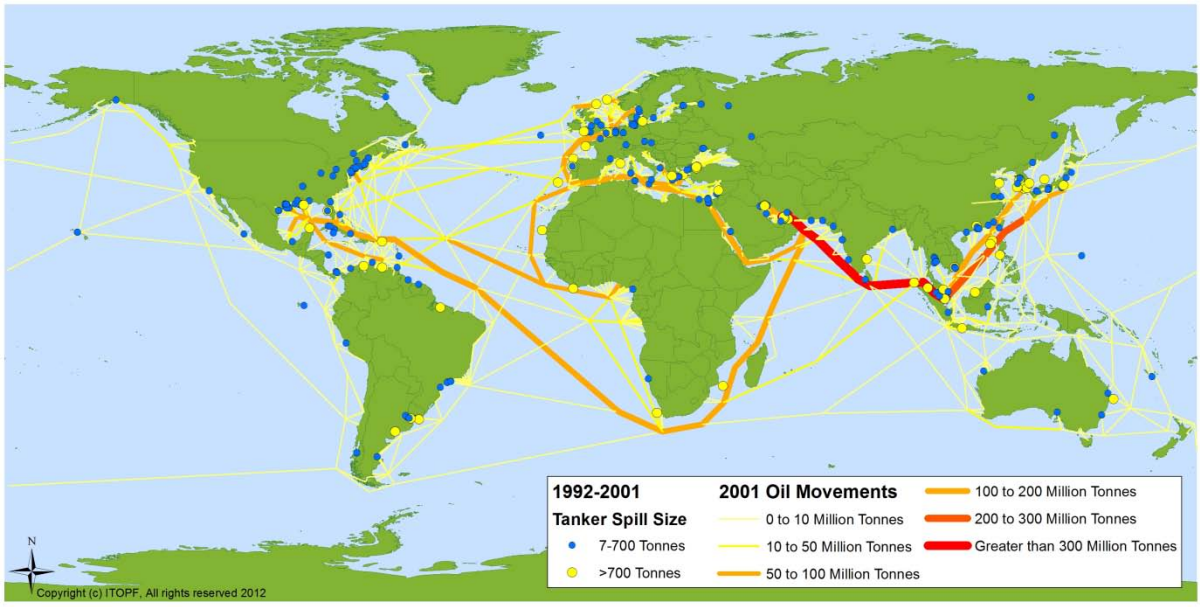

Figure 8: Oil tanker traffic (adapted from Lloyds MIU APEX data 2001 (Lloyds, 2001)) and tanker spills 7 tonnes and over (1992-2001).

5 Types of Oil Spilt from Tankers

Oil tankers transport either crude oil or oil products, such as bitumen, fuel oils, petroleum and naphtha. In addition, significant quantities of bunker fuel and lubricating oil can be carried on-board for use in engines, generators and other machinery. Where the data is available, ITOPF records the type of oil spilt in a tanker incident, which for this analysis has been divided into the following groups:

- Crude cargo
- Persistent refined cargo (i.e. heavy fuel oil)
- Non-persistent refined cargo (i.e. petrol)
- Bunker fuels
- Other (i.e. Lube oil and bilges)
- Unknown

For the purposes of this analysis, the term ‘persistent’ is used to describe oil that contains a large proportion of heavy fractions or high-boiling material and therefore can persist over time when released into the marine environment.

The frequency that each type of oil has been spilt in ten year periods, from 1992-2001 and 2002-2011, is shown in Figure 9. The changes in trends when divided into five year periods were subtle, so in order to observe these changes more clearly the data has been divided into ten year periods.

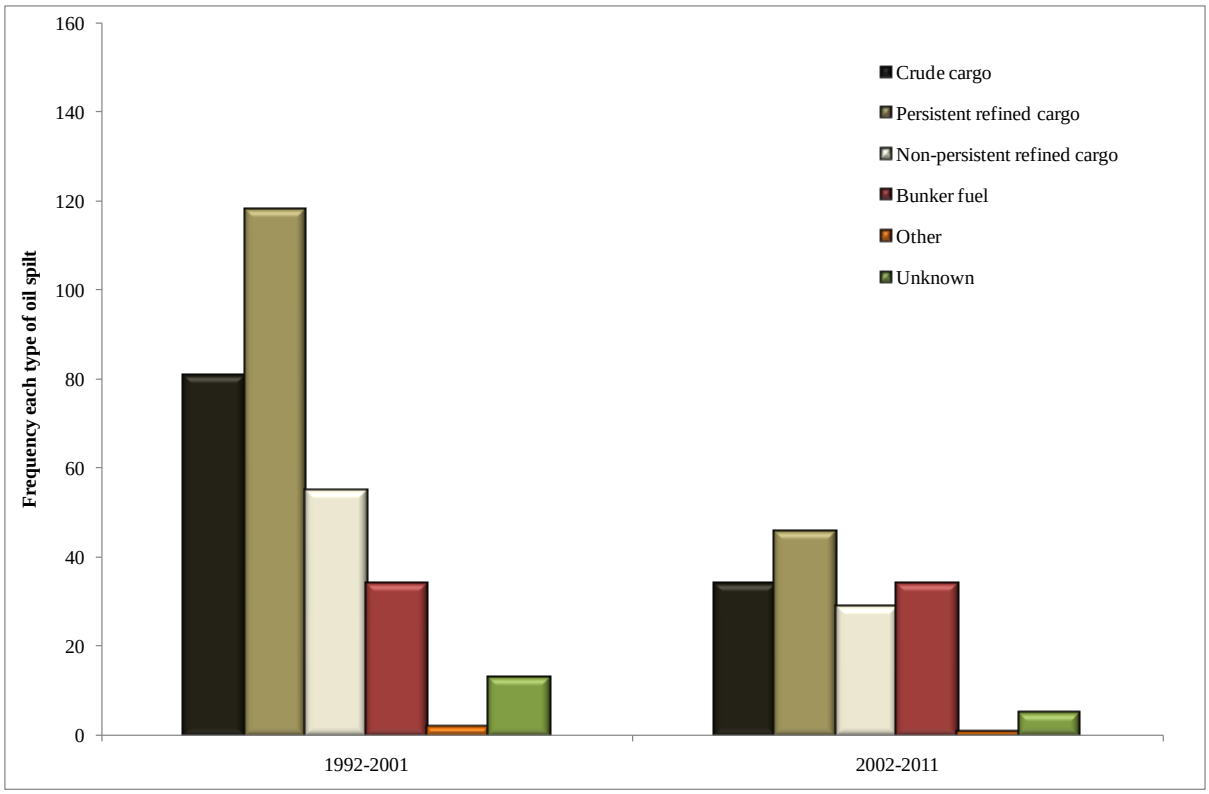

Figure 9: Frequency of release from tankers of 6 categories of oil between 1992 to 2001 and 2002 to 2011 (7 tonnes and over)

Spills of crude oil and both persistent and non-persistent refined oil cargos show a reduction in frequency over the past twenty years; the number of crude oil and refined oil cargo spills have more than halved in the period 2002-2011 compared to 1992-2001. However, in both time periods there continues to be a greater number of refined than crude oil spills. At present the reasons for this trend are not clear.

The overall quantity of oil spilt has decreased in the past twenty years and a very clear decline in the spillage of crude and refined products, comparing 1992-2001 and 2002-2011, can be seen in Figure 10.

