UK EEZ Shipping Risks and Emergency Towage Provision Study

Prepared for the Maritime and Coastguard Agency (MCA)

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SYSTEMS • ENGINEERING • TECHNOLOGY

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EXECUTIVE SUMMARY

BACKGROUND

The Maritime and Coastguard Agency (MCA) has a duty on behalf of the UK Government to regularly reassess the risk in UK waters from shipping related pollution. Until 2011 the MCA operated four Emergency Towage Vessels (ETVs) as a risk mitigation measure for counter-pollution purposes. In 2011 a decision was made to remove these vessels under the assumption that market forces would take hold and the provision of commercially-available towage would increase[1]. There is evidence that the commercial towage market has not responded in the way it was originally envisaged, while the UK maritime environment has increased in complexity over the same period of time.

This document is a concise version of the marine report [1] and its associated appendices [2]. The study seeks to quantify the risk of pollution from shipping transiting the UK Economic Exclusion Zone (EEZ) and then understand the impact of ETVs as risk reducing measures. It should be noted that whilst ETVs will reduce the risk of pollution incidents from shipping they do not offer a comprehensive preventative measure. The maritime environment is a highly complex and unpredictable domain where multiple and cumulative factors, such as meteorological, human error and equipment failure influence the probability of incident.

GEOGRAPHIC SCOPE

Detailed analysis has been undertaken across the entire UK EEZ with specific focus on seven high-risk areas as shown below. It should be noted that, for analytical purposes, areas 1 and 2 were combined.

1. Pentland Firth;
2. Fair Isle Channel;
3. Dover Strait (and its approaches);
4. South West Approaches;
5. St George's Channel;
6. The North Channel; and
7. The Minches.

Figure 1: The seven areas under assessment in the UK EEZ

METHODOLOGY

Where possible the study approach has been undertaken using validated data sources. At the core of this study lies a Geographic Information Systems (GIS model) which contains ship traffic data (including transits and ship types), marine hazard data, ship failure probabilities and economic assessment factors.

Within this model are several different analytical aspects including:

- Interrogation and analysis of Automatic Identification System (AIS) data from around the UK EEZ, so as to derive ship traffic data;
- A risk assessment to and from shipping in the UK EEZ, taking into account:
  - Shipping density (Figure 2)[2] for the UK EEZ and seven specific regions driven by the AIS analysis;
  - Natural and artificial offshore hazards;
  - The disablement rates of various ship types;
  - The intercept time of available tugs;

[1] An ETV was subsequently re-instated in Scotland due to the paucity of tug availability in the region.

[2] Map data © OpenStreetMap contributors

- Future trends and mitigating options and activities; and
- The volumes of bunker and cargo oil aboard the ships.

- An assessment of the future growth of shipping out to the year 2025;
- Stakeholder engagement via four nationwide engagement events held in Bristol, Edinburgh, Liverpool and London; and
- A Cost-Benefit Analysis (CBA) of various options for emergency towage provision around the UK EEZ.

Two differing assumption sets were applied during the analysis to understand the sensitivity of the model and allow benchmarking against real world figures. These assumption sets were based around 'realistic' and 'pessimistic' scenarios, hereafter referred to as Assumption Set 1 and Assumption Set 2.

Assumption Set 1: *Pragmatic Risk Likelihood and Consequence*

A case based on current norms reflecting changes in shipping from 1994 to 2019. This uses a set of assumptions based on data from multiple sources (including the Bonn Agreement BE-AWARE study [3] to develop an informed scenario, reflective of the modern shipping environment, taking into account modern ship operations, conditions and design; and

Assumption Set 2: *High Risk Likelihood and Consequence.*

This represents a 'worst case' scenario for the risks to and from shipping in the UK EEZ. This is based on historical market norms of 1994 at the time of Lord Donaldson's original report [4].

INCIDENT RISK ANALYSIS

Figure 5 shows the high level risk assessment methodology that has been used to assess the risks of a shipping incident within the UK EEZ. It must be noted that the risk assessment only forms *part* of the overall recommendation on emergency towage. The risk in each area is an input into the CBA to help derive an economic case for emergency towage provision. This identifies the areas most at risk of pollution incidents based upon factors such as ship traffic type and density and the marine hazards.

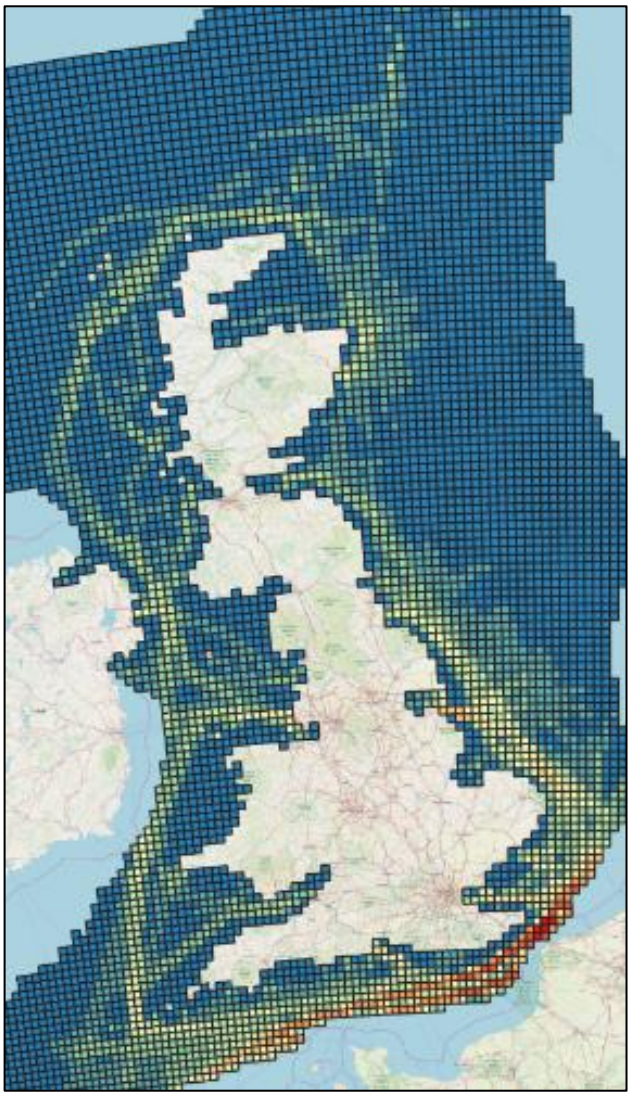

Figure 2: Shipping density (all ship types) 2015 to 2017 in the UK EEZ

The risk assessment shows that highest risk areas identified are those in the South of England, namely Dover Strait and South West Approaches. As expected, this corresponds to the high levels of shipping traffic in these areas. The lowest risk areas for ship disablement are St George's Channel and the North Channel, both of which are assessed as low risk.

Table 1: Overall risk assessment for AoIs[3]

Area of Interest	Risk of Pollution Event
Dover Strait	Higher
South West Approaches	Higher
St George's Channel	Lower
The North Channel	Lower
The Minches	Medium
Pentland Firth	Medium
Fair Isle Channel	Medium

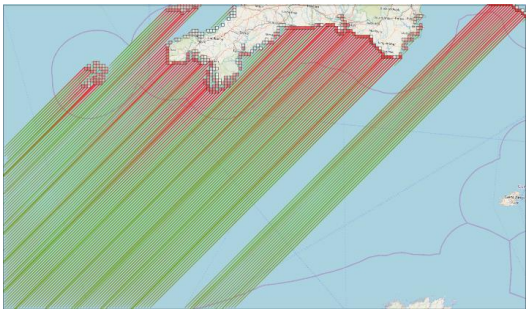

Figure 3: Example Drift Analysis for South West Approaches

Green and red vectors indicate the areas where there is a low and high probability respectively of an oil spill impacting on economically and/or environmentally sensitive locations resulting from a drifting vessel.

