THE RESEARCH COUNCIL OF NORWAY (RCN), NORWEGIAN MARITIME AUTHORITY (NMA), NORWEGIAN COASTAL ADMINISTRATION (NCA)

NSRM CATEGORISATION AND NORMALISATION

TECHNICAL NOTE
ST-10310-1
SUMMARY:

This technical note describes how we have categorised ships for the purpose of normalising accident statistics. Normalisation is done by combining data from the Norwegian Maritime Authority (NMA) accident database with exposure data based on AIS data. The AIS data is linked to the StatCode5 categories for ship types and this does not fully comply with the categories used by NMA. The National Ship Risk Model (NSRM) project thus had to create some new ship categories, but on an overall level this is in accordance with the categories used by NMA. Fishing vessels, passenger vessels and cargo vessels are the ship categories we have included in the NSRM project. The other main categories from the NMA database; recreational crafts and offshore mobile units have not been included and the same applies to naval vessels covered by StatCode5.

Further, this technical note gives an introduction to normalisation of accident statistics and describes applicable dimensions to be used. Four different type of exposure data has been used; applicable for different type of ship types and accident type. Port calls will as an example be relevant for the accident type allision while hours in operation can be more relevant for other ship types and accidents. The two other exposure data types are number of ships and sailed distance. The NSRM project has used accident data and AIS data for the period 2010-2014, data can be trended over these year broken down on a monthly basis. Other dimensions applicable when normalising accident data are geographical areas, activity type and the ship register such as flag and nationality. In addition it can be interesting to compare ships with different age and dimension such as length.

This technical note is completed as a part of the National Ship Risk Model – project, headed by NTNU Social Research.
1 INTRODUCTION

For the purpose of normalising accident statistics we need to link the accident data to activity data (exposure data). Simply spoken normalised accident data is given by dividing number of accident to exposure data as illustrated in the equation below.

\[
\text{Normalised accident data} = \frac{\text{No of accidents}}{\text{Exposure data}}
\]

The two main data sources available for this project are the NMA accident database and AIS data, illustrated in Figure 1-1 below.

In this technical note we will describe how we can categorise ships to be able to combine the accident data to the exposure data from AIS for the purpose of normalisation. Additional dimensions such as location, time and activity type need to be defined as well for the accident statistics to make sense.
2 AIS DATA

The main source of exposure data in NSRM is AIS. The Automatic Identification System (AIS) send and receive messages in the very high frequency (VHF) maritime mobile band. Recommendation ITU-R M.1371 define 27 types of messages. Only position reports (Message 1, 2 and 3) and ship static and voyage related data (Message 5) are relevant for the project. The reporting interval for position reports is between two seconds and three minutes depending on speed and course alteration. For ship static and voyage related data the reporting interval is 6 minutes. All technical information about AIS data and how they are applied in this project is described in a separate technical note “Application of AIS data to accident statistics normalization” (Ref. 1).

Regulation 19 of SOLAS Chapter V requires AIS to be fitted aboard all ships of 300 gross tonnage and upwards engaged on international voyages, cargo ships of 500 gross tonnage and upwards not engaged on international voyages and all passenger ships irrespective of size. The requirement became effective for all ships meeting the above criteria by 31 December 2004.

The Norwegian Coastal Administration (NCA) has since February 2005 created a network of AIS base stations. In 2014 the network included more than 40 locations along the Norwegian coast and the satellite AISSat-1. AISSat-1 is in polar orbit and receives AIS messages from ships in Norwegian sea areas approximately every 90 minutes.

The AIS data is linked to the StatCode5 categories for ship types. In addition the ships is identified with IMO codes and call signs, identifications that can be used if there are no direct link between the NSRM ship category and StatCode5.

AIS is a system that:

- can send and receive messages using the VHF range
- is used by ships to report position, speed and other information to other ships
- can also be used to other stuff
- the international telecommunication union (ITU) define 27 different message types
- supports up to 64 different message types

There are two relevant AIS message types, illustrated in Figure 2-1. As highlighted by the arrow, MMSI is used as sender identity by both messages types.
Position reports (Message 1, 2 and 3)

- Dynamic information
- Reporting interval: 2 seconds to 3 minutes depending on speed and course alteration.
  - MMSI
  - Latitude
  - Longitude
  - Speed over ground (sog)
  - Course over ground (cog)
  - Rate of turn (rot)
  - true heading
  - navigation status

Static voyage and vessel information (Message 5)

- Static information
- Reporting interval: 6 minutes.
  - MMSI
  - IMO number
  - call sign
  - vessel name
  - type of ship and cargo
  - ship dimensions
  - Present draught
  - Destination
  - ETA

Figure 2-1 overview of AIS message types relevant for the project

MMSI: Available in all messages and for all ships
- A ships “phone number” that can change.
- In other words: MMSI identify a ship during some time interval and not for the ships lifetime.