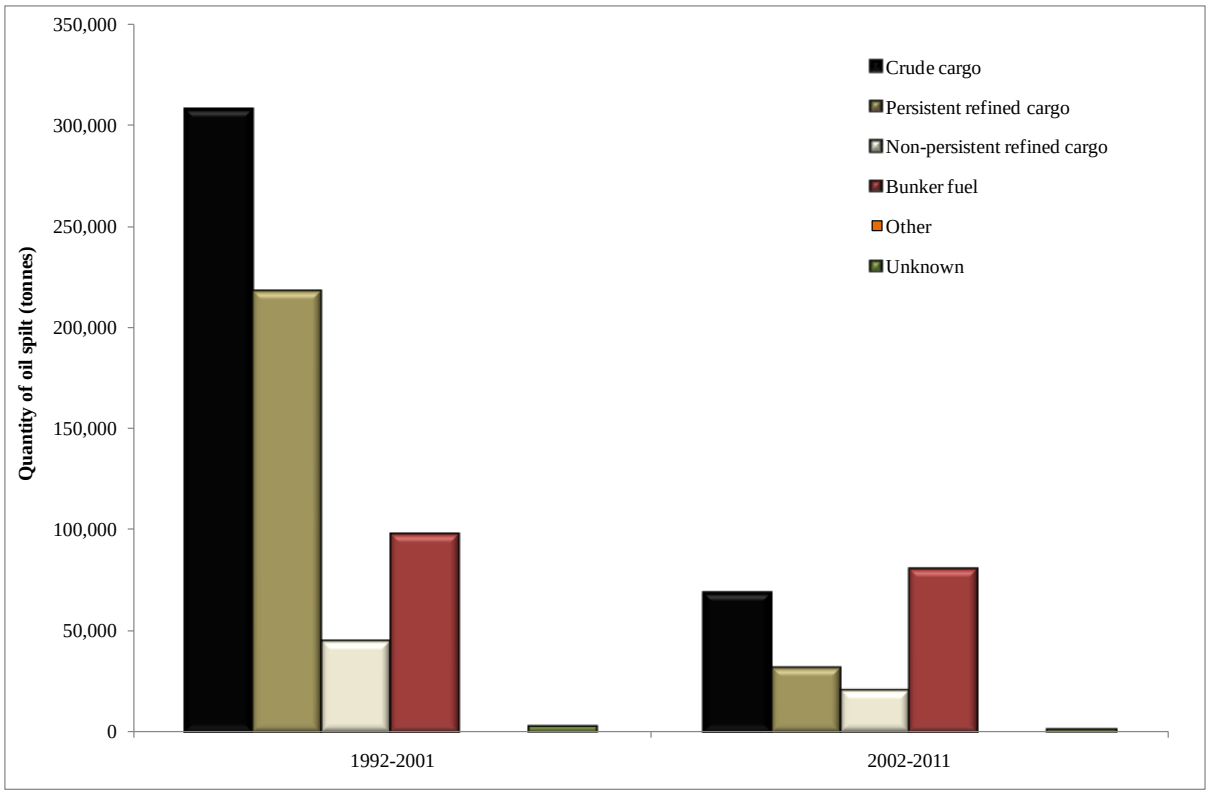

Figure 10: Quantity released from tankers of 6 categories of oil between 1992 to 2001 and 2002 to 2011 (7 tonnes and over)

In both periods the quantity of crude oil spilt was greater than the quantity of refined products spilt, both persistent and non-persistent. When this is compared to the frequency that these types of oils were spilt, it shows that whilst crude oil spills are less frequent than spills of refined oil, the amount of crude oil spilt is often greater. This is likely to be related to the size and carrying capacity of crude tankers compared to product tankers. The largest product tankers range from 120,000 to 200,000 dwt (i.e. Suezmax) where as the largest crude oil tankers can be over 320,000 dwt (i.e. Ultra Large Crude Carriers). From data provided by Lloyds List Intelligence (2011) in the period 1992 to 2011 the average amount of crude oil transported worldwide was approximately 130,000 tonnes per mile travelled, compared to an average of approximately 40,000 tonnes per mile for product (refined) oil (data for product tankers of 60,000 dwt or above is included in this calculation).

6 Operations and Causes of Tanker Spills

The causes and circumstances of oil spills from tankers are varied, but can have a significant effect on the final quantity spilt. The following analysis explores the incidence of spills (7 tonnes and over) from tankers in terms of the operation that the vessel was undertaking at the time of the incident and the primary cause of the spill.

Operations for medium spills (7-700 tonnes) have been grouped into the following categories:

- Loading/Discharging
- Bunkering
- Other Operations (includes activities such as ballasting, deballasting, tank cleaning and when the vessel is underway)
- Unknown Operations.

Reporting of larger spills (>700 tonnes) tends to provide more detailed information, which has allowed further breakdown of vessel operations. Therefore, operations for larger spills have been grouped into the following categories:

- Loading/Discharging
- Bunkering
- At anchor (Inland/Restricted waters)
- At anchor (Open water)
- Underway (Inland/Restricted waters)
- Underway (Open water)
- Other Operations (includes activities such as ballasting, deballasting and tank cleaning)
- Unknown Operations.

The primary causes for both spill size groups have been designated to the following categories:

- Allisions/Collisions
- Groundings
- Hull Failures
- Equipment Failures
- Fires and Explosions
- Other/Unknown (Other includes events such as heavy weather damage and human error. Spills where the relevant information is not available have been designated as unknown.)

Figures 11 and 12 show the number of incidents for spill size 7-700 tonnes, comparing ten year periods 1992-2001 and 2002-2011. In the period 1992-2001, 29% of incidents occurred during loading and discharging operations (69 incidents); during these operations 52% (36 incidents) were caused by hull and equipment failures. Contrastingly, in the period 2002-2011 the percentage of incidents occurring during loading and discharging reduced to 19 % (22 incidents), of which 36% (8 incidents) were caused by hull and equipment failures.

The number of incidents occurring during ‘other’ operations increased from 9% (22 incidents) in the period 1992-2001 to 43% (51 incidents) in the period 2002-2011. The main causes of these other operations were allisions, collisions or groundings (50% in period 1992-2001 and 69% in period 2002-2011).

Furthermore, for both time periods (1992-2001 and 2002-2011) and for all operation categories, 57% of incidents were caused by allisions, collisions or groundings.

