DEVELOPMENT OF SIMPLIFIED STABILITY AND LOADING INFORMATION FOR FISHERMEN

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SUMMARY
Much research has been conducted worldwide on the subject of stability and safety in the fishing industry. Generally, the objectives are a better understanding of vessel behaviour, and improved regulation of stability. There has been little advance in stability regulation because, to adjust the criteria would penalise some sector of the industry and make it less competitive. This paper describes two UK studies with the common objective of providing guidance to fishermen regarding their level of safety. It is hoped that, given improved information, the industry will be able to maintain use of the existing fleet while becoming more aware of its limitations, perhaps with some improvement in the safety culture.

1. INTRODUCTION

This paper describes two research projects conducted for the MCA in 2004. Each comprised the first phase of a project, to recommend methods that might be developed to provide guidance to fishermen. Project 530 was targeted at the larger vessels that are required to carry stability information booklets, and Project 529 at the more numerous smaller vessels, for which stability information rarely exists. The formal reports on each are available on the MCA website [1 and 2]. The second phase of each project is to be completed during 2005.

As the development of the methods has not been completed, this paper concentrates on the research and philosophy behind the recommendations.

2. BACKGROUND

The fishing industry is at or near the top of the list of the most hazardous occupations in most countries of the world. This statistic holds true for the full range of fisheries, from subsistence level operations in small craft to highly developed industrial operations. The fatality rate, world wide, is about 24000 per annum.

In terms of accidents in the fishing industry, capsizing and foundering are relatively rare events. In terms of fatalities they represent the greatest danger.

In their most recently published annual report, for 2003, the Marine Accident Investigation Branch (MAIB) state that they investigated accidents to 15 vessels, involving a total of 12 fatalities. Of these, 3 were capsized fishing vessels resulting in 7 fatalities. These figures typify statistics for the UK [3] and elsewhere, as discussed by Sevastianov [4] and Dahle and Myrhaug [5].

The sustained high rate of casualties to UK fishing vessels has prompted the MAIB to make recommendations to the Maritime & Coastguard Agency (MCA) regarding the provision of simplified stability information for fishermen, and the provision of guidance on the loading of small fishing vessels.

For many years, administrations have stated that fishermen should understand, and operate in accordance with, the information in their vessels' stability books. They now have to recognise that such expectations are unrealistic and, having accepted the MAIB recommendations, the MCA have to address the issues.

3. REQUIREMENTS OF SIMPLIFIED INFORMATION

Stability booklets are of great value to the regulatory authorities, and to consultants who may be asked to advise on modifications. It is widely recognized however, that fishermen do not use stability information booklets as a means of ascertaining their level of safety on a regular basis. Most do not understand the presentations or their implications. It is understandable that fishermen frequently take the view that their stability has passed the stability assessment, and therefore must be safe to operate.

Vessels under 12 metres in length make up about 80% of the UK fleet, and are not required to comply with any stability requirements or carry stability information.

4. IDENTIFYING THE HAZARDS

If information on safety is to be of any value it must address the particular hazards that are relevant to the vessel, its operation and environment.

4.1 OPERATIONAL HAZARDS

In UK waters alone there are a wide variety of vessel types, employing a range of fishing methods, in conditions ranging from calm sheltered waters to the open ocean. One might argue that each vessel is unique in terms of the combination of these aspects, but it is possible to categorise the hazards in a number of ways.

Table 1 presents typical hazards for 6 common methods of fishing. They are grouped according to their frequency and duration. Hazards that occur regularly tend to be of short duration, so that the probability of a stability incident resulting from them is kept low. Hazards of longer duration tend to occur less frequently. Some, however, are of a permanent nature, at least in terms of the fishing operation, and may be progressive, perhaps due to an accumulation of small changes.

All of these hazards are under the direct control of the crew, and can be avoided or reduced.