IMO Number: Only available in Message 5 and not for all ships.
- A ships “social security number”, unchanged for the ships lifetime.
- Not all vessels have an IMO number

Call sign: Same as IMO number
- I am not sure if they remains unchanged during a ships lifetime
- Are they unique?

In 2015 we process position reports from 2012 with MMSI 290000000, no IMO or Call sign. How can we know which ship it was sent from?

Solution used today:

1. Buy ship information from IHS Fairplay. They have information about all vessels with an IMO number assigned.
2. If it is possible to get IMO from AIS, then lookup ship information using IMO.
3. If no match was found or vessel does not have IMO, lookup using MMSI.
4. If no match found, then the vessel is set to be Unknown.

Possible improvements:
- Use AIS data to create a list of vessels
- Get ship data that includes MMSI history for each ship.
Nice to know:

- Ship information from IHS Fairplay use the ship type coding system StatCode5
- The ship type of all vessels having an IMO number is categorized using this system.
- If we get an IMO number, then we know the StatCode5 code for that vessel.

Problem:
Vessels not having an IMO number must be categorized by someone/us.
3 NMA ACCIDENT STATISTICS

3.1 Introduction to NMA accident statistics

The NMA accident database spans more than three decades, containing information on maritime accidents as early as 1981. During this time, the database has been reworked on multiple occasions, and the definition on what constitutes a noteworthy maritime accident has changed over time. In its earliest iteration only accidents of a very serious character was included in the database. Around 1989 this all changed, following the incorporation of a new personnel accident system (using the acronym “PUS” in the Norwegian translations). The advent of PUS skyrocketed the number of accidents reported, which in turn led to the registration and build-up of a large number of work/personnel accidents, many of which constituted minor injuries.

Following a change in regulation amendment in 2008, the NMA published a guidance paper limiting the scope of noteworthy personnel accidents to more serious injuries. This brought the reporting of sea-based personnel injuries in line with the traditional land based-reporting practiced by the NLIA (Norwegian Labour Inspection Authority), and marked a decline in the number of less-serious personnel accidents reported.

From a purely scientific point of view, these changes give rise to challenges regarding data continuity. Luckily there are several ways to remedy this. One solution is to use accident specific cut-offs to focus on the more serious accidents. Another solution is to limit the scope of the investigation to a shorter timeframe, thus focusing on periods of comparable registration practices. In this study we have chosen the latter, focusing our timeframe on the last couple of years.

Since 2008, the NMA has registered on average 275 personnel accidents, and 250 ship accidents each year, not counting accidents related to leisure craft. As of 01.01.2015 the total number of accidents registered is 31 673. The statistics for 2010-2014 (data used in NSRM project) is presented in Table 1.

<table>
<thead>
<tr>
<th>Accident type</th>
<th>Fire/explosion</th>
<th>Grounding</th>
<th>Collision</th>
<th>Allision</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year of accident</td>
<td>2010</td>
<td>2011</td>
<td>2012</td>
<td>2013</td>
<td>2014</td>
</tr>
<tr>
<td>2010</td>
<td>25</td>
<td>18</td>
<td>20</td>
<td>34</td>
<td>23</td>
</tr>
<tr>
<td>2011</td>
<td>112</td>
<td>122</td>
<td>114</td>
<td>103</td>
<td>102</td>
</tr>
<tr>
<td>2012</td>
<td>45</td>
<td>25</td>
<td>24</td>
<td>37</td>
<td>22</td>
</tr>
<tr>
<td>2013</td>
<td>49</td>
<td>54</td>
<td>57</td>
<td>57</td>
<td>56</td>
</tr>
<tr>
<td>2014</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>225</td>
<td>219</td>
<td>215</td>
<td>230</td>
<td>203</td>
</tr>
</tbody>
</table>
3.2 NMA accident database main categories of ships

The cases registered in the NMA accident database is coded according to a taxonomy of ships. This taxonomy consists of 2 levels. The highest level consists of 5 so-called vessel groups. These 5 classes are named (1) Fishing vessel, (2) Passenger vessels, (3) Cargo vessels, (4) Offshore mobile units, and (5) Recreation crafts. Level 2 consist of more than 130 vessel types.