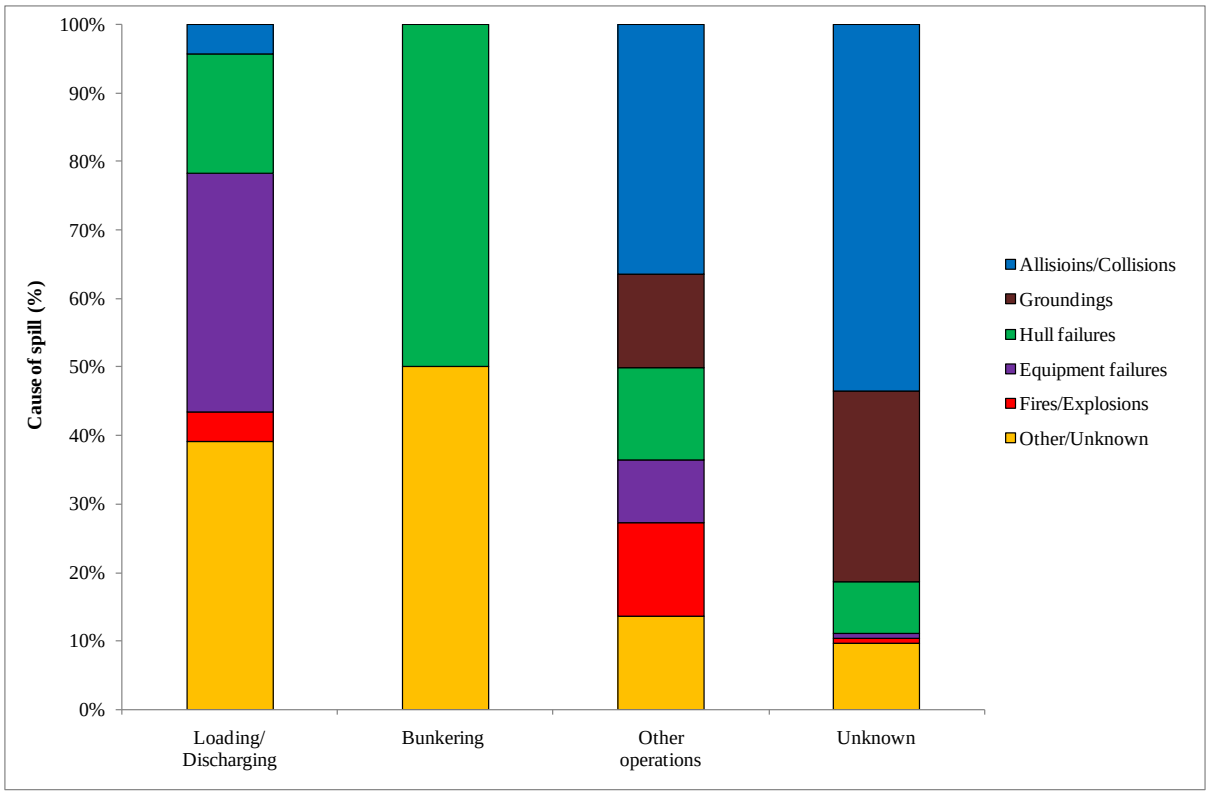

Figure 11: Incidence of tanker oil spills 7-700 tonnes by operation at time of incident and primary cause of spill between, 1992-2001

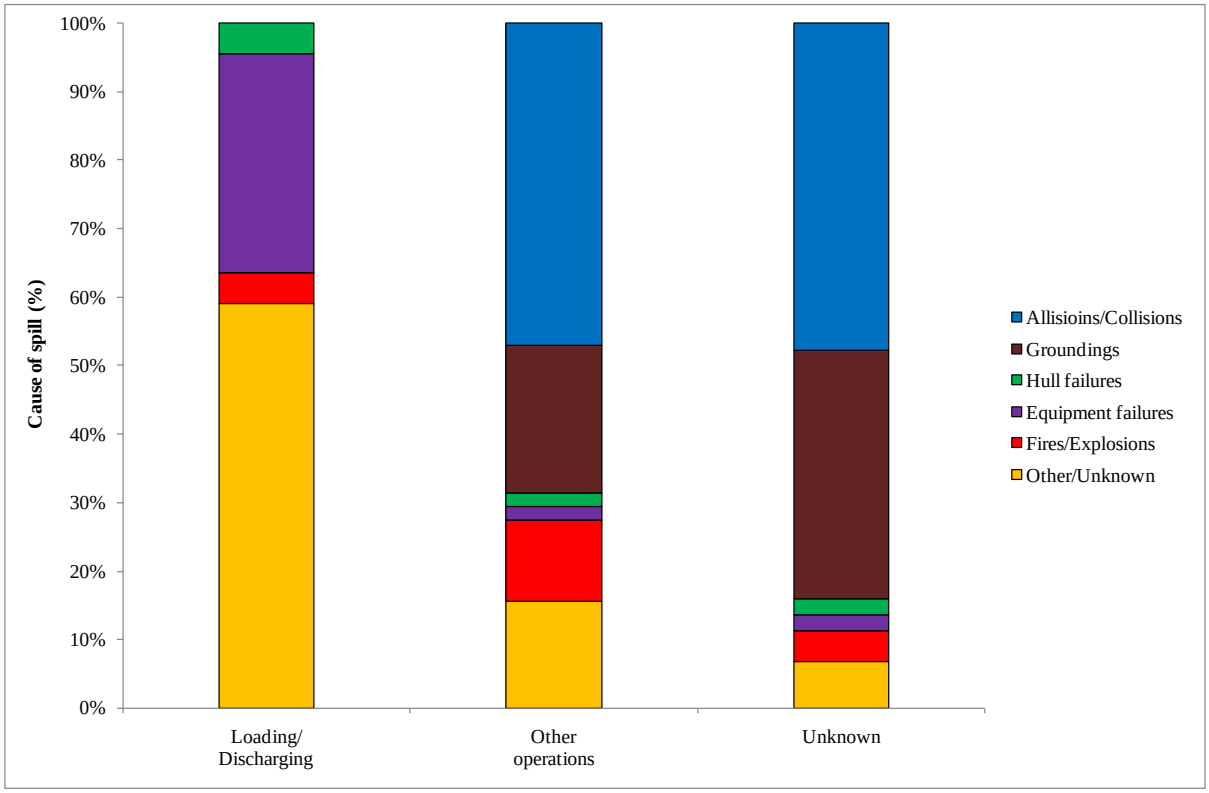

Figure 12: Incidence of tanker oil spills 7-700 tonnes by operation at time of incident and primary cause of spill between, 2002-2011 (One incident in this size category occurred while the vessel was bunkering but has not been included in the above figure)

This trend continues with larger spills of >700 tonnes, where in both time periods approximately 60% of oil spills were caused by allisions, collisions or groundings (Figures 14 and 15). A closer look at the operations at the time of the incident for large spills shows that in the past twenty years, 45% of incidents (42 incidents) occurred whilst the vessel was underway in open water (Figure 13). However, from further analysis, it is encouraging to see that the occurrence of an incident whilst the vessel is underway in open water is five time less in the period 2002-2011 (7 incidents) compared to the period 1992-2001 (35 incidents).

Contrastingly, the number of incidents whilst underway in inland and restricted waters has not changed significantly between 1992-2001 and 2002-2011, in particular the number of incidents caused by allisions, collisions or groundings is almost consistent**.**

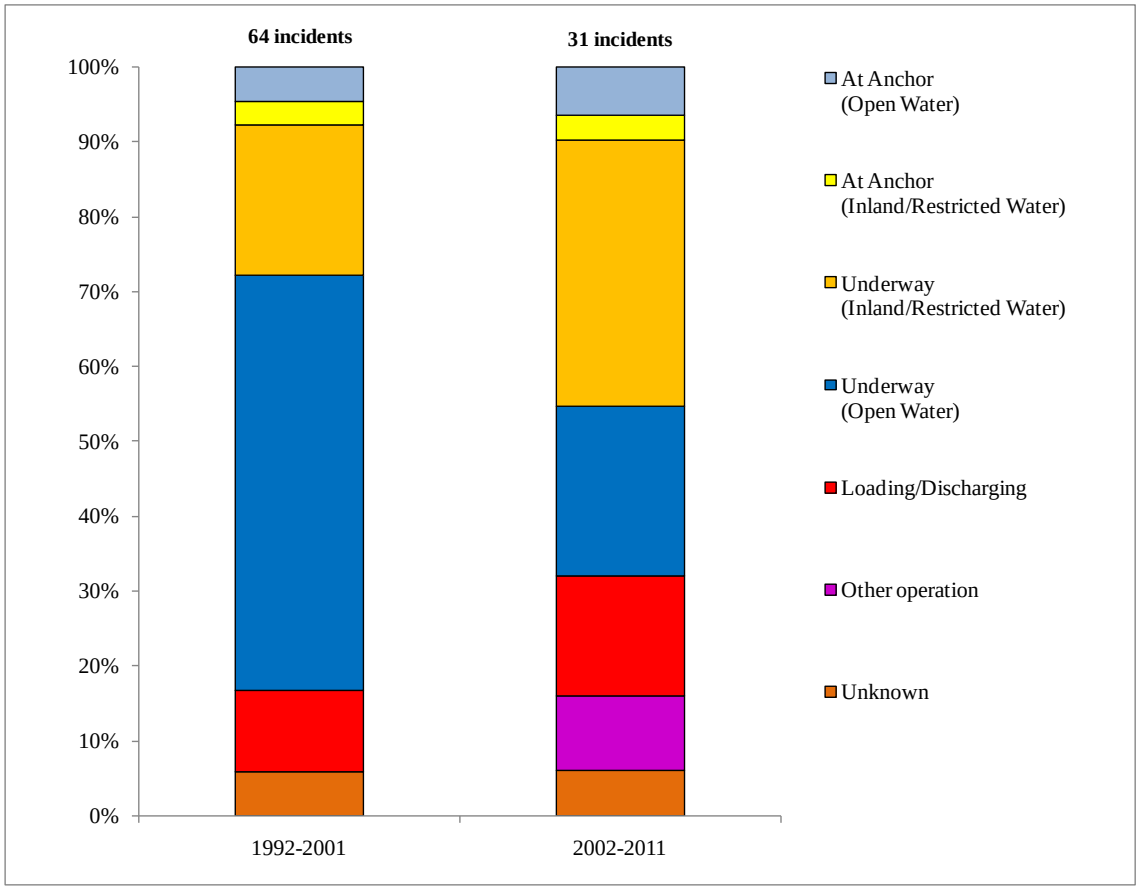

Figure 13: Operation at time of incident for tanker spills over 700 tonnes comparing 1992-2001 and 2002-2011