		Pelagic Trawling	Demersal Trawling	Beam Trawling	Dredging	Netting	Potting
Regular, transient hazards	**Handling the gear**			Boarding the gear	Boarding the gear		
	Boarding the catch	Lifting cod end from high block	Lifting cod end from high block		Boarding the gear. Blocking freeing ports		
Occasional, prolonged hazards	**Handling abnormal loads**		Lifting cod end from block high & aft or offset	Lifting from derrick block high & outboard	Lifting from derrick block high or outboard		
	Coming fast		Moment applied under way or in tideway	Moment applied under way or in tideway	Moment applied under way or in tideway		
	Freeing fastened gear		Moment applied high & aft or offset	Lifting from derrick block high & outboard	Lifting from derrick block high & outboard		Moment applied high & offset
	Overloading the boat	Bulk fish. Reduced freeboard & cargo shift	Bulk fish. Reduced freeboard & cargo shift		Shellfish on deck. Reduced freeboard & cargo shift	Net bins on deck. Reduced freeboard & cargo shift	Moving pots. Reduced freeboard & stability
Progressive, permanent hazards	**Modifying the gear**	Larger nets, drums or doors	Larger nets, drums or doors	Longer or heavier beams or derricks	Longer or heavier beams or derricks	Repositioned or more powerful net haulers	Repositioned or more powerful pot haulers
	Modifying the boat	Many possibilities	Many possibilities	Many possibilities	Many possibilities	Many possibilities	Many possibilities

Table 1: Operational Hazards

Fishing Method	Number of vessels (1997)	Casualties Jan 91 – Feb 97	Casualty Rate per 1000
Trawlers	938	7	7.5
Beamers & Dredgers	262	13	49.6
Potters	1275	8	6.3
Netters & Liners	2641	5	1.9
Hand Gears	1441	0	0
Total	6557	33	5

Table 2: Under 12 metre Casualties by Fishing Method

Modifications to the gear or the boat should be reported to the authority, and their effects calculated, but frequently this is not the case.

General advice regarding the other hazards may be contained in the stability book, but they are not addressed as part of the stability assessment in the UK. Calculations regarding their effects are not presented in conventional stability booklets.
Some administrations require the more frequent hazards, such as boarding of the gear, to be assessed against the criteria and, in the UK, similar requirements are imposed on other types of working vessel. UK fishing vessels are exempt from such scrutiny and, in many cases, have insufficient stability margin to comply with the minimum requirements when handling their gear, even when it is empty. This is particularly true of beam trawlers and scallop dredgers, as discussed in [6], and demonstrated by the casualty data for small vessels presented in Table 2.

4.2 ENVIRONMENTAL HAZARDS

The environmental hazards most likely to be encountered are: wind heeling, shipping water, loss of stability on a wave, rolling in waves, impact from breaking waves, icing and flooding.

These differ from the operational hazards in that the crew have only indirect control over them. They can, for example, maintain secure closures to prevent downflooding from shipped water, and keep the vessel head to severe seas to reduce the possibility of loss of stability on a wave, or being heeled to a large angle by a breaking wave. The crew can be provided with warnings and advice on ways to minimise the dangers but they cannot necessarily avoid the hazards.

5. PREVIOUS UK RESEARCH

Stability has been the subject of extensive research throughout the world, and considerable effort has concentrated on the safety of fishing vessels. In the UK alone, there have been 5 other government funded research projects to study fishing vessel stability in the last 10 years [6 to 10]. Despite this concerted effort, regulation of stability remains largely unchanged and casualties remain high.

The study of beam trawlers [6] quantified their vulnerability to the MCA, demonstrating that most cannot comply with the legal requirement for vessels to meet the minimum criteria "*in all foreseeable operating conditions*". It resulted in a guidance note being published, and requirements for details of the gear weight and derricks to be included in the stability booklet. No changes have been made to the vessels or their operation, so their level of safety remains low.

The particular vulnerability of small vessels, with their lack of stability assessment, was addressed by Seafish in 1997. It was an extensive study, involving 96 vessels, and provided a sound basis for a simplified method of assessment that was incorporated into their Construction Standards. It was proposed for inclusion in the MCA Code for small fishing vessels but, following pressure from the industry, was not adopted. To maintain harmony between standards, it was subsequently removed from the Seafish Standards.

The MCA, meanwhile, had also been working towards a method of assessment for small vessels. Seaspeed Technology conducted a study in 1994 with a similar remit to that of Project 529. Like the Seafish study, it resulted in a proposal for a simplified method of assessment, but it was not adopted.

The MCA then addressed the behaviour of small vessels in rough seas. Seafish conducted Phase 1 of the study, Project 449, to categorise the types of vessel in the fleet. The University of Strathclyde conducted the second phase, Project 484, with numerical and physical modelling of two vessels in beam seas, one with the influence of fastened gear. The researchers concluded that tests should be conducted on a wider variety of vessel types, and the projects did not result in any new requirements.

A common aim of previous research has been to develop methods of assessment that can be used to determine whether vessels comply with a set of minimum requirements. With cost implications, and the likelihood that some vessels must be modified or removed from the industry, it is inevitable that the introduction of such regulation meets strong industrial and political resistance.