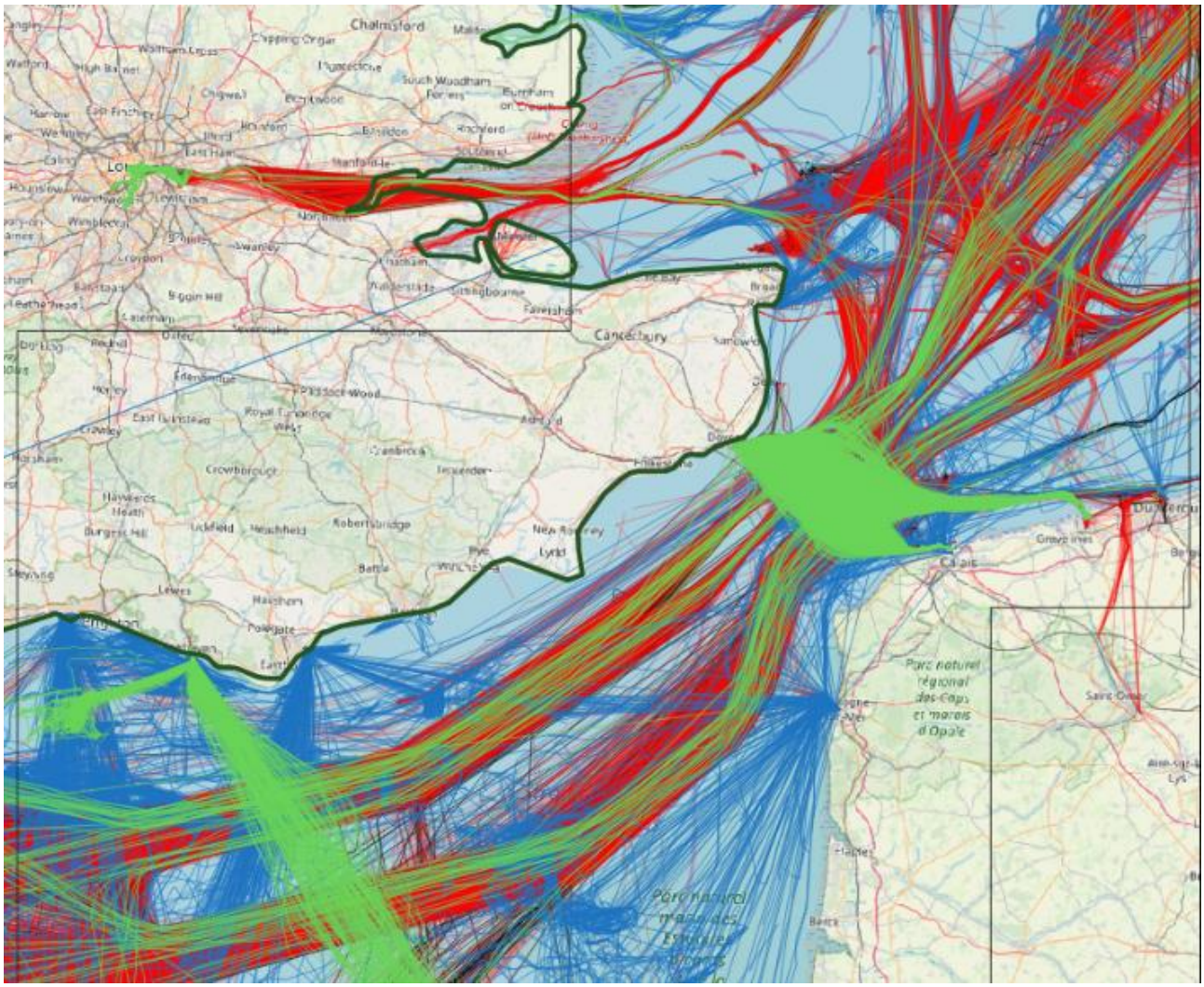

Figure 4: Dover Strait Vessel Track by Shipping Types

The green tracks are for vessels with a higher number of passengers; predominantly ferries operating out of Dover and Newhaven. This category also includes cruise ships which explains the green tracks following the Dover Strait shipping lanes. The red tracks are tankers.

[3] Note: due to their proximity, Pentland Firth and Fair Isle Channel are assessed as a single area.

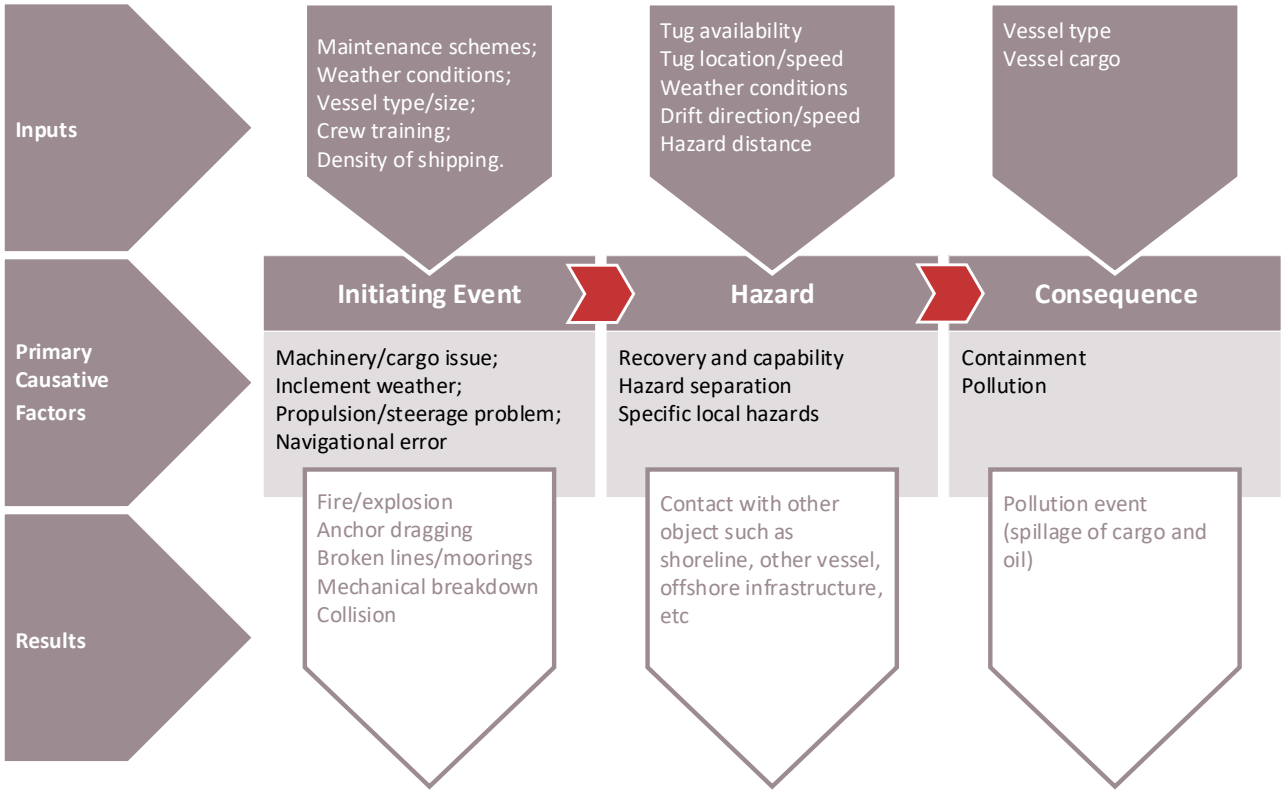

Figure 5: High-level risk assessment methodology flow diagram.