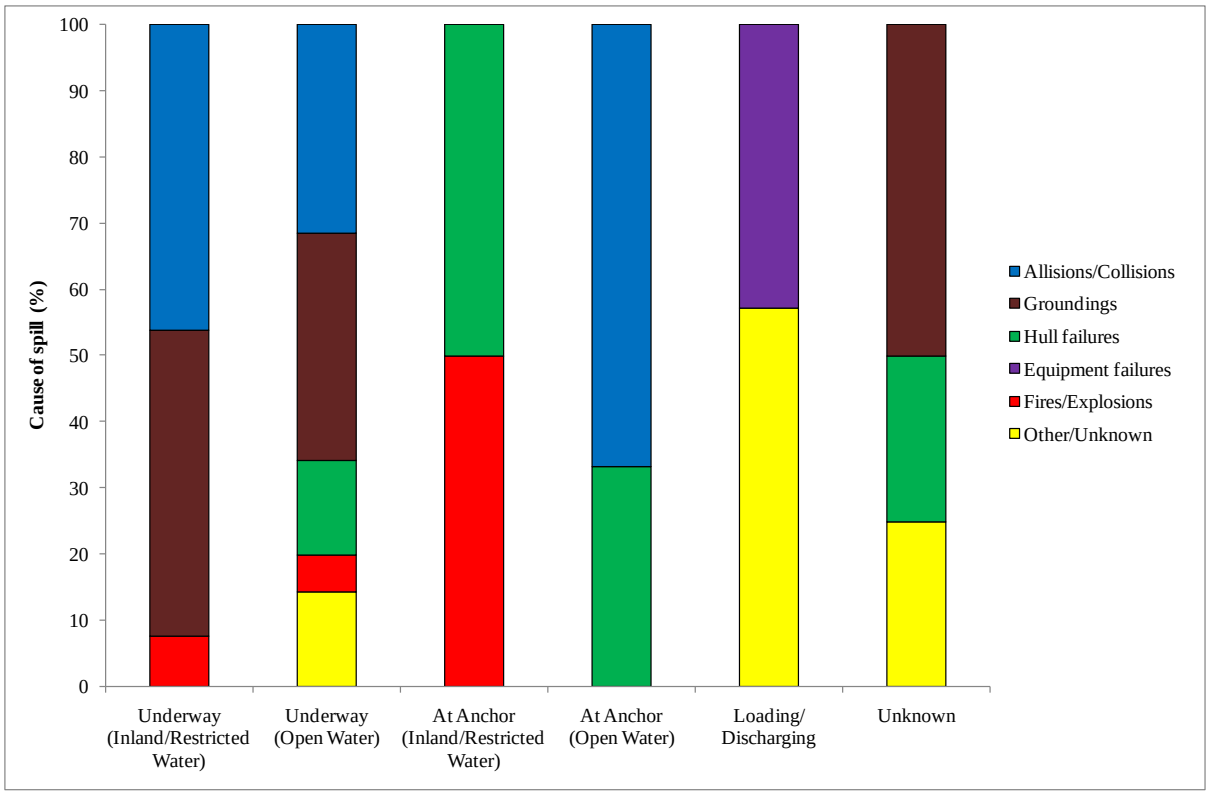

Figure 14: Incidence of tanker spills >700 tonnes by operation at time of incident and primary cause of spill, 1992-2001

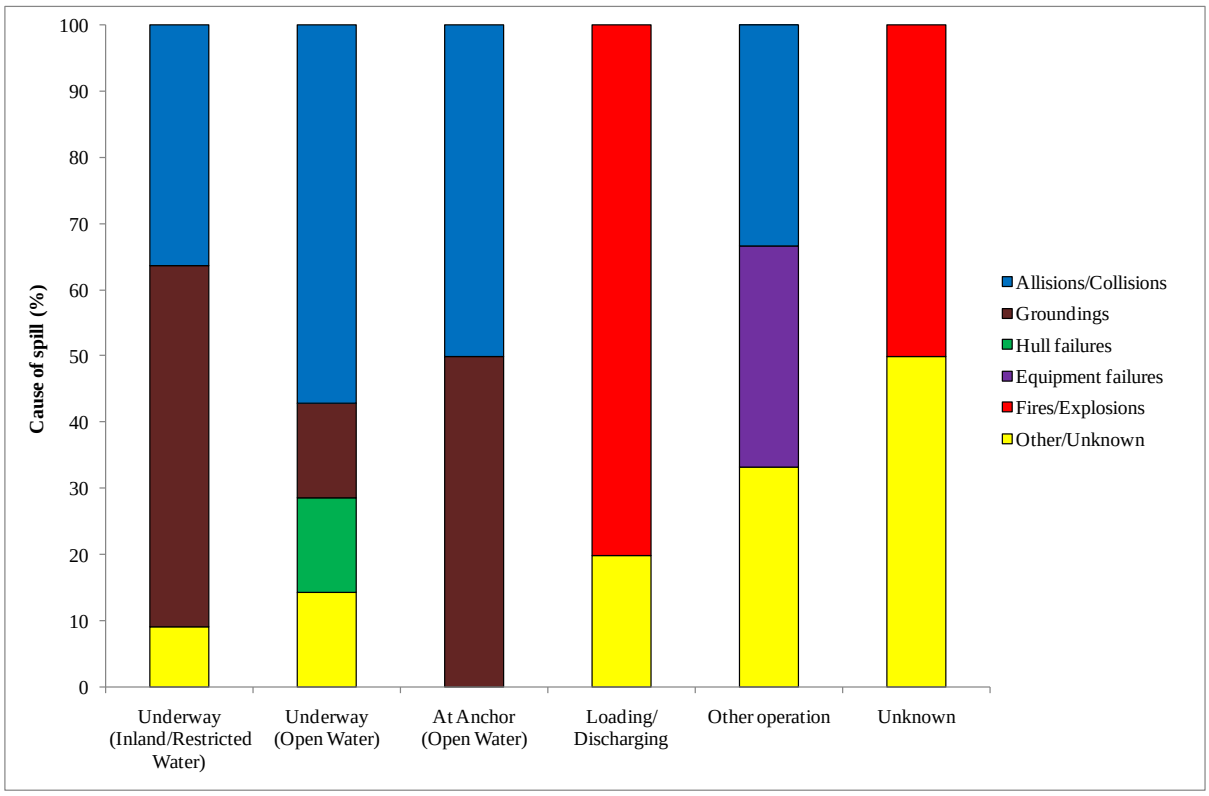

Figure 15: Incidence of tanker spills > 700 tonnes by operation at time of incident and primary cause of spill, 2002-2011 (One incident in this size category occurred while the vessel was at anchor in inland/Restricted waters but has not been included in the above figure)

6.1 Import vs. Export

A comparison of spill frequency in oil exporting and importing countries, between 1992 to 2011, revealed that net importing countries experience approximately 80% more spills than net exporting countries (Table 1). The reasons for this trend may be due to a combination of factors including vessel traffic density, weather conditions and possible crew fatigue from long journeys (perhaps more relevant to incidents that occurred due to human error in the early to mid 1990s, see Reasons for Trends section - ISM code).