Table 2 Ship categories used in NMA statistic database

<table>
<thead>
<tr>
<th>Level 1 Vessel group</th>
<th>Constructed Sub-categories</th>
<th>Level 2 Vessel type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Passenger vessel</td>
<td>Ferries (Ro/ro passenger vessels, a part of inland road system)</td>
<td>Vessels with certificates, speed over 20 knops</td>
</tr>
<tr>
<td></td>
<td>High-speed craft</td>
<td>Vessels with certificates, speed over 20 knops</td>
</tr>
<tr>
<td></td>
<td>Large passenger vessels</td>
<td>Passenger vessels above 1500 BT</td>
</tr>
<tr>
<td></td>
<td>Other passenger vessels</td>
<td>-</td>
</tr>
<tr>
<td>Cargo vessels</td>
<td>Offshore</td>
<td>Vessels being indexed in NOR/NIS, with above 500 BT</td>
</tr>
<tr>
<td></td>
<td>Coastal traffic</td>
<td>Bulk, tank and goods, below 3000 BT and above 24 meters</td>
</tr>
<tr>
<td></td>
<td>International Traffic</td>
<td>Bulk, tank and goods, above 3000 BT</td>
</tr>
<tr>
<td></td>
<td>Other cargo</td>
<td>Cargo vessels below 24 meters</td>
</tr>
<tr>
<td>Fishing vessels</td>
<td>Large Fishing vessels</td>
<td>Fishing vessels above 15 meters</td>
</tr>
<tr>
<td></td>
<td>Small Fishing vessels</td>
<td>Fishing vessels below 15 meters</td>
</tr>
<tr>
<td>Recreational craft</td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>Offshore mobile units</td>
<td></td>
<td>-</td>
</tr>
</tbody>
</table>

3.3 Data shortcomings

Working with the accidents database for the following years 2010 to 2014 revealed some shortcomings concerning data quality. Revealed shortcomings includes inconsistence in the registration of ship categories, such as vessel type and vessel group. The implication of this is that transformation of the existing categories in the accident database into new categories does not result in reliable data. These shortcomings calls for a rather extensive manual control of the data.
More problematic shortcomings, related to our intended use, are wrong information regarding the locations of the accidents. Some coordinates does not make sense in relation to the rest of the information regarding the accident (e.g. groundings in a Norwegian fjord with coordinates in the southern Atlantic, accidents in the mountains of Norway etc.). These obvious errors, in addition to the shortcomings they represent by themselves, may indicate a low reliability of the coordinates in general.

If the data reliability in the future is strengthened when it comes to 1) the IMO number or the MMSI number, and 2) the coordinates of the accident, more reliable accident data could be obtained by using AIS data linked with different other relevant data sources (e.g. weather data). Using AIS data more directly when reporting accidents can support a better data quality. A proposal for this will be included in later version of this technical note.
4 NORMALISING ACCIDENT FREQUENCIES

Exposure data is needed for the purpose of normalising the accident data from the NMA database. To find interesting accident frequencies we need to combine additional dimensions. The dimensions we have reflected on in NSRM project are illustrated in Figure 4-1.

In addition to number of accidents for each accident type, exposure data and the ship categories, five additional dimensions are included. These five dimensions are “ship and loads specification”, “time and location”, “activity type”, “on board organisation” and “register data”. These dimensions are described in detail in later sections.

Examples of accidents statistics of interest could be:

- Is there any differences between bulk cargo and tank cargo when it comes to collision frequency? If there is a difference, is it constant over time?
- Is the frequency of grounding different in the North sea, in Norskehavet and in the Barents sea? What age and size of ships are exposed to grounding?
5 SHIP CATEGORIES

How to categorise ships for the purpose of combining data, is also described and discussed in a paper presented on the Esrel conference 2015 (ref. 2)

5.1 Introduction to ship categories

For the purpose of normalising accident frequencies, the ship categories used for accident statistics and exposure data must correspond. StatCode5 (AIS data) and NMA vessel taxonomy does not correspond. One important difference is that StatCode5 does not have distinct categories for ferries and high-speed craft. Another is that StatCode5 does not differentiate between small coastal fishing vessels and deep sea fishing vessels. An overview of the categories in NMA database and StatCode5 is given in Figure 5-1. It should be noted that both have more details at lower levels.

![Diagram of different ship categories in StatCode5 and the NMA accident database](image)

This apparently trivial problem is a technical challenge because one must be able to make sure that it is possible to make a connection between “a set” of accident data and a “set of” exposure data, which belong to the same category of ship. The solution is to establish an additional level of categories – a «StatCode6» or the “NSRM categories”. These are presented in the following sections.

AIS data use the StatCode5 vessel taxonomy from IHS Fairplay and the common identity is the IMO number as illustrated in Figure 5-2.
5.2 Ship categories proposed by NSRM

The ship categories proposed by the NSRM is illustrated in Figure 5-3. The rationale behind this proposal is described in later sections of this technical note. The main objective is however to be able to combine and link accident data and exposure data from AIS, and use ship categories that is of interest when it comes risk management and control. Fishing vessels, passenger vessels and cargo vessels are the categories that have been included and studied in the NSRM project, on this level the categories are the same as in the NMA accident database.
5.3 Criteria for categorisation

There are several possible criteria that can be used for classification of ships. The focus in this project is safety and factors influencing on the possibility for accidents to happen. This has been kept in mind when we have proposed categories, criteria being;

- Differences in the nature of activity and work being performed by the ship
- Size, ship design and localisation
- Difference in regulations applicable
- Difference in stakeholders and authorities

5.4 Fishing vessels

![Diagram of fishing vessels categories](image)

Fishing vessels below 15 meters are assumed to correspond with all fishing vessels involved in coastal fishing. The purpose of this category is to monitor the accident rate associated with professional fishing activities that are not supported by a major shipping company, responsible for the safety management. Safety measures that may be implemented has to be oriented towards the individual fishermen.