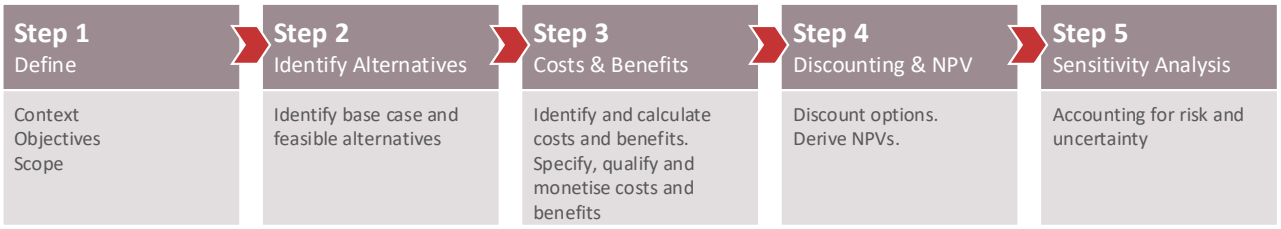

Figure 6: The Cost-Benefit Analysis Process

CURRENT EMERGENCY TOWING CAPABILITY

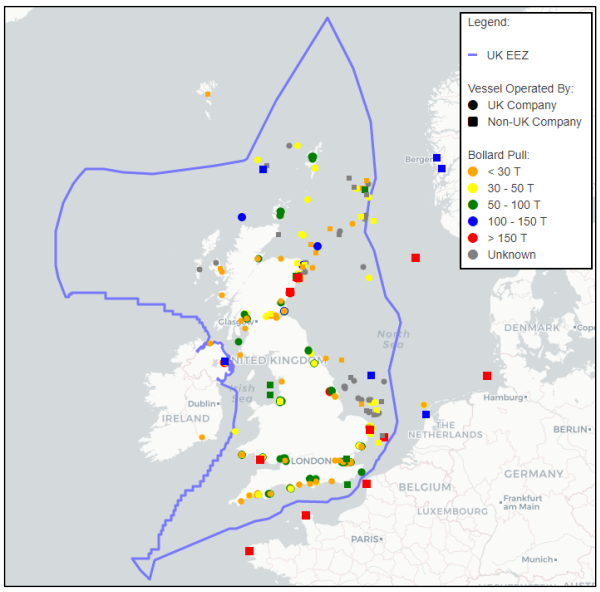

Figure 7: Current location and bollard pull of various vessels around the UK EEZ

An assessment was made on the potential commercial availability of vessels around the UK EEZ that could provide emergency towage capability. Figure 7 is a summary of this assessment and shows the assets operated by UK companies and non-UK companies of varying bollard pull capacities. The importance of this assessment is that it demonstrates areas of paucity for commercial towage operations, a factor taken into account in our overall assessment.

COST-BENEFIT ANALYSIS

The risk analysis, including the ship density information, were taken as key inputs to a Cost Benefit Analysis (CBA) designed to understand the societal cost of a potential incident. The CBA employed International Maritime Organization (IMO) Formal Safety Assessment Revised Guidelines [5] which provides the following formula to estimate the societal cost of an oil spill (*SC*) for a given spill size (*V*):

$$SC(V) = F_{assurance} \times F_{uncertainty} \times f(V)$$

The primary aim of the CBA is to understand the net benefit to society as a result of risk mitigation through the provision of ETVs. A detailed CBA was conducted adhering to the principles of HM Treasury's Green Book guidance under both Assumption Set 1 and Assumption Set 2. The high level process is shown in Figure 6.

Simplistically put, the CBA seeks to ascertain the value for money the ETV investment represents when compared to the economic benefit of reducing the risk of pollution from shipping.

Benefits	Costs
Reduction in probabilised risk of consequence through introduction of emergency towage provision	Capital costs or Lease costs
	Operational costs *(e.g. maintenance, crew, consumables, etc.)*
	Societal costs *(e.g. loss of tourism, impact on fishing, damage to habitats, etc.)*

Economic Costs

The costs incurred from oil spills can lead to significant economic losses by industries and individuals dependant on coastal economic activity. The tourism and fisheries sectors are typically where the largest impact is felt, however, there are many other business activities and sectors which suffer losses. For this study, the effect of oil spilled on the economy of coastal areas considers the following economic factors:

- Aquaculture sites;
- Fishing (value);
- Ports and ferry terminals ;
- Power stations; and
- Seaside towns.

Environmental Costs

The UK EEZ encompasses 1,214 Marine Protected Areas both current and proposed which equates to currently 4,734,711 km^2 of protected area with a further 10,005,507 km^2 proposed. This includes areas protected by National, European Union and Global Agreements.

The importance of these protected areas is considered within the CBA through the application of financial in line with procedures in the Treasury's Green Book [9].

The CBA considered three options selected for analysis under both assumption sets, namely:

- Option 1: the provision of a dedicated charter ETV;
- Option 2: the provision of a retained charter; ETV and
- Option 3: the provision of a seasonal dedicated charter ETV.

The CBA resulted in the calculation of a Net Present Social Value (NPSV), and Benefit-to-Cost Ratio (BCR) for each option. A positive NPSV figure (>0) indicates that the present value of all benefits is greater than the present value of all costs, therefore the option will generate net positive benefits to society. Similarly, a BCR value greater than 1 indicates a net benefit to society. The larger the NPSV or BCR value, the greater the net positive benefit to society. Please note that larger and hence higher cost ETVs have been considered for South West Approaches and Dover Strait due to the volume and nature of the shipping traffic in these areas. These larger vessels attract higher costs and hence have an impact on the CBA.

Assumption Set 1 (AS1)

For AS1, no AoIs resulted in a positive NPSV or a BCR exceeding the *de minimis* threshold of 1.0.

Assumption Set 2 (AS2)

For Assumption Set 2, three areas resulted in a positive NPSV and BCR as highlighted in Table 3. They are:

- Dover Strait;
- South West Approaches; and
- St George's Channel.

Table 2: Net Present Social Value (NPSV) and Benefit-to-Cost Ratio (BCR) for all three options (AS1)

Area of Interest	Option 1		Option 2		Option 3	
	NPSV	BCR	NPSV	BCR	NPSV	BCR
Dover Strait	-£ 44.781m	0.00020	-£ 22.390m	0.00020	-£ 22.391m	0.00016
The North Channel	-£ 30.423m	0.000025	-£ 15.212m	0.000025	-£ 15.212m	0.000017
The Minches	-£ 30.422m	0.000068	-£ 15.211m	0.000068	-£ 15.211m	0.000058
South West Approaches	-£ 44.489m	0.0067	-£ 22.245m	0.0067	-£ 22.236m	0.0071
St George's Channel	-£ 30.412m	0.0004	-£ 15.206m	0.00040	-£ 15.206m	0.00038
Fair Isle Channel and Pentland Firth	-£ 30.422m	0.000052	-£ 15.211m	0.000052	-£ 15.211m	0.000039

Table 3: Net Present Social Value (NPSV) and Benefit-to-Cost Ratio (BCR) for all three options (AS2)

Area of Interest	Option 1		Option 2		Option 3	
	NPSV	BCR	NPSV	BCR	NPSV	BCR
Dover Strait	+£5.3m	1.1	+£1.7m	1.1	-£0.6m	1.0
The North Channel	-£26.9m	0.1	-£13.4m	0.1	-£13.8m	0.1
The Minches	-£22.5m	0.3	-£11.3m	0.3	-£13.1m	0.1
South West Approaches	+£885.1m	20.8	+£430.4m	20.2	+£346.9m	16.5
St George's Channel	+£44.3m	2.5	+£21.8m	2.4	+22.6m	2.5
Fair Isle Channel and Pentland Firth	-£22.0m	0.3	-£11.0m	0.3	-£10.4m	0.3

RECOMMENDATIONS AND CONCLUSIONS

Assumption Set 1 is reflective of the current conditions found with the EEZ and on that basis the analysis indicates that the improving reliability and safety of vessels (most notably the legal requirement for double hulled tankers) results in there being no CBA justification for the employment of ETVs within the UK waters. The only scenario that could justify the provision of ETVs is to mitigate against large tanker spills, which is an infrequent occurrence. As with all low probability/high impact risk scenarios, **there is an argument that preventative measures are preferable to post incident recovery**.

Whilst historically the presence of an ETV could be justified, the nature of shipping has changed over the years since 1994 and as a result the risks have reduced owing to changes in technology, design, operation and safety awareness of shipping.

It could be argued that the change in outputs between the two sets of assumptions demonstrates a tangible improvement in safety and reliability standards (most notably the need for all tankers to be double hulled) for shipping since the 1990s. This could be reinforced by the fact that there has been no significant release of oil in the UK EEZ on the scale of the MV BRAER or MV SEA EMPRESS since 1996.

Of all the AOIs, South West Approaches is the region that would benefit most from an ETV primarily driven by the long coastline, high shipping traffic volumes, high dependence on the marine economy and its status as a UNESCO world heritage coastline. Whilst not a CBA recommendation, consideration should also be made for the provision of an ETV in Scottish waters due to the high dependency on the maritime sector and relative lack of economic resilience in certain geographic areas.

It is important to note that while the economic arguments presented herein are based solely on the counter pollution benefits of employing ETVs, other aspects of their deployment may present additional benefits that are not considered within the scope of this report. This includes compensating for the extreme paucity of sufficiently-powered tugs in many of the regions.

Saving lives at sea and possible secondary functions of ETVs is not considered. Further options around shared ETVs among other nations and other arrangements have not been modelled within this report, but may yield further benefits.