6. ASSESSMENT – STATE OF THE ART

The first stability criteria to be widely adopted were those developed by Rahola in the 1930s, and they continue to form the basis of stability assessment in the UK and throughout the world. They require vessels to maintain a minimum level of stability, and are seen by many as providing a working solution, but have a number of limitations:

- They measure stability in the absence of heeling moments, so residual stability is not addressed.
- They have a statistical, rather than technical, basis.
- The sample vessels available to Rahola were not representative of the wide variety of size and form to which the criteria are now applied.
- There is no regard for the size of vessel or the seastate in which it operates, so large vessels in sheltered areas require the same GZ values as small vessels in exposed waters.

In 2002, Francescutto [11] described the proposals and limited progress that have been made in this field, and promoted an analytical approach, relying on the ever more sophisticated computer tools available for modelling ship responses to waves. Such an approach may never be suitable for small fishing vessels however, which lack the necessary drawings and budgets.

MCA Research Project 509 [12] has recently provided information on the levels of safety provided by stability criteria. The study concerned high speed craft, but comprised model tests on a wide range of vessel types, intact and damaged, when stationary in waves. Unlike most experimental work on stability, the models were configured to match the criteria, rather than ballasted to actual vessel conditions. The findings are considered applicable to all types of vessel. It revealed that the stability parameters used in conventional criteria are not necessarily the best measure of safety from capsizing in waves. The range of stability proved to be the most important, with the maximum righting moment of secondary value. The requirements for minimum GM values, angles of maximum GZ, and areas under GZ curves appear to provide a level of safety in most cases by controlling parameters that tend to be related to range and righting moment. The experiments highlighted the importance of the size of the vessel relative to the waves, which is not addressed by constant GZ requirements for all combinations. The study concluded with a proposal for a radical change to stability assessment, using a formula to relate residual stability and the beam of the vessel to the anticipated operating environment:

$$\text{Significant Wave Height} = \frac{\text{Range}\sqrt{\text{RMmax}}}{20\,\text{Beam}}$$

Where the range of stability and maximum righting moment are determined for the residual curve after taking account of any anticipated heeling moments.

This method also relies on conventional calculation of the stability and so would only be suitable for the larger fishing vessels, but it provides a valuable insight into the parameters of most importance for all vessels.

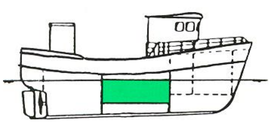
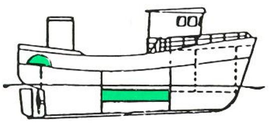
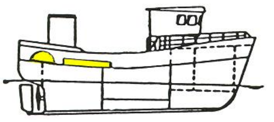
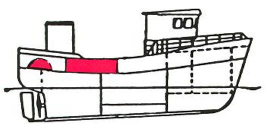
7. SIMPLIFIED INFORMATION FOR LARGE VESSELS

Some countries have recognised the need for simplified information, and a number of methods are in use or proposed.

7.1 STABILITY NOTICE, NORWAY & ICELAND

A method of simplified presentation is required by the Norwegian Maritime Directorate for vessels of 10.7 to 15 metres, and recommended by the Icelandic Maritime Administration. It is an attempt to convey, on one A4 sheet, the level of stability relative to the minimum requirements, together with some operational advice addressing some of the factors described in section 4. See Figure 1.

STABILITY NOTICE

	PLACEMENT OF GEAR AND CATCH	STABILITY Acceptable	On the Limit	Danger of Capsize
	• Catch in cargo hold			
	• Part load in hold • Gear on deck			
	• Some catch on deck • Gear on deck • Empty cargo hold			
	• Considerable catch on deck • Gear on deck • Empty cargo hold			

Simple efforts for maintaining stability:

- Close doors of hatches
- Ensure scuppers are open to allow water to drain
- Secure catch and gear against shifting
- Move gear and catch from deck into cargo hold
- Freeboard amidships should be at least 20cm
- Avoid excessive aft trim
- Minimum Freeboard at stern should be 20 cm
- Avoid following seas
- Large heeling moments when hauling gear are to be avoided.
- Change of trim and heel when trying to free snagged gear can impair stability of vessel.
- Do not go to areas with danger of icing.
- Remove snow and ice from vessel.

Figure 1: Example of a Norwegian Stability Notice

The levels of safety are colour coded. It is not known what margins are used to determine the transition between them but the fact that the loading is described in approximate terms, rather than by exact values, suggests that precise prediction is not the intention here.