Fishing vessels above 15 meters are assumed to correspond with fishing vessel conducting deep sea fishing. The purpose of this category is to monitor the accident rate associated with professional fishing activities where larger industrial companies are responsible for the safety management, and where the interaction between shipping companies and regulative bodies may be an important part of the safety management.

5.5 Passenger vessels

Coding of sub-categories from the NMA accidents database have been linked to the NSRM categories for passenger ship as illustrated in Figure 5-5.

In the NMA accident database there are about 20 sub categories for passenger vessels. We propose a division into five categories. These are different in size, in localisation and in the way they operate. Several safety studies in Norway have been focusing on the inland ferries and high-speed craft, both with a high activity level along the cost and with quite high accident rate.
Figure 5-5 NSRM ship categories for passenger vessels with link to NMA accident database categories

It is not possible to split between the inland and international ferries based on the coding used by NMA. The trade area (fartsområde) for each accident is however included, and this parameter can be used to split between inland and international ferries. In NSRM passenger/cruiseships are divided into coastal express and other passenger/cruiseships as the coastal express may be an interesting ship category to study.

More details on how we combine accident data with AIS exposure data for passenger vessels is included in Appendix.

5.6 Cargo Vessels

The main categories we have used are work and service vessels, offshore service vessels, wellboats and cargo.

The category “Work and service vessels” have little in common with the other categories when we compare the work processes. The oil- and gas related vessels such as seismic, container, oil-pollution service is in this category, but it could be questioned if they belong there.

The category “offshore service vessels” are sub-categories of “special vessels” in the NMA database. Their work processes and activities stands outs from the other cargo vessels and the regulatory regimes are different. The PSA is a supervision authority in addition to NMA. We have proposed the following four sub-categories of “offshore service vessels”; “supply”, “stand-by”, “anchor handling” and “other offshore support vessels”. These categories are different both in activities and in the risk they are exposed to. It is however not obvious how data for anchor handling vessel can be extracted from the NMA accident database.

Wellboats are proposed as a separate category. In the NMA accident database it is a sub-category to bulk. The wellboats transport living fish and this is different from other transport, such as the Norwegian Food Safety Authority being a supervisory authority. Both wellboats and supply vessels (offshore service vessels) are handling cargo. The regulatory regime is however different from the cargo category.
Cargo is one category in the NMA accident database. The argument for dividing it into three subcategories are that there are large differences when it comes to operation and safety for these categories. Tank and bulk are specific categories in StatCode 5.

Coding of sub-categories from the NMA accidents database have been linked to the NSRM categories for passenger ship as illustrated in Figure 5-6.

![Figure 5-6 NSRM ship categories for cargo vessels with link to NMA accident database categories](image)

The categories listed beneath each “box” are from NMA database second levels. More details on how we combine accident data with AIS exposure data for cargo vessels is included in Appendix.

5.7 Recreational craft, Offshore Mobile units, Naval vessels

Not treated further in the NSRM project. There are however a need the link to the StatCode5 coding to include these ships into the population.
6 EXPOSURE DATA

Relevant exposure data obtainable from AIS includes:

- Sailed distance (nautical miles)
- Time in operations – elapsed hours
- Number of port calls
- Number of ships

The technical solutions for how to use AIS data to obtain these exposure data, is described in a separate technical note (ref.1). This sections only gives a short introduction.

**Sailed distance** is the estimated number of nautical miles sailed by a category of ship (or single ship) within a defined geographical area and period of time. The estimate is obtained by adding distances between single AIS position reports for individual vessels within a defined time period (see ref.1 for how this data is obtained).

**Hours in operations – elapsed time** is the estimated number of hours that a category of ship (or single ship) have been in operations within a defined geographical area and period of time. The data is obtained by summing elapsed time between AIS position reports for an individual vessels within a defined time period (see ref.1 for how this data is obtained).

**Number of port calls** is estimated by an algorithm that detects clusters in a vessel’s position reports, i.e. the vessel has been stationary within some small area for some time period. The average position of such “stationary” reports are used to find all ISPS ports within the vicinity. If a ISPS port is found, then the port call is marked as being to the closest ISPS port. If no ISPS port is found, then the port call is marked as being to an unknown port. ISPS port data from “Kartverket” has been used.