Using the information available for large spills it can be seen that spills occurring in net import countries are caused mainly by allisions, collisions and groundings whilst the vessel is underway (Figures 16 and17). Whilst the numbers of incidents have decreased between 1992-2001 and 2002-2011, the percentage of incidents occurring while the vessel is underway remains the main operation at the time of a spill as does allisions, collisions and groundings as the cause of the spill.

Table 1: Number of tanker spills over 7 tonnes, comparing net exporting and importing countries. Import and export status has been based on net calculations using information from The World Factbook (CIA, 2009a) & (CIA, 2009b).

Size of spill	Net exporting countries (no. of spills)	Net importing countries (no. of spills)
7-700 Tonnes	76	281
>700 Tonnes	19	76
Total	**95**	**357**

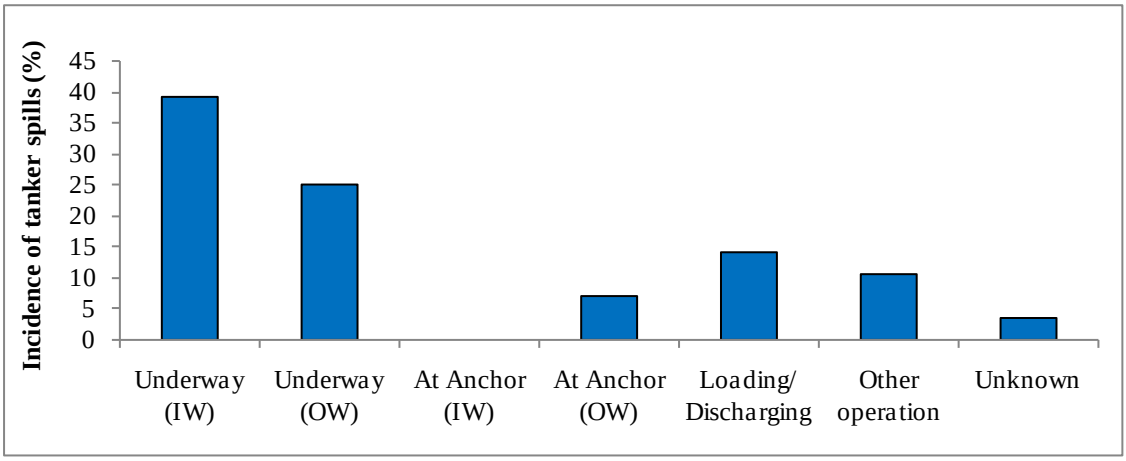

Figure 16: Incidence of tanker spills >700 tonnes that occurred in net importing countries, by operation at time of incident, 2002-2011 (IW: Inland/Restricted Waters; OW: Open Water)

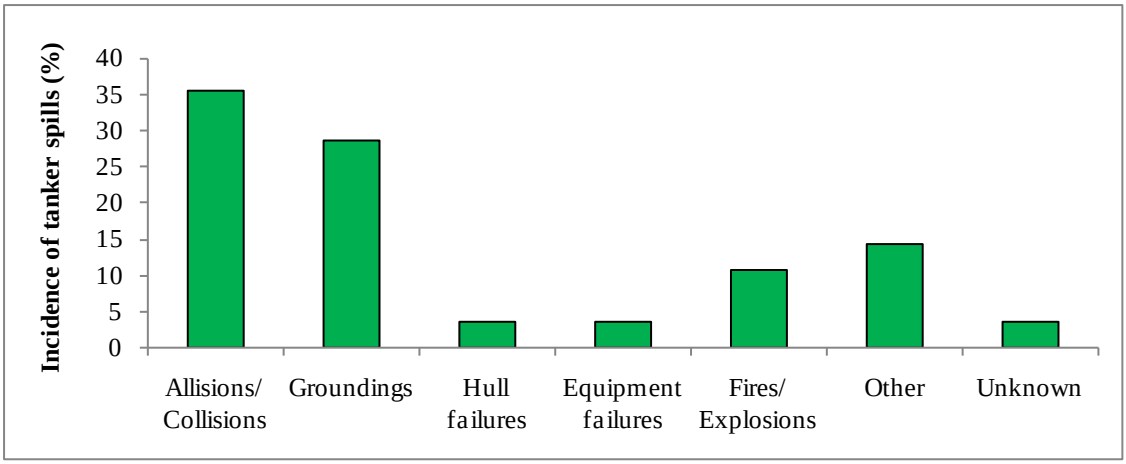

Figure 17: Incidence of tanker spills >700 tonnes that occurred in net importing countries, by primary cause of spill, 2002-2011

After the well known grounding incident involving the oil tanker TORREY CANYON, off the coast of England in 1967, the IMO adopted the 1969 International Convention on Civil Liability for Oil Pollution (1969 CLC, later amended to the 1992 CLC) to provide third parties with compensation for oil pollution damage. In addition, the 1971 International Fund for Compensation for Oil Pollution Damage (1971 Fund Convention, later amended to the 1992 Fund Convention) was adopted to provide an additional layer of available compensation for instances when the amount payable by the shipowner and his insurer is insufficient to cover all the claims.

Whilst the 1992 CLC is funded by the shipowner through Protection and Indemnity insurance, the 1992 Fund Convention is funded by contributions from the oil receiver. The results of this analysis serve to support the basis of the 1971 and 1992 Fund Conventions, which place the financial burden on receivers of oil rather than exporters.

7 Reasons for Trends

The main trend shown in this analysis is the downward progression in the number of oil spills and the quantity spilt. This is most encouraging given the increase in seaborne oil trade as shown in Figure 18.