LIMITATIONS OF THE STUDY

In order to assess the risks to and from shipping in the UK EEZ and to use those risks to perform a CBA a number of assumptions had to be established and, where possible, these have been explained within the report. However, a number of key limitations were identified during this study:

- This study is valid only for the UK EEZ and is accurate as far as the received AIS data is accurate. A detailed methodology on how the data has been interrogated and processed is contained within the methodology section of this document, including how erroneous data has been dealt with;
- Only the prevailing weather conditions have been modelled in this analysis to reduce the complexity of the overall model and subsequent analyses;
- Specific tidal influences have not been factored into the assessment, however the general drift speed used in the risk assessment and subsequent CBA is based on data from analyses performed that includes more general tidal influences;
- International political influences have not been factored in when it comes to towage provision; this is especially pertinent to relationships with the Republic of Ireland and France; these could impact the severity of the risk, particularly in four of the seven areas of interest;
- Through stakeholder engagement, Frazer-Nash has learned that commercial towing arrangements could potentially be in decline. The change in future commercial towage has not been considered in this analysis; only current towage provision has been assessed.

This study has assessed the risks to and from shipping and the level of emergency towage provision around the UK. It has made recommendations based on available data, but like all studies it is important to understand the limitations of its methodology and recommendations

CONTEXT OF STUDY

This study has been commissioned to determine the underlying environmental, navigational and weather risks to shipping and thus the risk of pollution from shipping incidents within the UK EEZ. Over the last few decades there has been a number of developments in the maritime environment:

- The average size of ships has increased, especially those in the container ship market;
- The average age of the world fleet has reduced;
- Technical developments and legislative changes have combined to improve safety;
- Economic pressures and reduced crew complements have increased the risk of fatigue and human error; and
- Spatial and environmental factors mean that there are competing pressures on the use of the sea areas around the coast of the UK.

The last full review of shipping risk and emergency towing requirements in the UK as a whole took place in 2008, although a smaller study for the waters around north and west Scotland was undertaken in 2016. In response to the MAIB's recommendation, following their investigation into the SAGA SKY incident in 2016, to conduct a review of the risk to shipping in the Dover Strait, the MCA decided to expand the study to cover the whole UK EEZ. This would both update their understanding of the overall risk and address any regional concerns about adequate mitigation measures.

PURPOSE

The MCA is responsible for the environmental safety of the UK coast and waters. In response to the MAIB recommendation, Frazer-Nash has been tasked by the MCA to perform a robust, qualitative assessment of the risks posed by and to commercial shipping around the UK Exclusive Economic Zone (EEZ), with a focus on the distinct shipping areas. The analysis extends to 2025, and projects the assessed risks based on current available data.

During the course of the study a variety of stakeholders from within the industry were engaged to gain a comprehensive understanding of the present state of emergency towage in the UK. Our engagement with stakeholders, working alongside Solis Marine, allowed us to ensure that:

1. The risks are underpinned by thorough operational knowledge of emergency towage, salvage and marine casualty management;
2. The risks are quantified by a robust, understandable and objective methodology using sound risk assessment techniques and principles; and
3. The risks are realised using the International Maritime Organisation's (IMO's) Formal Safety Assessment (FSA) processes.

LEGAL FRAMEWORK

The UK is a signatory to a number of international conventions that place duties on contracting parties to protect the marine environment. The principal conventions are:

- The United Nations Convention on the Law of the Sea (UNCLOS)
- International Convention on Oil Pollution Preparedness, Response and Co-operation (OPRC)
- International Convention Relating To Intervention On The High Seas In Cases of Oil Pollution Casualties (The Intervention Convention)
- The Convention On The Prevention Of Marine Pollution By Dumping Of Wastes And Other Matter (the London Convention)

The Secretary of State for Transport takes the powers needed to comply with these Conventions from the Merchant Shipping Act 1995, and the Merchant Shipping and Maritime Security Act 1997. The Secretary of State for Transport has the overall responsibility for taking or co-ordinating measures to prevent, reduce and minimise the effects of marine pollution but this does not extend to any statutory provision of emergency towing.

METHODOLOGY

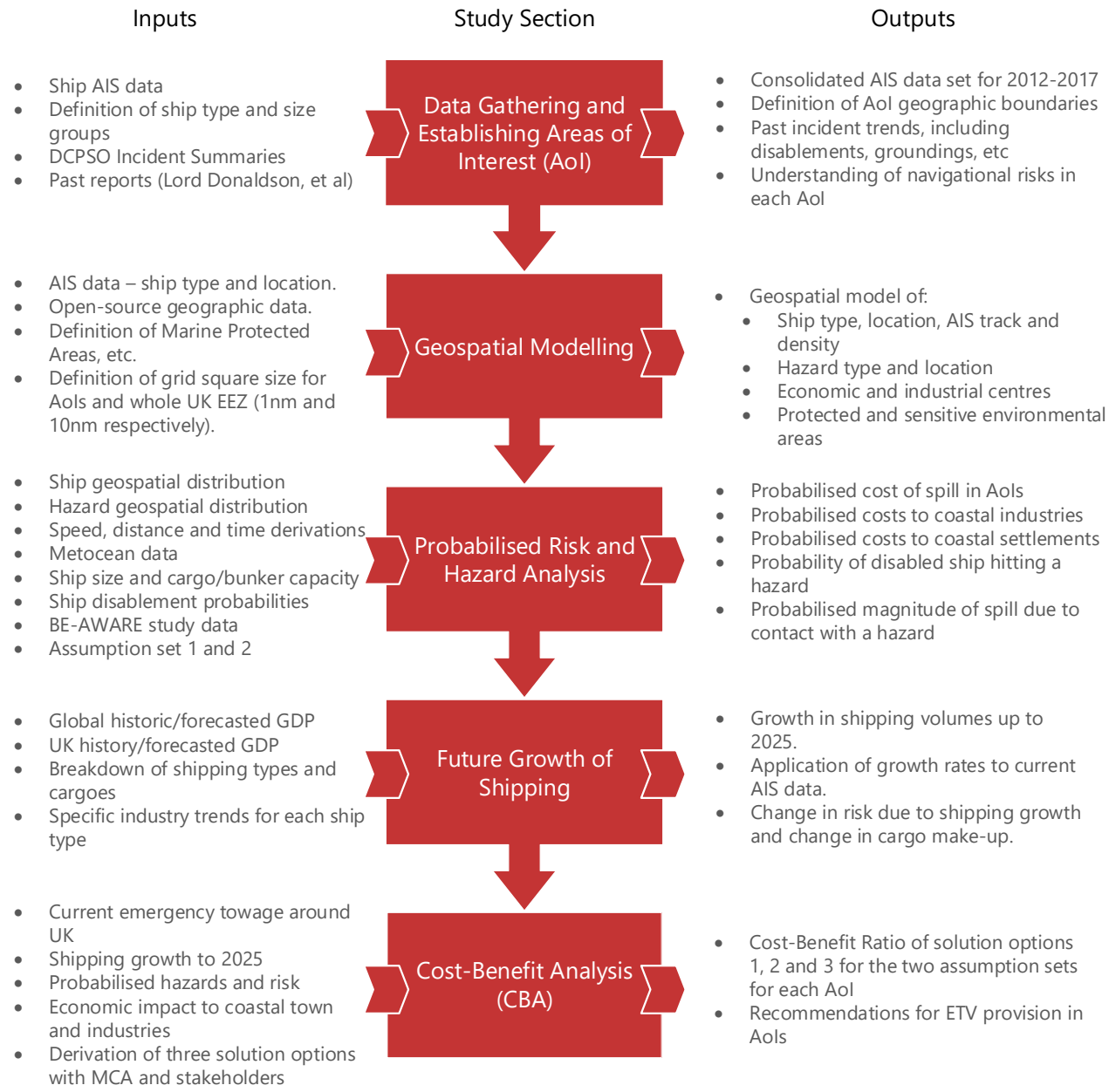

Figure 8: Overall risk study methodology flow diagram

The analytical approach to the study draws upon a wide range of data sources and assimilates them to first establish the shipping density and traffic in the UK EEZ. It then seeks to understand the probability of incident in any one area and finally the likely economic and societal impact of such an incident. Overlaid onto this model can be varying scenarios through the altering of key variables or the introduction of new factors, for example the presence of commercial towage or the presence of a dedicated ETV.

Key data sources are detailed in full in the references section at the rear of this paper. The most important are cited below. Where they fit in each stage of the analysis is shown in Figure 8.

- Ship Automatic Identification System data from 2013-2017
- Various key data assumptions taken from the BE AWARE project, a comparable study commissioned by Bonn Agreement partner countries and encompassing the North Sea.
- Historical ship failure and incident statistics from the MCA
- Industry engagement through regional workshops held across the UK
- Engagement and interview of commercial towage vessel operators in UK waters
- Historical meteorological and hydrographic data
- Various socio-economic reports and analysis from Government and independent research agencies.