In the future, port calls to other harbours could also be obtained by AIS if positions data of the different categories of harbours is applied. Other data sources than AIS could also be used to obtain information regarding number of port calls such as e.g. “ferjedatabanken”¹.

**Number of ships** is estimated by counting the number of ship identities visible in AIS data for a defined geographical area and time period. (See ref.1 for how this data is obtained).

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¹ [http://fdb.triona.no/front.xhtml](http://fdb.triona.no/front.xhtml)
7 TIME AND GEOGRAPHICAL AREAS/LOCATION

7.1 Time
In the NSRM project AIS and accident data from the time period is 2010 – 2014 is included. The accident statistic can be sorted on these five years and broken down on a monthly basis. In a future versions it may be possible to divide on time of day (day/night and light/dark).

7.2 Geographical Areas/Location
Just as there are no natural categories of ships, there are no natural categories for geographic areas. Here too, this depends on the purpose of categorization. In connection with risk monitoring maritime traffic, it will be suitably to use various taxonomies for geographic areas. This could be:

- Legal/juridical classification
- Segment classification
- Topographical classification

The legal/juridical classification of the geographical area is justified by the fact that both regulations and regulatory stakeholders vary between different geographical areas. The maritime boundaries\(^2\) (Figure 7-1 and Figure 7-2) of the coastal state should be used to differentiate between different geographical areas. The legal/juridical taxonomy of geographical areas consist of the following:

- Internal waters (water inside the baseline)
- Territorial waters (e.g. 12 nautical miles outside baseline and internal waters)
- Ocean (International waters, including contiguous zone, economical zone, continental shelf)
- Contiguous zone (12 nautical miles outside the territorial waters, i.e. a sub category of “Ocean”)

This taxonomy make it possible to separate and monitor the waters with compulsory pilotage (water inside the baseline), the waters where the coastal states have the right to apply its law and its coercive power (territorial waters), the waters where the coastal state does have no jurisdiction over the vessel traffic, but sovereign rights over natural resources and on the seabed and the waters above (International waters, including contiguous zone, economical zone, continental shelf), and the international waters where the coastal state have the right to control in order to prevent violations on Norwegian territory or territorial waters (contiguous zone).

Figure 7-1 Maritime boundaries

Figure 7-2 Norwegian maritime borders
The segment classification implies a possibility of dividing the waters into segments that are considered as relevant to monitor separately from other areas. The classification of the segments could be based on e.g.:

- Fjords
- Fairways (e.g. the risk classified³ fairways)
- Stretch of coastline (e.g. an divisions of the coastline according to the division of the 7 pilot administration districts along the coast, VTS area vs non VTS area)

A topological classification could be oriented towards the variation in navigational complexity due to obstacles in the course line (such as reefs, rocks, shorelines, islands, bridges, offshore installation and other vessels) and local variations in currents. This will make it possible to monitor and analyse accidents that occurs in relation to specified natural or artificial obstacles.

³ 92 fairways have currently been classified.
8 ACTIVITY TYPE

This dimension is not implemented as a part of the NSRM project.

**Domestic transport** includes *small coasting*\(^4\) and all types of voyages within protected waters (voyages areas 2-4), except of voyages within completely sheltered waters (voyages area 1)

**International transport** includes *large coasting*\(^5\), *North Sea and Baltic Sea voyages*\(^6\), *European voyages*\(^7\), *Short international voyages*\(^8\), *International voyages*\(^9\), *Overseas voyages*\(^10\) and *Unrestricted voyages*.

**Passing transport** includes *innocent passages*\(^11\) and vessels passing within the geographical area “Ocean” (i.e. International waters, including contiguous zone, economical zone, continental shelf) without making any port calls in Norway

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\(^4\) Includes coasting along a country’s coasts, rivers, canals and lakes (small coasting). Includes the coasting, where the ship passes unsheltered stretches of over 25 nautical mil, and all within the surrounding waters, provided that the ship never located further off the coast than 20 nautical miles from the base line.

\(^5\) Implies coasting in Swedish, Danish and German waters east of a line Lindesnes - Limfjorden (west estuary), and west of a line Karlskrona - Świnoujście.

\(^6\) Implies coasting in Skagerrak, Kattegat, the Baltic Sea inclusive of the Bothnic and Finnish bay, the North Sea up to 61 ° N latitude, and the United Kingdom, Ireland east of 8 ° W length and the English Channel limited by a line Brest-Cork.

\(^7\) All voyages within the external borders of the White Sea, Svalbard, Jan Mayen, Iceland, Madeira, the Azores, the Canary Islands, west coast of Africa north of 30 ° N latitude, the Mediterranean and the Black Sea.

\(^8\) An international voyages where the vessel does not travel more than 200 nautical mil from a port, and where the distance between the last port of call in the country where the journey begins and the final destination does not exceed 600 nautical miles.