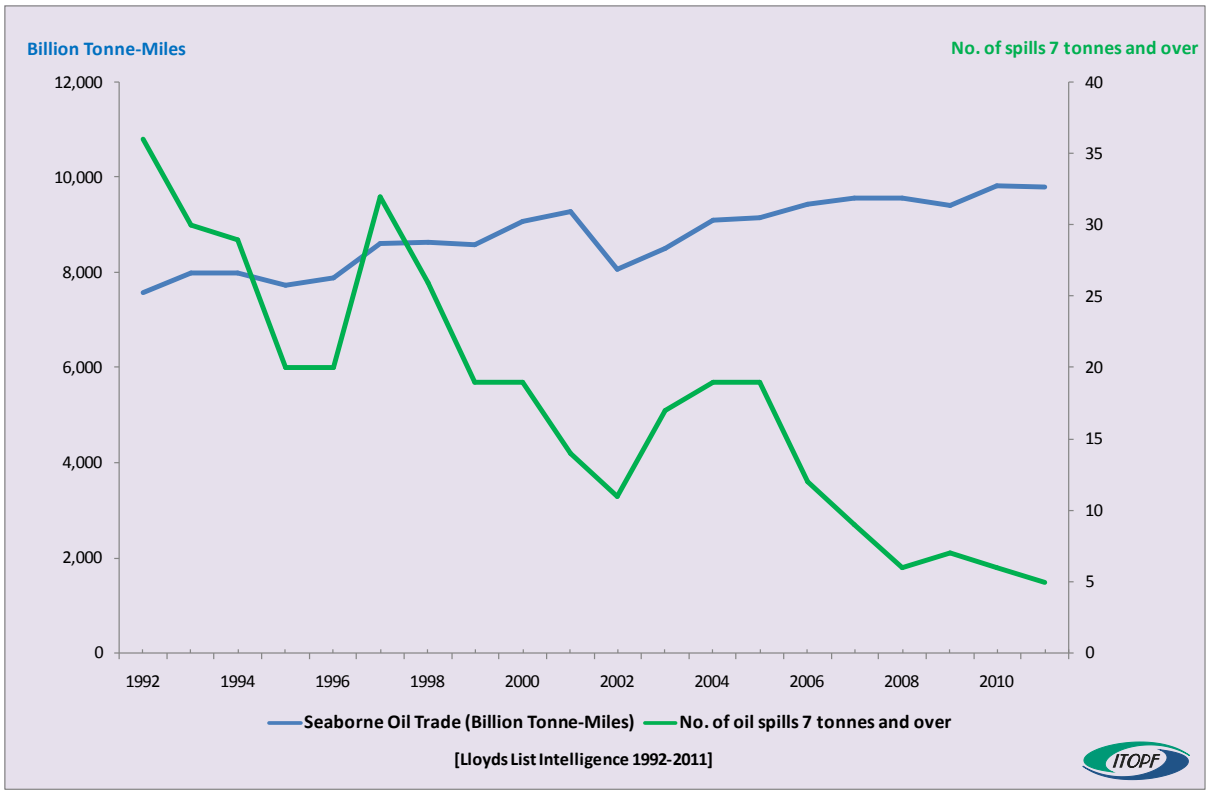

Figure 18: Seaborne oil trade and number of spills 7 tonnes and over, 1992 to 2011 (Crude and Oil Product*)

Product vessels of 60,000 DWT and above

There are likely to be several factors that have contributed to the reduction in oil spills over the past twenty years. However, this trend appears to coincide with the implementation and enforcement of conventions and regulations that are specifically designed to prevent the spillage of oil and reduce the impact a spill may have on the environment (Figure 19). The most notable of which are:

1. **MARPOL 73/78**:

The International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol 1978 (MARPOL 73/78). This convention was adopted by the IMO in 1973 and entered into force in 1983, providing regulations to control and prevent pollution of the sea by harmful substances from ships. As of March 2012, 151 States have ratified the convention, accounting for almost 99% of the world's merchant shipping tonnage (IMO, 2012). While the implementation of these regulations has generally helped to reduce pollution to the marine environment, it is Annex I, providing detailed construction requirements, that is most likely to have contributed to the reduction in the quantity of oil spilt from tankers. Requirements include segregated ballast tanks positioned to provide protection during a collision or grounding, protected locations for fuel tanks (newer vessels) and double hulls (IMO, 2011). Double hulls have been found to provide protection in low energy collisions and groundings that are likely to occur in areas where vessels will be travelling at slower speeds, such as ports and restricted waterways (AMSA, 2002).

2. **OPA 90**:

Oil Pollution Act 1990. This United States legislation deals with all aspects of preparedness, response and compensation. It was established after the EXXON VALDEZ spill in 1989 in the Prince William Sound, Alaska and was created to help prevent and respond to oil spills through strict implementation of regulations, increased resources and

funds. There are pre-conditions that apply to ships trading to the US, including provisions relating to manning, ship construction and other relevant safety measures which will help to prevent oil spills. More specifically, inspection of vessels, standards and levels of manning on tankships, standards of watchkeeping, tanker navigation safety standards, training, pilotage, Vessel Traffic Service Systems, on-board communication systems, overfill, tank level and pressure monitoring, plate thickness and double hull requirements (Britannia Steam Ship Insurance, 1999).

3. **ISM Code**:

International Management Code for the Safe Operation of Ships and for Pollution Prevention. This code was adopted by the IMO in 1993 after human error was found to be the main cause behind a series of incidents in the 1980s. The code requires companies to develop and implement a Safety Management System, which ensures "conditions, activities and tasks, both ashore and afloat, affecting safety and environmental protection are planned, organised, executed and checked in accordance with legislative and company requirements" (International Chamber of Shipping & International Federation, 2010). While a direct link cannot be made to the reduction in tanker incidents, it is reasonable to assume better planning, organisation and training has made a significant contribution. Supporting this code are:

- Conventions such as the Standards of Training, Certification and Watchkeeping for Seafarers (STCW, adopted by the IMO in 1978, amended in 1995), which through set requirements in each of these fields aims, *inter alia,* to reduce fraudulent practices, adapt working hours and rest requirements for seafarers and ensure crew are trained to an appropriate standard; and
- Programmes such as the Tanker Management and Self Assessment programme (TMSA, introduced by the Oil Companies International Marine Forum (OCIMF) in 2004), which provides a method to assess shipowners management; and
- Ship Inspection Report Programme (SIRE, introduced by the OCIMF in 1993), which can be used as a risk assessment tool for charterers, ship operators, terminal operators and government bodies.

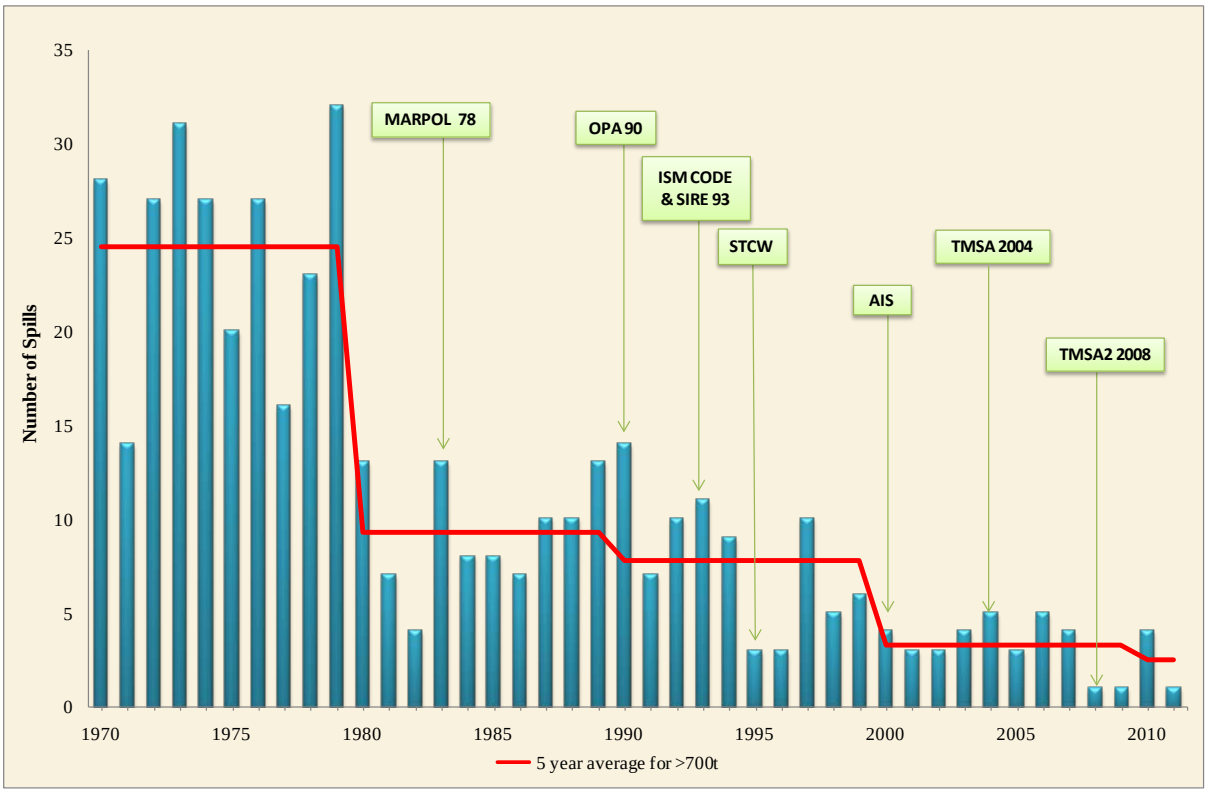

Figure 19: Number of tanker spills showing major shipping legislation developments, 1970-2011

8 ITOPF Attended Incidents – Tankers and Non-tankers.

To place the reduction in the number of tanker incidents in context, it is useful to consider the number of incidents involving tankers and non-tankers attended by ITOPF. ITOPF can be requested to attend on site if there is likely to be an impact on environmental or economic resources. The role of ITOPF during an incident is, *inter alia*, to provide advice and guidance on the fate and effects of the pollutant(s), appropriate clean-up responses and to investigate any damages to coastal resources such as fisheries, mariculture, industry and recreational areas.