Establish Areas of Interest

To evaluate the impact of spillage within the UK EEZ, a number of AoIs were established. These were considered by the MCA to be areas most likely to present hazards to shipping potentially containing areas of coastline with areas especially vulnerable to pollution events (e.g. conservation areas, tourist areas of industries). These AoIs were considered in detail whereas the rest of the EEZ was considered at a lower fidelity.

Geospatial Model

A geospatial software model was established to provide an analysis of each of the AoI's risks and impacts of a spillage event. Each AoI was divided into smaller grid squares which facilitated the accurate modelling of the contents of each square. These were one square nautical mile within the AoIs and 10 square nautical miles outside AoIs. The geospatial model contains environmentally protected regions, centres of economic activity, key national infrastructure such as nuclear power stations, fishing regions and hazards to shipping both natural and man-made. The model includes in addition to geographic hazards and environmentally significant regions; shipping densities, nature of vessels present, prevailing weather patterns (and therefore drift rates) and availability of commercial tugs.

Probabilised Hazard Analysis

With the geospatial model outputs established, assumptions relating to the probabilities of vessels encountering hazards and the subsequent fault tree probabilities and impacts resulting in a spillage event were determined and agreed with experts from MCA. Two assumption sets were applied to provide a differential for further analysis.

The outputs generated the total probabilised oil spilled within each AoI based on the nature of the AoI established in the geospatial model and the applied assumptions in terms of event likelihood and severity. It is worth noting at this stage that the model outputs can not be defined in terms of the number of vessels assumed to founder, but rather an aggregation of all of the vessels in each AoI and their probabilised oil spilled, to provide a total number.

Cost Benefit Analysis

The amount of oil spilled was then used as the basis of establishing the cost of clean-up of this oil spilled. This was carried out for all AoIs including an assumed ETV present and without an ETV, such that the difference between these figures yielded the financial benefit the vessel provides. The financial benefit of providing ETVs in each AoI was then compared with the cost of this provision to establish a net benefit.

Description of the UK Economic Exclusive Zone (EEZ)

The EEZ used for this study is that for the island of Great Britain, the Isle of Man and for Northern Ireland. Other Crown Dependencies are not included, neither are overseas territories.

The UK EEZ encompasses a wide variety of potential hazards and sensitive areas. Numerous conservation areas are located around the whole UK coastline, and the UK has extensive and well-developed offshore infrastructure. This infrastructure includes oil platforms, offshore wind farms, undersea electrical and communications cables and undersea pipelines.

The UK also has a significant coastal industry, with many coastal settlements deriving significant amounts of revenue from offshore activities including leisure, tourism, fishing and other aquaculture activities. Scotland is particularly sensitive to fishing, as over 60% of the UK's total catch is from fishing in Scotland [7]. Fishing in Scotland had a value of £572 million in 2018 [7] and aquaculture makes an economic contribution of £1.8 billion in 2016 [8].

The UK EEZ also includes environmental features that pose hazards to ships in transit, such as sand banks, shoals, reefs and areas of high tidal flows and ranges. Some areas (e.g. Pentland Firth) are particularly hazardous for navigation.

RISK MODEL (BASED ON GEOGRAPHIC INFORMATION SYSTEM ANALYSIS)

AIS-DRIVEN SHIP DENSITY

Figure 9[4] is a heat map showing the shipping density (all types) of the sea lanes in the UK EEZ (2015 to 2017); the effect of Traffic Separation Schemes (TSS) is shown, particularly in the English Channel and Dover Strait. The prominence that Dover Strait plays in global shipping is long-established.

INCIDENT RISK ASSESSMENT APPROACH

It is recognised that the risks to and from shipping within the UK EEZ are many and varied, as are the probabilities of occurrence and the severity of the associated consequences (loss of vessel or cargo, loss of life, restriction of waterways, pollution etc.). However, to ensure the numerical model is meaningful, manageable and supportive of quantified CBA, it has been bound by focussing on the risk that ETVs were originally introduced to mitigate (pollution risk) caused by vessels not under control drifting onto hazards that could cause loss of containment (i.e. oil tank/bunker rupture).

This is considered to be the worst case scenario but as highlighted previously, it is recognised there are other forms of pollution and impacts from vessels foundering in UK waters that will be included as part of the qualitative review.

Figure 10 shows the high-level risk assessment methodology that has been used to assess the risks to and from shipping in the UK EEZ. It includes three distinct stages:

1. The description of the initiating event,
2. The outline of the hazards; and
3. The resulting consequences.

This methodology does not introduce any reduction in probabilities for the initiating events due to technological and operational developments in the years up to 2025. This is because the speed of adoption by the IMO and the commercial marine market is traditionally slow and would have minimal impact on the probability of disablement through this study period.

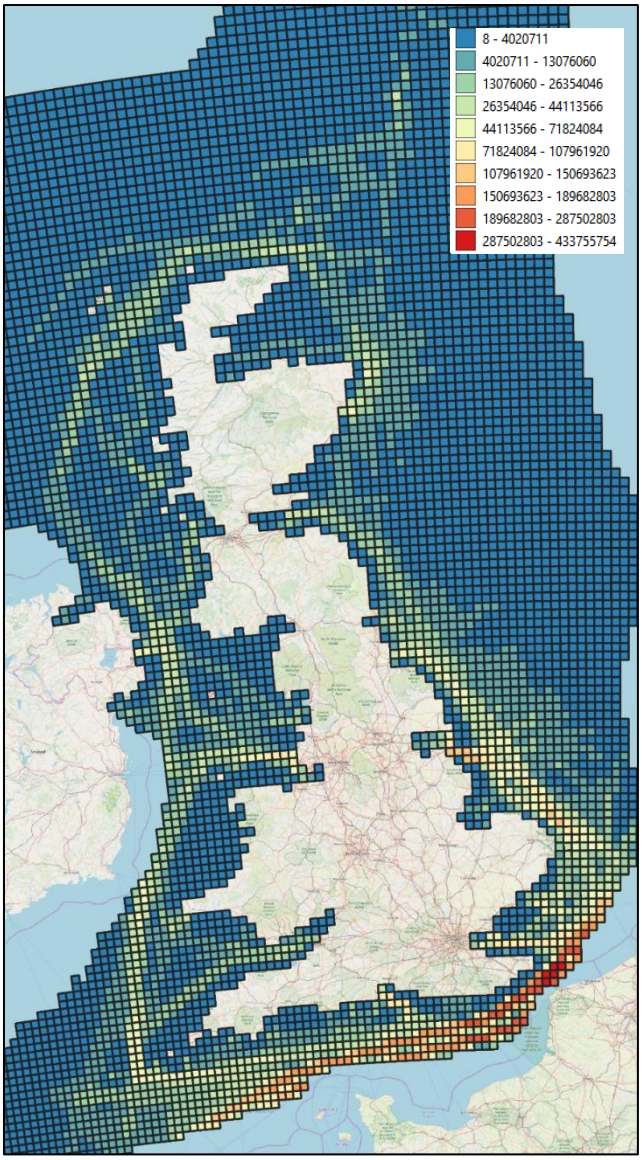

Figure 9: Shipping density (all types) 2015 to 2017 in the UK EEZ

Risk Assessment Analysis by Study Area

Each of the seven AoIs was categorised as a high, medium or low risk of a shipping hazard causing a pollution event. This assessment was based on:

[4] Map data © OpenStreetMap contributors

- The density of shipping (Figure 9) and vessel types typically present in the AoI;
- Environmental factors and prevailing weather, sea state and tidal conditions within the AoI;
- The nature of the coastline within or adjacent to the AoI;
- The presence, position and nature of hazards to shipping within the AoI; and
- The availability of commercial towing capability within or near the AoI.