\(^9\) A voyages from a country covered by the SOLAS Convention to a port outside that country or vice versa, and in this respect, any territory for whose international relations a Contracting Government is responsible or for which the United Nations is the administering authority, considered as a particular country.

\(^10\) Voyages from one continent to another over one of the world’s oceans.

\(^11\) Innocent passage is a juridical concept for a vessel that pass through the territorial waters of another state subject without conducting any port calls
9 SHIP AND LOADS SPECIFICATION

Ship conditions denotes specific attributes and features related to the vessels that are assumed to influence the risk in itself. Three attributes have been defined:

- Age of the vessel
- Gross tonnage
- Length
- Type of load

SafeSeaNet may be a source for type of load.
10 ON BOARD ORGANIZATION

This dimension is not implemented as a part of the NSRM project.

On board organization denotes characteristics regarding the work organization. The following attributes have been defined:

- Compulsory pilotage (Vessels with compulsory pilotage and vessels without compulsory pilotage)
  - Use of pilot or Pilotage Exemption Certificates
- Categories of manning levels

These dimensions have not yet been implemented. This is dimensions that relies on additional dynamical information sources (not only AIS and NMA accident database). SafeSeaNet may be a valuable data source for this dimension.
11 REGISTER DATA

Register data is a collection of variables that reflects the regulatory regimes related to the vessels, and based on the "division of responsibility" between flag states and coastal states\textsuperscript{12}. The following variables could be used:

- Flag state
- Class society
- Paris MOU
- Flags of convenience

The \textit{flag state} variable make it possible to distinguish between (1) NOR, (2) NIS, and (3) Foreign vessels. This make it possible to monitor if there is a variation in the accident frequencies between Norwegian vessels and the foreign vessels.

The \textit{class society} variable make it possible to distinguish between all the different class society and monitor if there is differences in accident frequencies.

The \textit{Paris MoU} variable make it possible to distinguish between “white”, “grey” and “black” list defined in Paris MoU.

The \textit{Flags of convenience} variable make it possible to distinguish the vessels registered in the 34 national registries that the International Transport Workers Federations consider as Flag of convenience. This is vessels were the seamen are considered to have long periods of work without proper rest, leading to stress and fatigue, poor on-board conditions, inadequate food and clean drinking water, and very low wages.

\textsuperscript{12} Coastal states regulate "outside the hull" in their territorial waters and the flag state regulates "within the hull" (enshrined in UNCLOS)
12 REFERENCES

APPENDIX

Categorisation of ships and the details of combining data.
Passenger vessels

The link between the NSRM categories and StatCode5 for passenger vessels are indicated in Figure 0-1.

![Diagram showing the link between NSRM categories and StatCode5 for passenger vessels.]

Figure 0-1 NSRM ship categories for passenger vessels with link to NMA accident database categories

The categories included in StatCode5 for passenger vessels are listed in Table 3 including labels.

Table 3 StatCode5 categories for passenger vessels

<table>
<thead>
<tr>
<th>I3_code</th>
<th>I3_name</th>
<th>I4_code</th>
<th>I4_name</th>
<th>I5_code</th>
<th>I5_name</th>
</tr>
</thead>
<tbody>
<tr>
<td>A32</td>
<td>Passenger / General Cargo</td>
<td>A32A</td>
<td>Passenger/General Cargo Ship</td>
<td>A32A2GF</td>
<td>General Cargo/Passenger Ship</td>
</tr>
<tr>
<td>A36</td>
<td>Passenger/Ro-Ro Cargo</td>
<td>A36A</td>
<td>Passenger/Ro-Ro Cargo Ship</td>
<td>A36A2PT</td>
<td>Passenger/Ro-Ro Ship (Vehicles/Rail)</td>
</tr>
</tbody>
</table>
Cargo vessels

The link between the NSRM categories and StatCode5 is indicated in Figure 0-2.

![Figure 0-2 Link between NSRM categories and StatCode 5 for cargo vessels](image)

The StatCode5 categories with labels for bulk cargo are listed in Table 4.

### Table 4 StatCode5 categories for Bulk vessels

<table>
<thead>
<tr>
<th>l3_code</th>
<th>l3_name</th>
<th>l4_code</th>
<th>l4_name</th>
<th>l5_code</th>
<th>l5_name</th>
</tr>
</thead>
<tbody>
<tr>
<td>A21</td>
<td>Bulk Dry</td>
<td>A21A</td>
<td>Bulk Carrier</td>
<td>A21A2BC</td>
<td>Bulk Carrier</td>
</tr>
<tr>
<td>A21</td>
<td>Bulk Dry</td>
<td>A21A</td>
<td>Bulk Carrier</td>
<td>A21A2BG</td>
<td>Bulk Carrier, Laker Only</td>
</tr>
<tr>
<td>A21</td>
<td>Bulk Dry</td>
<td>A21A</td>
<td>Bulk Carrier</td>
<td>A21A2BV</td>
<td>Bulk Carrier (with Vehicle Decks)</td>
</tr>
</tbody>
</table>
The StatCode5 categories with labels for tankers are listed in Table 5.