Between 1992 and 2011 the total number of tanker spills, of all sizes, that ITOPF has attended is 192. The number of tanker spills per year fluctuates between 2 and 19 spills, the lowest year being 2011 and the highest being 1997. ITOPF has attended on site at spills from non-tanker vessels since the late 1970s, including bulk carriers, containerships, general cargo vessels, cruise ships and fishing boats. The total number of non-tanker spills attended between 1992 and 2011 is 191. The number of non-tanker spills attended per year fluctuates between 2 and 17, the lowest year being 1994 and the highest being 2007.

Therefore, in this 20 year period ITOPF has attended an approximately equal number of tanker and non-tanker incidents. However, in this period, the percentage of tanker incidents attended per year has decreased and the attendance to non-tanker incidents has increased (Figure 20). The number of non-tanker incidents that ITOPF has attended, in five year periods from 1992 (Figure 21), has more than doubled and the number of tanker incidents attended has more than halved, such that ITOPF now attends a significantly greater number of non-tanker incidents.

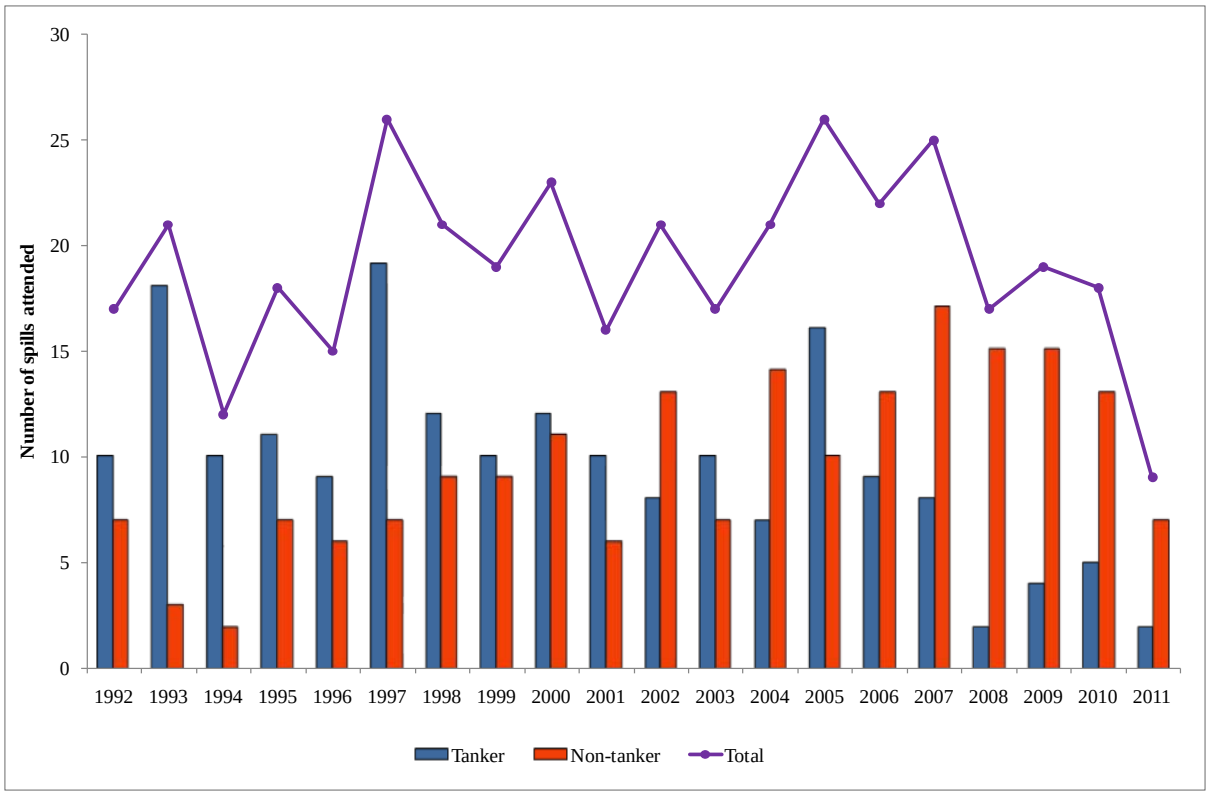

Figure 20: Number of tanker and non-tanker spills attended by ITOPF, 1992-2011

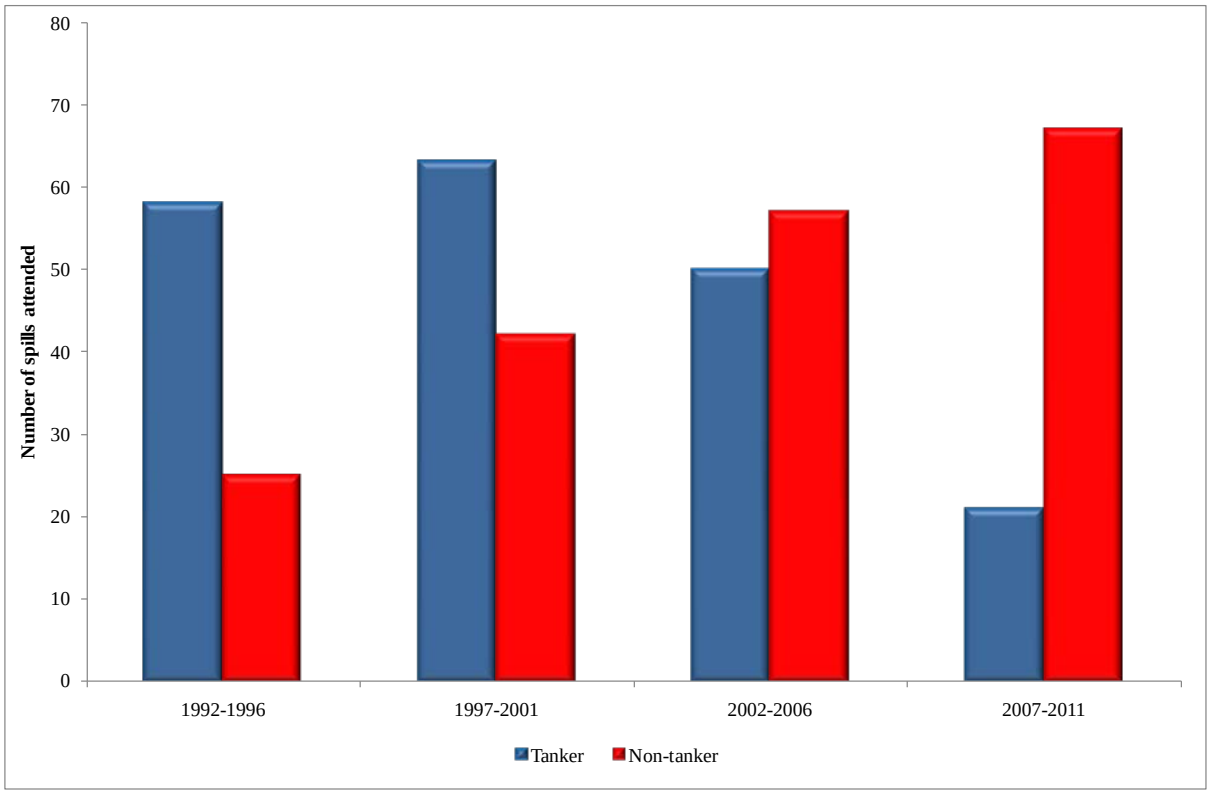

Figure 21: Number of tanker and non-tanker spills attended by ITOPF, divided into five year periods between 1992 and 2011

This increase in percentage of non-tanker incidents attended by ITOPF is due to a combination of factors including greater concern about relatively small bunker fuel oil spills

compared to previous decades, increased non-tanker vessel traffic and a greater awareness of the damage to marine resources. Since the 1970s there has been a global increase in the quantity of dry cargo transported by non-tanker vessels such as bulk carriers, containerships and general cargoships. The quantity of dry cargo loaded in 2010 is approximately five times that of 1970, rising from ~1.1 to ~5.7 billion tons (UNCTAD, 2011).