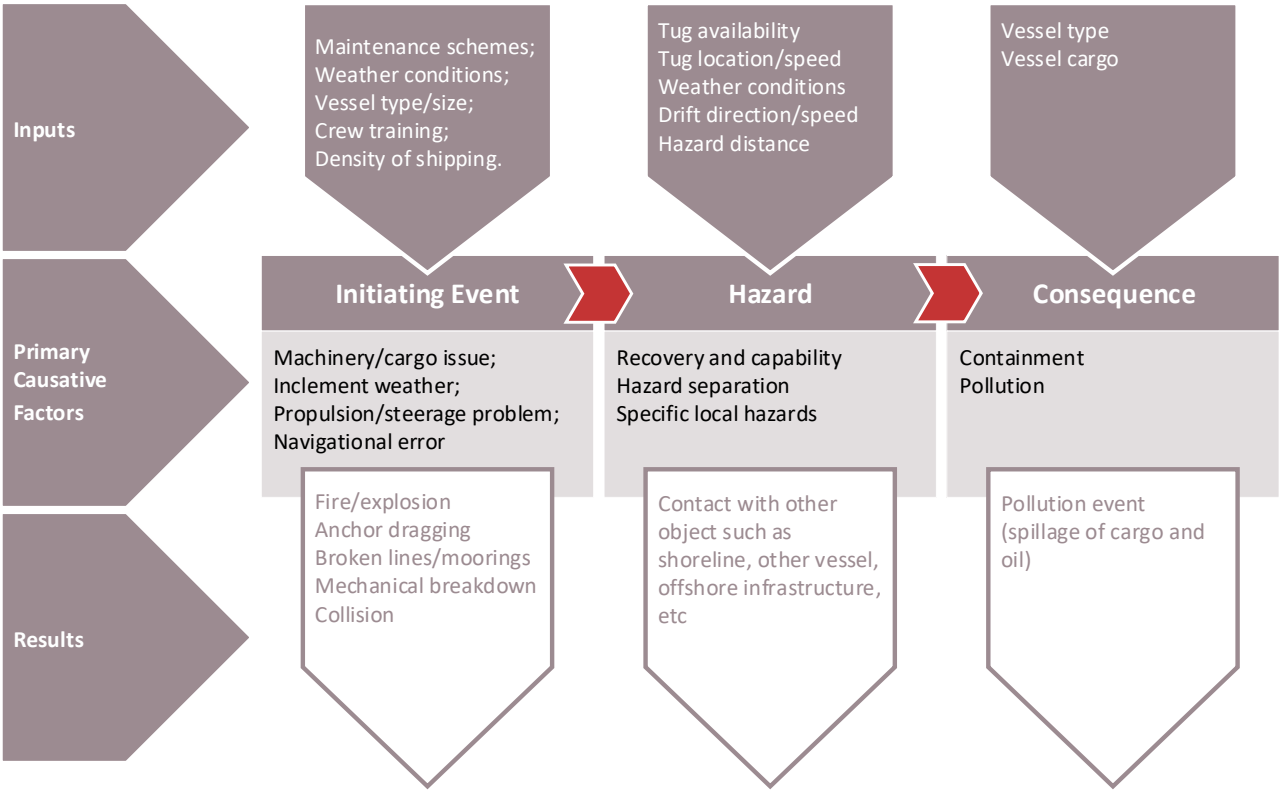

Figure 10: Risk assessment methodology flow diagram.

VESSEL TYPE AND DENSITY

Within the risk assessment AIS data was used to create the shipping density maps. This data includes various types of ships, for this study they have been broken down into four categories.

- **Tankers:** this category includes crude oil tankers, chemical tankers and ships that carry liquid cargoes in bulk;
- **Cargo vessels:** this category includes bulk carriers, general cargo ships, car carriers and container ships. In essence this category includes all vessels that don't carry liquid cargoes in bulk;
- **Passenger vessels:** this category includes passenger ferries and cruise ships; and
- **Fishing and offshore vessels:** this category includes all fishing and offshore support vessels.

ENVIRONMENTAL FACTORS AND HAZARDS

As with the 'SAGA SKY' incident, the likelihood a vessel requiring assistance increases greatly in gales and storms when the rate of drift increases. The predominant wind is from the South-West which makes the west coast of the UK and the south coast, including Dover Strait, more likely to be at risk from a stranded vessel. The risk increases in the winter months when the frequency of gales and storms is significantly greater.

Drift Analysis

Our analysis included calculating vessel drift vectors, probability of intersections with marine hazards, and the forward impact on environmentally/economically sensitive areas. As an input into this phase, we generated base layers capturing:

- Marine hazards, including geological and coastal hazards, and manmade infrastructure (including oil, gas, wind and nuclear plant); and
- Environmental/economic layer, combining geographic features (towns, ports, harbours), economic activity (e.g. fisheries), and other economically valuable infrastructure (windfarms, power stations, etc.).

An example of the vessel drift analysis is shown in Figure 11. The overall risk assessment of each of the AoIs under consideration is shown in Table 4.

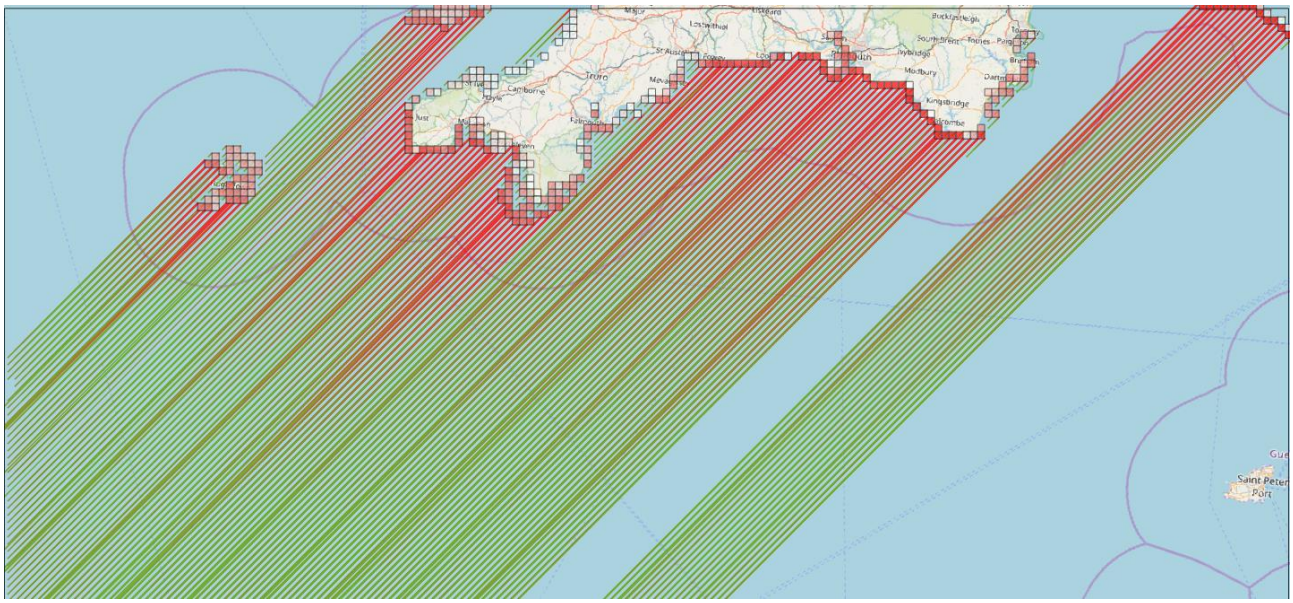

Figure 11: Example of South West Approaches Vessel Drift to Hazard

Table 4: Overall risk for the seven highlighted sea areas

Area of Interest	Risk of Pollution Event
Dover Strait	Higher
South West Approaches	Higher
St George's Channel	Lower
The North Channel	Lower
The Minches	Medium
Pentland Firth	Medium
Fair Isle Channel	Medium

ASSUMPTIONS

Two differing assumption sets were applied during the analysis to understand the sensitivity of the model and allow benchmarking against real world figures. These assumption sets were based around 'realistic' and 'pessimistic' scenarios, hereafter referred to as Assumption Set 1 (AS1) and Assumption Set 2 (AS2).

- **Assumption Set 1: *Pragmatic Risk Likelihood and Consequence***.
  A case based on current norms reflecting changes in shipping from 1994 to 2019. This uses a set of assumptions based on data from multiple sources (including the Bonn Agreement BE-AWARE study [3]) to develop an informed scenario, reflective of the modern shipping

environment, taking into account modern ship operations, conditions and design; and

- **Assumption Set 2: *High Risk Likelihood and Consequence.***
  This represents a 'worst case' scenario for the risks to and from shipping in the UK EEZ. This is based on historical market norms of 1994 at the time of Lord Donaldson's original report [4].