**Table 5 StatCode5 categories for tank vessels**

<table>
<thead>
<tr>
<th>l3_code</th>
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<th>l4_name</th>
<th>l5_code</th>
<th>l5_name</th>
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</thead>
<tbody>
<tr>
<td>A11</td>
<td>Liquefied Gas</td>
<td>A11A</td>
<td>LNG Tanker</td>
<td>A11A2TN</td>
<td>LNG Tanker</td>
</tr>
<tr>
<td>A11</td>
<td>Liquefied Gas</td>
<td>A11B</td>
<td>LPG Tanker</td>
<td>A11B2TG</td>
<td>LPG Tanker</td>
</tr>
<tr>
<td>A11</td>
<td>Liquefied Gas</td>
<td>A11B</td>
<td>LPG Tanker</td>
<td>A11B2TH</td>
<td>LPG/Chemical Tanker</td>
</tr>
<tr>
<td>A11</td>
<td>Liquefied Gas</td>
<td>A11C</td>
<td>CO2 Tanker</td>
<td>A11C2LC</td>
<td>CO2 Tanker</td>
</tr>
<tr>
<td>A12</td>
<td>Chemical</td>
<td>A12A</td>
<td>Chemical Tanker</td>
<td>A12A2LP</td>
<td>Molten Sulphur Tanker</td>
</tr>
<tr>
<td>A12</td>
<td>Chemical</td>
<td>A12A</td>
<td>Chemical Tanker</td>
<td>A12A2TC</td>
<td>Chemical Tanker</td>
</tr>
<tr>
<td>A12</td>
<td>Chemical</td>
<td>A12B</td>
<td>Chemical/Oil Products Tanker</td>
<td>A12B2TR</td>
<td>Chemical/Products Tanker</td>
</tr>
<tr>
<td>A12</td>
<td>Chemical</td>
<td>A12C</td>
<td>Wine Tanker</td>
<td>A12C2LW</td>
<td>Wine Tanker</td>
</tr>
<tr>
<td>A12</td>
<td>Chemical</td>
<td>A12D</td>
<td>Vegetable Oil Tanker</td>
<td>A12D2LV</td>
<td>Vegetable Oil Tanker</td>
</tr>
<tr>
<td>A12</td>
<td>Chemical</td>
<td>A12E</td>
<td>Edible Oil Tanker</td>
<td>A12E2LE</td>
<td>Edible Oil Tanker</td>
</tr>
<tr>
<td>A12</td>
<td>Chemical</td>
<td>A12F</td>
<td>Beer Tanker</td>
<td>A12F2LB</td>
<td>Beer Tanker</td>
</tr>
<tr>
<td>A12</td>
<td>Chemical</td>
<td>A12G</td>
<td>Latex Tanker</td>
<td>A12G2LT</td>
<td>Latex Tanker</td>
</tr>
<tr>
<td>Column A</td>
<td>Column B</td>
<td>Column C</td>
<td>Column D</td>
<td>Column E</td>
<td>Column F</td>
</tr>
<tr>
<td>----------</td>
<td>----------</td>
<td>----------</td>
<td>----------</td>
<td>----------</td>
<td>----------</td>
</tr>
<tr>
<td>Chemical</td>
<td>A12O</td>
<td>Fruit Juice Tanker</td>
<td>A12O1LJ</td>
<td>Fruit Juice Tanker</td>
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</tr>
<tr>
<td>Oil</td>
<td>A13A</td>
<td>Crude Oil Tanker</td>
<td>A13A2TS</td>
<td>Shuttle Tanker</td>
<td></td>
</tr>
<tr>
<td>Oil</td>
<td>A13A</td>
<td>Crude Oil Tanker</td>
<td>A13A2TV</td>
<td>Crude Oil Tanker</td>
<td></td>
</tr>
<tr>
<td>Oil</td>
<td>A13A</td>
<td>Crude Oil Tanker</td>
<td>A13A2TW</td>
<td>Crude/Oil Products Tanker</td>
<td></td>
</tr>
<tr>
<td>Oil</td>
<td>A13B</td>
<td>Oil Products Tanker</td>
<td>A13B2TP</td>
<td>Products Tanker</td>
<td></td>
</tr>
<tr>
<td>Oil</td>
<td>A13C</td>
<td>Bitumen Tanker</td>
<td>A13C2LA</td>
<td>Asphalt/Bitumen Tanker</td>
<td></td>
</tr>
<tr>
<td>Oil</td>
<td>A13D</td>
<td>Coal/Oil Mixture Tanker</td>
<td>A13E2LD</td>
<td>Coal/Oil Mixture Tanker</td>
<td></td>
</tr>
<tr>
<td>Other Liquids</td>
<td>A14A</td>
<td>Water Tanker</td>
<td>A14A2LO</td>
<td>Water Tanker</td>
<td></td>
</tr>
<tr>
<td>Other Liquids</td>
<td>A14F</td>
<td>Molasses Tanker</td>
<td>A14F2LM</td>
<td>Molasses Tanker</td>
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</tr>
<tr>
<td>Other Liquids</td>
<td>A14G</td>
<td>Glue Tanker</td>
<td>A14G2LG</td>
<td>Glue Tanker</td>
<td></td>
</tr>
<tr>
<td>Other Liquids</td>
<td>A14H</td>
<td>Alcohol Tanker</td>
<td>A14H2LH</td>
<td>Alcohol Tanker</td>
<td></td>
</tr>
<tr>
<td>Other Liquids</td>
<td>A14N</td>
<td>Caprolactam Tanker</td>
<td>A14N2LL</td>
<td>Caprolactam Tanker</td>
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</tr>
<tr>
<td>NULL</td>
<td>B35E</td>
<td>Bunkering Tanker</td>
<td>B35E2TF</td>
<td>Bunkering Tanker</td>
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</tr>
<tr>
<td>Inland Waterways</td>
<td>W11A</td>
<td>Inland Waterways Chemical Tanker</td>
<td>W11A5TC</td>
<td>Chemical Tanker, Inland Waterways</td>
<td></td>
</tr>
<tr>
<td>Inland Waterways</td>
<td>W11B</td>
<td>Inland Waterways Oil Tanker</td>
<td>W11B5TU</td>
<td>Oil Tanker, Inland Waterways</td>
<td></td>
</tr>
<tr>
<td>Inland Waterways</td>
<td>W11C</td>
<td>Inland Waterways Other Liquids Tanker</td>
<td>W11C5LE</td>
<td>Edible Oil Tanker, Inland Waterways</td>
<td></td>
</tr>
<tr>
<td>Inland Waterways</td>
<td>W11D</td>
<td>Inland Waterways Other Liquids Tanker</td>
<td>W11C5LO</td>
<td>Water Tanker, Inland Waterways</td>
<td></td>
</tr>
<tr>
<td>Inland Waterways</td>
<td>W11E</td>
<td>Inland Waterways Other Liquids Tanker</td>
<td>W11C5LV</td>
<td>Vegetable Oil Tanker, Inland Waterways</td>
<td></td>
</tr>
</tbody>
</table>