7.2 SAFE LOADING MATRIX, USA

This method was conceived by John Womack, a naval architect in the USA [13]. The matrix combines details of the loading of the vessel in terms of the tank contents and quantity of catch, and assigns a colour code to indicate the level of safety for each combination. The method is under development and has not been adopted as a requirement by the authorities.

The presentation is similar in principle to that used in Norway, but provides much greater detail in terms of combinations of deadweight loadings, greater precision in comparing the relative levels of safety.

For vessels with a large number of tanks or other variable deadweights, the matrix may be rather complicated. Womack suggests two alternatives. A series of loading matrices may be developed, each for a different range of one variable, or a worst case may be used. He has also proposed a further development, incorporating guidance on the level of safety in a range of environmental conditions.

Womack advised that, when selecting boundaries for the colour scheme on the matrix, he takes account of a very wide range of factors. These include the obvious, such as the type of fishing and the potential for downflooding, as well as the less well defined such as local forecast availability and reliability, or the likely direction of approach of storms relative to the refuges. Some of these factors must be judged on a subjective basis, and implementation of the system by a number of consultants or surveyors would require the development of an objective set of criteria or guidelines.

In a development of this method, a commercial system is available, combining it with motion monitoring presented on a computer display on board the vessel.

The safe loading table is developed by the consultant and installed on the computer. Roll and pitch are measured continuously to monitor the amplitude of the motions and to derive mean values of heel and trim. All of these measurements are presented visually on the display. Warnings are given when the measured values approach or exceed pre-set limits.

7.3 MOTION AND ENVIRONMENTAL MONITORING, ICELAND

In Iceland, efforts have been directed towards providing the fishermen with good environmental data, and continuous monitoring of stability. The researchers believe the greatest capsize risk to be from steep or breaking waves and that, with reliable wave forecasts, fishermen can avoid operation in areas of danger. Draught and roll period measurements enable them to monitor the effects of loading on stability, and a method has been developed to estimate the height of wave required to cause capsize.

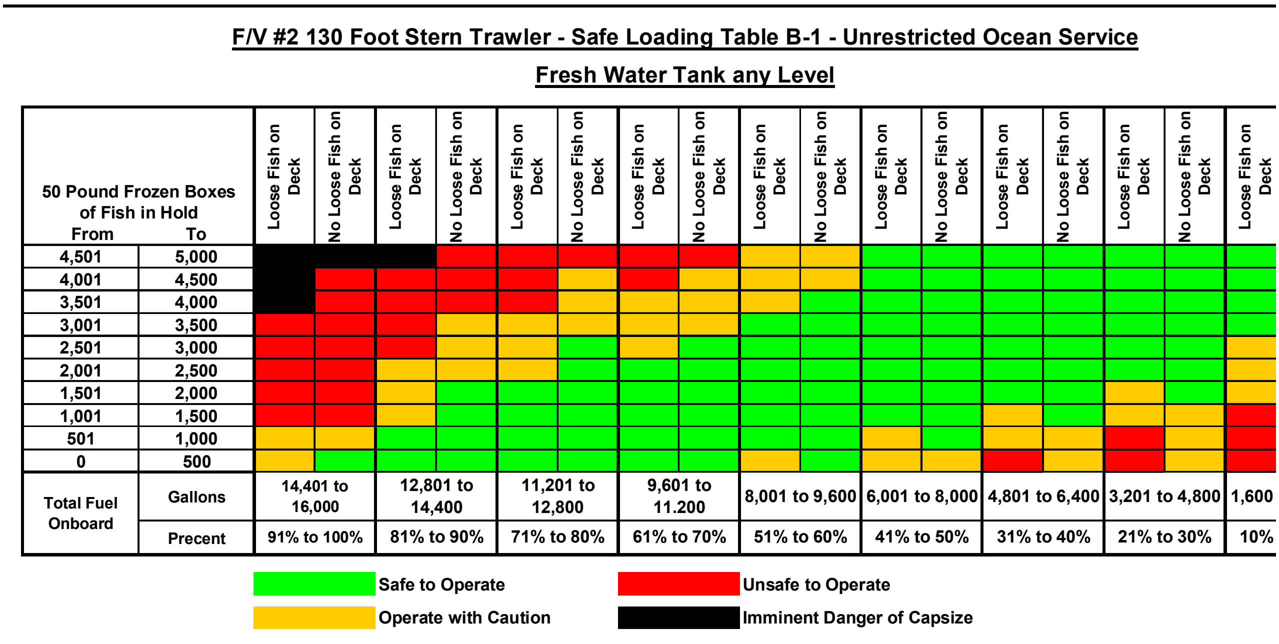


Figure 2: Example of a Canadian Safe Loading Matrix

Both of these systems provide additional information that fishermen can use in planning their voyage.