FUTURE SHIPPING FLEET SIZES

As part of this study, the growth of shipping up to 2025 was assessed. The study performed an analysis on the growth of various types of ship up to this year using 2018 as a baseline. The approach is based on the findings of a review commissioned as part of the UK government's Foresight Future of the Sea project which highlighted the correlation between shipping growth and GDP growth [6]. The analysis was underpinned by an assessment of the trend of historical Gross Domestic Product (GDP) of both the UK economy and the World economy to develop a number of growth rates for each year and for each ship type. These were used to assess the potential growth around the UK EEZ and fed into the cost-benefit analysis (CBA) process.

Figure 12 illustrates the rates to the growth of shipping for the four types (tankers, cargo vessels, passenger vessels, and fishing and offshore vessels) out to 2025, relative to the 2018 baseline.

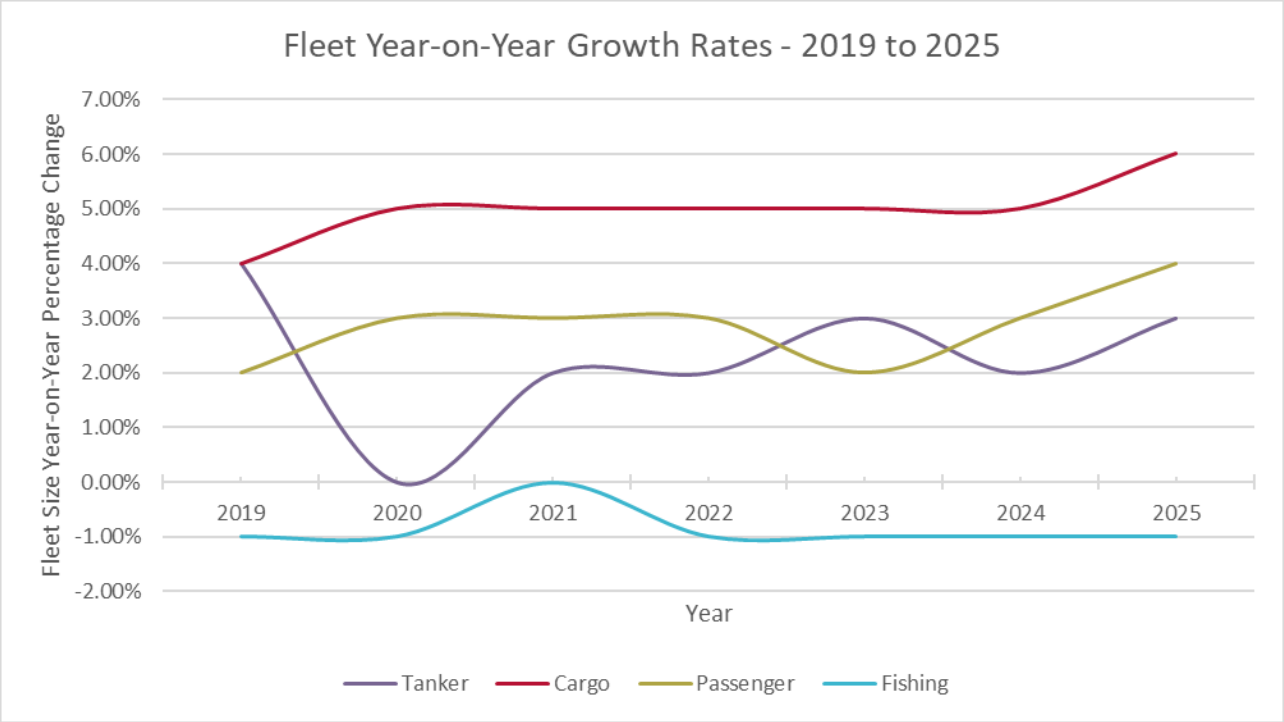

Figure 12: Projected vessel growth rates for the years 2019 to 2025

AVAILABILITY OF COMMERCIAL TOWAGE

OVERVIEW

An assessment was made of the potential commercial availability of vessels around the UK EEZ that could provide emergency towage capability. Figure 13 is a summary of this assessment and shows the assets operated by UK companies and non-UK companies of varying bollard pull capacities. The importance of this assessment is that it demonstrates areas of paucity of commercial towage operations, a factor taken into account in our overall assessment.

DATA SOURCES

To establish the location of available commercially available towing vessels within the UK EEZ, Solis Marine identified and contacted several sources which were then used in order to provide an overall picture of towing vessels that were operated from the UK, along with a snapshot of those vessels that may be based outside the UK but may be available to assist with towing operations. The sources, noted below, were used to establish the location, type, capability and additional functions of the towing vessels.

Data Used to Compile the List of Towing Vessels

UK operators of harbour towage supplied lists of tugs and vessels capable of towing at sea with a bollard pulling power greater than 30 tonnes. A further search of all known UK-based operators of towing vessels was carried out to identify potential towing vessels, with the data from their websites used to populate the database.

In addition to this, a search of AIS data for towing vessels was carried out for all vessels on 1 March 2019, which generated an understanding of any transiting vessels that may be present. A further check of the major offshore industry ports was also carried out to confirm that the vessels alongside had been captured. A further search, using an alternative AIS data supplier, was taken to identify ‘Tugs’, ‘Towing Vessels’ and ‘Large Towing Vessels’ within the UK’s EEZ.

Towing vessels that are currently on the MCA’s CAST[5] list, current at the time of preparing this report, are included. Chartering websites for tugs and anchor handling vessels available on 01 March 2019 were included in the list of towing vessels identified that were also available. Shipbrokers Marint and Seabay Group were consulted to provide information on the availability of towing vessels that were available for charter during the study.

Vessels operating in UK waters were captured to indicate their potential availability. However, it can not be known for certain whether the vessels would have been available to act as a towing vessel as they may have been chartered, or their deck cargo would exclude the use of their deck for towing.

[5] Coastguard Agreement on Salvage and Towage - a framework agreement that secures a pricing mechanism for tugs, noting that emergency situations could drive price increases.