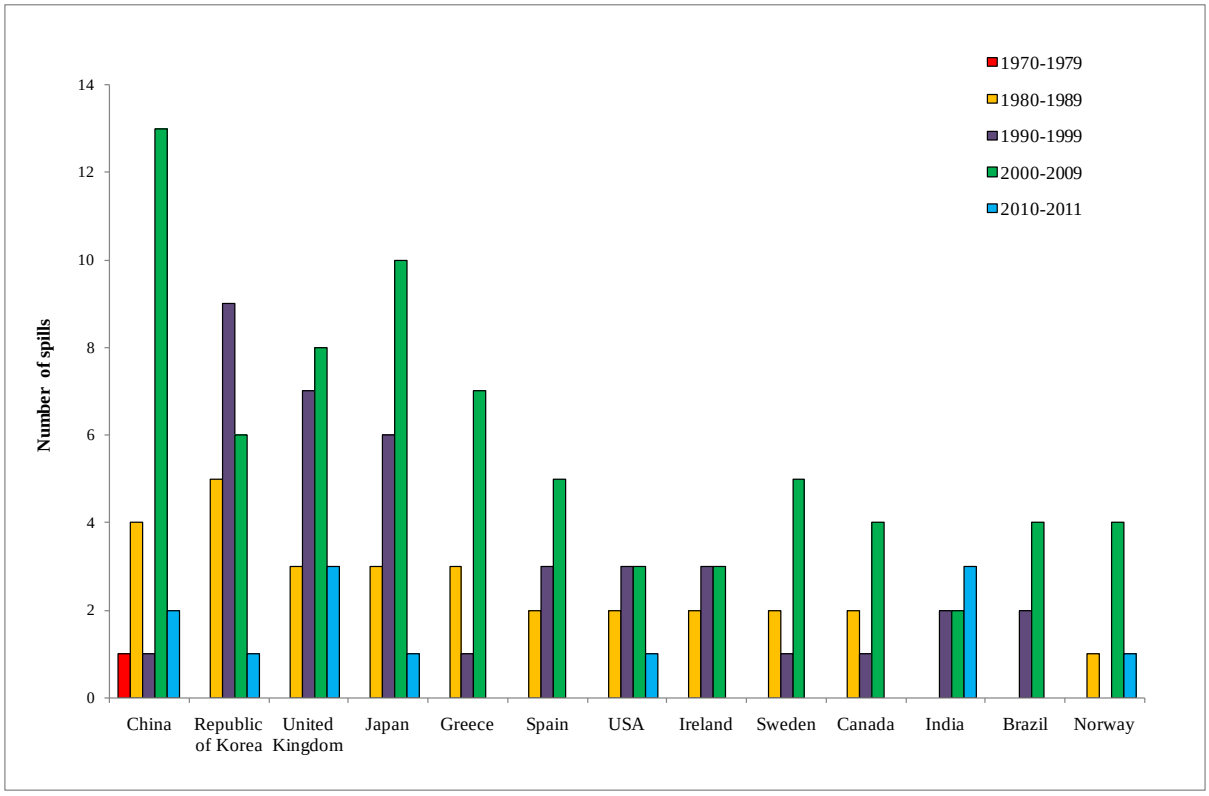

Figure 22: Number of non-tanker spills attended by ITOPF per country, 1970-2011 (countries experiencing more than 5 spills in total)

Further analysis of non-tanker incidents attended by ITOPF, examining the countries most attended, shows a significant presence in Asia (Figure 22), more specifically, China, the Republic of Korea and Japan. This is not surprising given the expansion of imports and exports in these regions over the past decade. In 2010, China, the Republic of Korea and Japan were classed as major importers of iron ore and coal, and China as a major exporter of coal and predicted to be a major importer of grain (UNCTAD, 2011). This expansion is likely to have resulted in increased vessel traffic along shipping routes and coasts, presenting navigational challenges and increasing the risk of an incident.

In addition, the use of coastal areas for aquaculture has greatly intensified. In China and the Republic of Korea aquaculture production has almost doubled in a ten year period, rising from ~ 27million tonnes in 1999 to ~ 45 million tonnes in 2009 in China (FAO, 2006-2012a) and from 777,711 tonnes in 1999 to 1.3 million tonnes in 2009 in the Republic of Korea (FAO, 2006-2012b). In 2004, the total area for national marine aquaculture in China was 1.62 million hectares (at sea, mudflats and land based); of the total output from this area 51.3% was at sea (FAO, 2006-2012c).

Increasing expansion in the use and exploitation of the sea means there is an increased likelihood that a spill of oil in these countries will result in damage, particularly to mariculture. A key role for ITOPF when attending an incident is to assist in evaluating the damage to fisheries and is a significant factor in ITOPF's increased attendance to non-tanker spills in these countries.

9 Conclusion

There is an overall downward trend in the number oil spills and the quantity of oil spilt since 1992. This is encouraging given the increase in seaborne oil trade, in both crude oil and refined oil products.

It has been found that large quantities of oil spilt can result from just a few incidents, the cause of which is typically allisions, collisions, groundings or hull failures. In such incidents, the vessels are mainly underway in open water, but it should be noted that the frequency of these incidents is declining.

The types of oil most frequently spilt are crude and refined products carried as cargo. The quantity of crude oil spilt is greater than refined products, the reason for which is likely to be due to the size and carrying capacities of crude oil tankers compared to product tankers.

The trend in ITOPF attended incidents shows that the percentage of tanker incidents attended per year has decreased and the percentage of non-tanker incidents has increased. This increase in non-tanker attended incidents is likely to be due to several factors including increases in public awareness, potential for damage and an increase in the volume of dry cargo transport.

In ITOPF's opinion the overall downward trend of spills can be contributed to a combination of implementation and enforcement of conventions and regulations, training, assessments and communication, and development of technology.

10 Definitions

Inland/Restricted water: Used to describe bodies of water where vessel transit may be restricted by land or manmade structures and includes the Panama Canal, Suez Canal, Strait of Magellan and when the vessel is in a river, inlet, bay, port, harbour etc.

Open water: Used to describe bodies of open water. Includes any incident between a tanker and a rig or Single Point Moorings in open water.

Collision: Contact between two or more vessels, which impacts the side of the vessel. Includes situations where one or more vessels are at anchor. Incidents where the vessel has been punctured by a buoy or anchor have been categorised as a collision.

Allision: Contact between a vessel and a fixed, stationary structure or land mass (e.g. breakwaters, jetties, piers and mooring structures), which impact the side of the vessel.

Grounding: Contact between the vessel and underwater structure(s) or landmass, which impacts the bottom of the vessel.

11 Acknowledgements

I would like to thank Tim Wadsworth, Colleen O'Hagan, Kelly Reynolds, Deborah Ansall and Lisa Stevens at ITOPF for their guidance and assistance whilst writing this paper.

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