Measured environmental data derived from land based weather stations, and wave buoys located in the fishing grounds, are made available via Internet or mobile telephone. These are supplemented by weather and wave forecasts, and areas where severe waves might occur are highlighted on wave height contour plots. Each month the system receives up to 5000 calls by telephone and up to 8000 via the Internet. With a fleet of 1400 open boats and 1000 decked vessels, that represents at least one call per week, per boat, indicating that it is a well used and respected service.

Researchers concluded, following model tests on a number of fishing vessels, that the wave height to cause capsize was related to the area under the righting moment curve. Thus, if the displacement and GZ curve are known then the critical wave height can be estimated. The relationship between GM, displacement and critical wave height is determined by a consultant and presented on board. The roll period monitor enables the GM to be estimated and, while it does not provide a measure of GZ, it is closely related for a particular vessel. This is combined with the displacement, from calculation or a draught monitor, and the crew can look up the estimated critical wave height.

The stability monitoring has been under development since the 1990s, and was described in London in 2001 [14], but does not appear to have been adopted elsewhere.

7.4 WARP TENSION MONITORING, NETHERLANDS

It is understood that, although the fitting of warp tension monitoring is not compulsory in the Netherlands, it is recommended, and almost all beam trawlers over 24 metres are equipped with it. Owners have found that the capital cost is recovered by reduced wear on the fishing gear and that is understood to be a powerful incentive which has led to widespread use throughout the world, but not in the UK fleet.

Monitoring systems range from a simple load cell at the lifting block with a display in the wheelhouse, to a highly developed system integrated with the winch and engine controls. At a cost of about £10,000, the latter provides the benefits of automated pay out of the winch and reduction of engine revolutions or propeller pitch in the event of a sudden increase in warp tension, as would occur when coming fast. Because they give early warnings of increasing load, the trawls tend to be recovered before they contain excessive sand, stones or other debris, and so heavy lifts are not undertaken.

Whilst peak loads on rocky ground may be high, the signals are filtered and the mean towing loads are lower than the maximum safe lift for the vessel. Alarms that are pre-set to the maximum safe load for lifting are not therefore triggered during normal fishing operations.

The principal supplier stated that no vessels fitted with the equipment have capsized or gone missing, except one, which capsized during an excessive lift when one load cell was under repair.

7.5 DISCUSSION OF THE METHODS

Both of the visual presentations illustrated highlight the fact that the stability margin is variable and, if the documents are posted in the wheelhouse, this message is unlikely to be overlooked by the crew.

The stability notice is simple enough for untrained crew to understand and memorise, so that regular reference is not necessary. This would not be the case for the more complex loading matrix, and this is seen as a distinct disadvantage.

Roll period monitoring is not a reliable method of determining the stability, but can be effective in monitoring changes to the stability of a particular vessel. The Icelandic draught and roll period monitoring system therefore represents a similar approach to the stability notice and loading matrix, but it sets out to measure the loading rather than rely on the crew's assessment of it.

Draught monitoring is used commonly on cargo vessels, and on dredgers which also load while at sea. It should be effective in monitoring of fishing vessels vulnerable to overloading.

Roll period monitoring is perhaps unlikely to be as valuable. The roll motion is modified when fishing gear is deployed. Changes to the vessel's inertia may be significant, particularly for a beam trawler where the added inertia of water entrained around the gear is applied at the outboard ends of the derricks. The fishing gear also adds to the damping, and this has a secondary effect on the roll period. These factors will both tend to increase the roll period.

A roll period monitoring system might include pre-set warnings, based on the GM required to comply with the criteria, and the corresponding roll period. A potential problem with such systems is that the fishermen may become used to warnings of slow roll period, for example when the gear is deployed and there is no danger, and may be complacent when an equally slow roll period occurs as a result of poor loading.

As Table 1 shows, overloading represents only one of many potential hazards. Only the warp tension monitoring system enables assessment of the heeling hazards. Monitoring of the heel angle, as in the Canadian system, is not sufficient because, with both port and starboard warps overloaded the situation is hazardous but the heel may be negligible. Regardless of the level of detail and accuracy of the stability data, even the best-educated fisherman cannot evaluate his level of safety without information on the load being lifted. The potential for monitoring systems to address the hazards is illustrated by Table 3.