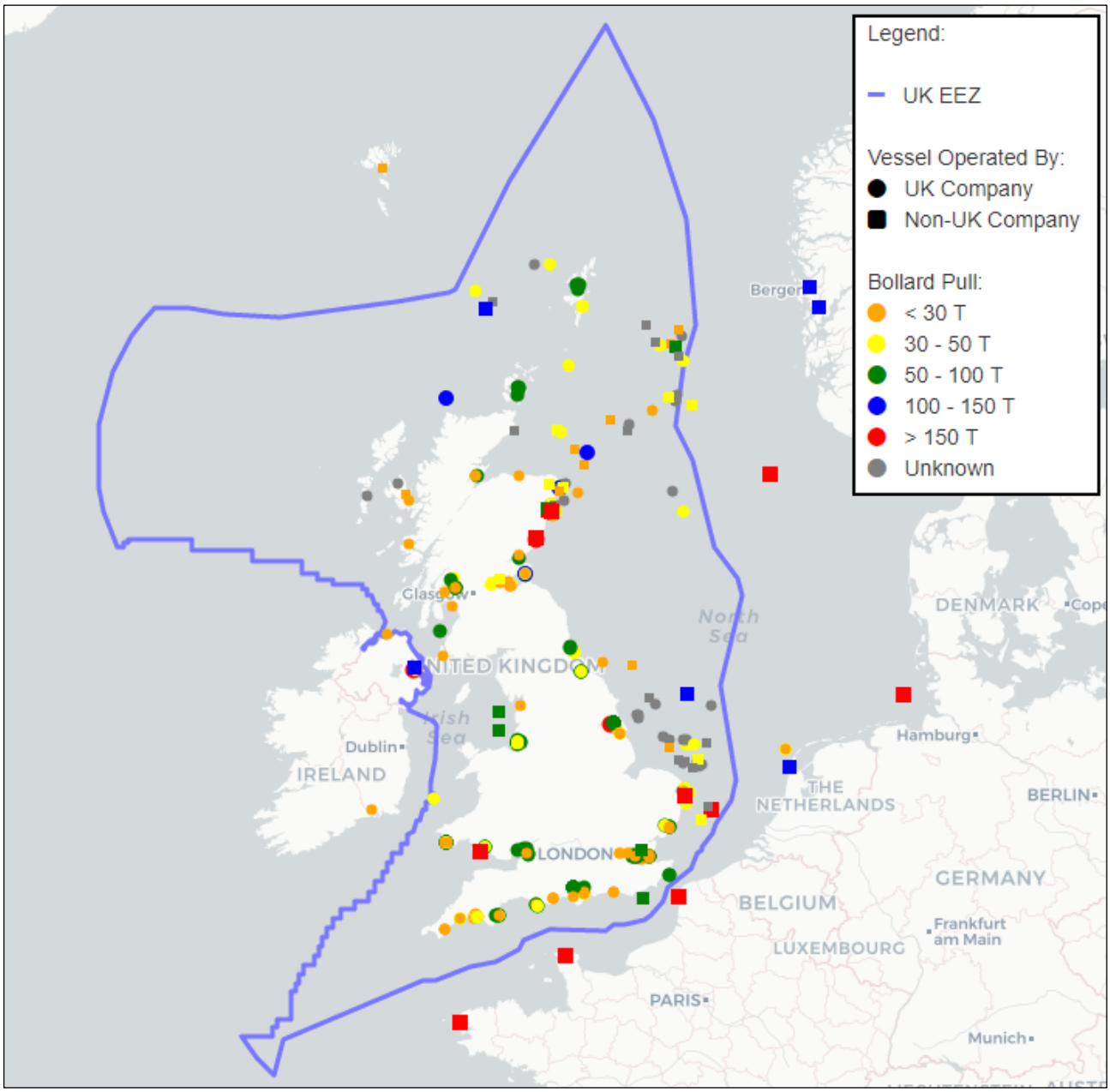

Figure 13: Current location and bollard pull of various vessels around the UK EEZ

COST-BENEFIT ANALYSIS

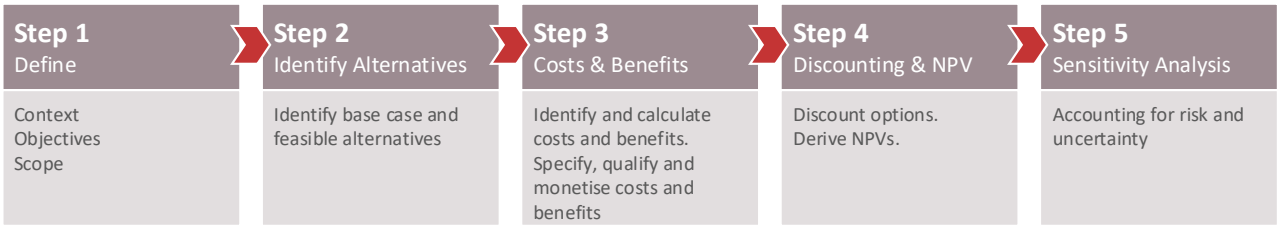

Figure 14: The Cost-Benefit Analysis Process

OVERALL COST-BENEFIT ANALYSIS APPROACH

The approach to cost-benefit analysis (CBA) for this study is based on HM Treasury's Green Book guidance [9]. The guidance indicates that a CBA should attempt to monetise the impact of different options – in this case emergency towage provision – on social welfare (social cost / benefit analysis), by considering the costs and benefits to UK society as a whole.

Once costs and benefits have been identified and valued, a benefit cost ratio (BCR) is derived, along with a net present social value (NPSV) calculation, which illustrates the benefits less costs for the intervention being considered. A present value is then created using the GDP deflator from the most recent forecasts by the Office for Budget Responsibility (OBR). Future costs and benefits are discounted to take into consideration the time preference of money using the Green Book's discount rate.[6] The CBA steps are shown in Figure 14.

The Context

The economic and societal costs associated with a disabled vessel making contact at a hazard contact point are defined as:

- The direct financial costs associated with the physical clean-up of spilled cargo and/or fuel oil from the disabled vessel.
- The indirect financial costs associated with the potential depletion in the economic productivity and/or amenity value of the environmental resource(s) affected by the release of pollution (e.g. loss of trade from reduced visitor numbers, reduced fishing revenues, restricted movement of vessels etc.).
- The indirect financial costs associated with fines and prosecutions for damage to protected environments and the habitats and species therein.

The Objective

The primary objective of the CBA is to understand whether emergency towage provision can provide net gains to UK society as a whole.

The Scope

The CBA sets out to understand the effect that emergency towage provision might have on UK society by modelling the probabilised consequence of shipping accidents that result in oil pollution (the probabilised cost of pollution). It aims to determine the current net effect of existing provision (the base case), and compare this with alternative forms of provision (options), by considering the reduction (or increase) in probabilised consequence. Thus, the expected benefit from additional or enhanced emergency towage provision is the reduction in

[6] To adjust for the social time preference. Currently 3.5% per annum.

probabilised risk of consequence. To understand the costs avoided, the value of the economic and environmental factors affected by oil pollution need to be identified and estimated.

The costs of emergency towage provision will be the next best alternative use of the required resources (the opportunity cost). The market value of capital costs, operational costs, and wider societal costs (loss of tourism, fishing value, habitats etc.) will be estimated for the CBA.

RECOMMENDATIONS

The results of the study lead to the following recommendations:

ASSUMPTION SET 1

- The results indicate that there is no case for investment in ETVs based purely on meeting the required economic criteria;
- Given the comparison between Assumption Set 1 and Assumption Set 2, the drive for improvement in ship design and operational standards should continue to be represented at IMO and other organisations, as this has likely contributed to a reduction in the risks to and from shipping in the UK EEZ;
- Socio-cultural and community factors however, as opposed to economic, may still render investment in an ETV in the South West Approaches and Scotland desirable; and
- Consideration of qualitative, rather than simply economic, arguments for ETV investment in areas with an overall high risk assessment (the Dover Straight and South West Approaches) could also be made.

ASSUMPTION SET 2

- A vessel on a dedicated charter available 100% of the time should be present in the South West Approaches based in Falmouth. This is a compelling CBA case due to both shipping densities and societal impacts;
- A vessel on a dedicated charter available 100% of the time should be present in the Dover Strait at the Port of Dover. The CBA provides a marginal CBA case driven by high traffic volumes but, which the exception of Dover, relatively low societal impacts across the relatively small extent of coastline;
- A vessel on a dedicated charter available 100% of the time should be present in the St George's Channel at the Port of Milford Haven. This is justified primarily by the significant environmental and societal impacts and the vessel types found in the area; and
- An appropriate ETV should be maintained in Scotland, as a spill would have a significant impact on the Scottish maritime industry, especially aquaculture and tourism upon which the local communities have economic dependence.

CONSOLIDATED VIEW

The analysis indicates that the improving reliability and safety of vessels (most notably the legal requirement for double hulled tankers) results in there being no CBA justification for the employment of ETVs within the UK EEZ. The underpinning rationale that could justify the provision of ETVs is to mitigate against large tanker spills, which are an infrequent occurrence. That said, as with all low probability/high impact risk scenarios, there is an argument that preventative measures are preferable to post incident recovery.

Of all the AOIs, the South West Approaches is the region which would benefit most from an ETV primarily driven by the long coastline, high shipping traffic volumes and high dependence on the marine economy.

Whilst not an CBA recommendation, consideration should also be made for the continued provision of ETV in Scottish waters due to the high dependency on the maritime sector and relative lack of economic resilience in certain geographic areas.

Ultimately, dedicated ETV platforms are not justifiable from a cost perspective however shared assets between nations (most notable France) or assets with secondary functions, for example maintaining navigation aids on behalf of Trinity House, could result in an acceptable compromise. The high impact/low probability nature of major incidents in the marine environment suggests that carefully considered, mitigating measures are employed. Due to our dependency on the sea as an island nation, cost might not be the only aspect to be considered when making decisions around ETV

provisions with benefit to local economies and safety of life at sea aspects also playing an important role.

STUDY LIMITATIONS

It must be noted that the following factors do not impact the CBA results or our analysis but have been included to form the subjective part of our recommendations:

- There are limitations to the complexity of the model used in this study, given the variability of weather in the maritime environment only the prevailing weather conditions have been included;
- Specific tidal influences have not been factored into the assessment, however the general drift speed used in the risk assessment and subsequent CBA is based on data from analyses performed that includes more general tidal influences;
- International political influences have not been factored in when it comes to towage provision; this is especially pertinent to relationships with the Republic of Ireland and France; these can influence the response to an event, particularly in four of the six areas of interest;
- A change in commercially-available tug distribution, configuration or abilities has not been factored into the analysis. A change of tug configuration can't be modelled in this particular assessment, for example tugs with over-the-bow towing arrangements (as opposed to stern capability) could have an impact on connection times, etc.
- Through stakeholder engagement, Frazer-Nash has learned that commercial towing arrangements could potentially be in decline. The change in future commercial towage has not been considered in this analysis owing to its transient and variable nature; only current towage provision has been assessed.

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