Table 6: StatCode5 coding for dry cargo vessels

<table>
<thead>
<tr>
<th>Column A</th>
<th>Column B</th>
<th>Column C</th>
<th>Column D</th>
<th>Column E</th>
<th>Column F</th>
</tr>
</thead>
<tbody>
<tr>
<td>A31</td>
<td>General Cargo</td>
<td>A31A</td>
<td>General Cargo Ship</td>
<td>A31A2GA</td>
<td>General Cargo Ship (with Ro-Ro facility)</td>
</tr>
<tr>
<td>A31</td>
<td>General Cargo</td>
<td>A31A</td>
<td>General Cargo Ship</td>
<td>A31A2GO</td>
<td>Open Hatch Cargo Ship</td>
</tr>
<tr>
<td>A31</td>
<td>General Cargo</td>
<td>A31A</td>
<td>General Cargo Ship</td>
<td>A31A2GS</td>
<td>General Cargo/Tanker (Container/oil/bulk - COB ship)</td>
</tr>
<tr>
<td>A31</td>
<td>General Cargo</td>
<td>A31A</td>
<td>General Cargo Ship</td>
<td>A31A2GT</td>
<td>General Cargo/Tanker</td>
</tr>
<tr>
<td>A31</td>
<td>General Cargo</td>
<td>A31A</td>
<td>General Cargo Ship</td>
<td>A31A2GX</td>
<td>General Cargo Ship</td>
</tr>
</tbody>
</table>
The category “Offshore service vessels” can be further broken down as given in Table 7.

Table 7 Level4 StatCode5 Decode Offshore service vessels (inn kode nr.)

- Platform Supply Ship
- Platform Supply Ship
- Platform Supply Ship
- Offshore Tug/Supply Ship
- Offshore Tug/Supply Ship
- Offshore Support Vessel
- Offshore Support Vessel
- Offshore Support Vessel
- Offshore Support Vessel
- Drilling Ship
- Pipe Layer
- Pipe Layer
- Production Testing Vessel
- FPSO (Floating, Production, Storage, Offloading)
- FPSO (Floating, Production, Storage, Offloading)
- Well Stimulation Vessel
- Standby Safety Vessel
- FSO (Floating, Storage, Offloading)
- Trenching Support Vessel
- Pipe Burying Vessel
- FSO (Floating, Storage, Offloading)