The outcome of Research Project 530 was the recommendation that stability notices be displayed on all fishing vessels, complemented, where appropriate, by systems monitoring freeboard and initial stability, and/or loads applied by the gear handling equipment.

	Pelagic Trawling	Demersal Trawling	Beam Trawling	Scallop Dredging
Handling the gear	Not required	Not required	Load monitoring	Load monitoring
Boarding the catch	Load monitoring	Load monitoring	Not required	Load monitoring
Handling abnormal loads	Not required	Load monitoring	Load monitoring	Load monitoring
Coming fast	Not required	Load monitoring	Load monitoring	Load monitoring
Freeing fastened gear	Not required	Load monitoring	Load monitoring	Load monitoring
Overloading the boat	Vessel monitoring	Vessel monitoring	Not required	Not required

Table 3 Use of monitoring systems to address operational hazards

8. SMALL CRAFT REGULATIONS

Project 529 included a review of the stability requirements for small fishing vessels in other countries, and for other small vessels in the UK.

8.1 FISHING VESSELS IN OTHER COUNTRIES

Typically, administrations either apply standard IMO criteria to all fishing vessels, or just to the larger vessels with no stability regulation of small craft. The only countries found to have specific requirements for vessels under 12 metres, that were not the IMO criteria, were those of France, New Zealand, Russia and the Nordic countries. It is understood that requirements are under development in Canada.

France imposes minimum freeboards for decked vessels. Undecked vessels have maximum weight limits and requirements for reserve buoyancy, with a simple formula for vessels without hydrostatic data. There is a minimum GM requirement, for which a roll test may be used, and restrictions on reduction of freeboard due to lifting. Only decked vessels are permitted to operate towed gear, and are subject to restrictions on propulsive power and the minimum GM when handling the gear.

New Zealand restricts the operation of towed gear to decked vessels that comply with standard IMO criteria, and have adequate range of stability. Non-decked and partially decked vessels are restricted to enclosed waters or inshore limits and must be fitted with reserve buoyancy. Freeboard requirements are applicable to all decked and non-decked vessels. Simplified requirements apply to vessels less than 6 metres in length, operating in enclosed waters or within 2 miles of the shore. A simple heel test is conducted, with an angle limit, and minimum heeled freeboard for decked boats.

The Russian regulations apply to vessels of between 4.5 and 10 metres in length. There are freeboard and GM requirements, and minimum angle of downflooding and range of stability apply to decked vessels. For vessels equipped for towing or lifting, there are heel angle and freeboard limits when handling the gear and suffering a shift of the gear or catch. Undecked vessels have restrictions on: permissible wave height, residual freeboard, beam, roll period, bow height, distance from shore and speed. Stability is considered sufficient for rough water if the freeboard requirements are met when the vessel is heeled by a transverse shift of the design load.

The Nordic Boat Standard limits the maximum load, having regard to the freeboard, strength and stability. Minimum freeboards are assigned to both open and closed boats. For vessels equipped for lifting there is a heel angle limit. There is a GM requirement and, for decked vessels, GZ and range of stability requirements. There is an option for physical measurement of GZ. A heel test is required for open boats, with freeboard and heel angle limits. Norway and Iceland apply this standard to vessels of 6 to15 metres.

The Nordic Boat Standard, and the requirements of Denmark, New Zealand and Russia, all include a minimum range of positive stability for decked vessels. New Zealand and Russia require a range of not less than 60°, while Denmark and the Nordic Boat Standard require 70°. These requirements are for decked vessels, with all watertight closures secured.

The Nordic boat standard, France, New Zealand and Russia all require load lines.

8.2 OTHER SMALL VESSELS IN UK

Small commercial vessels, other than fishing vessels, must comply with the appropriate MCA code of practice. For workboats, this includes minimum freeboard and a load line, and standard IMO requirements for the GZ curve. A vessel equipped for lifting must comply with heel angle, freeboard, GZ curve and range of stability requirements with the maximum lifting moment applied.

Operation of non-commercial vessels is unregulated, but the European Directive applies when a new vessel is placed on the market. This includes a requirement for adequate buoyancy and stability that will normally be met by compliance with the International Standard ISO 12217. The requirements vary depending on the anticipated environmental conditions, they differ for boats above and below 6 metres in length, and compliance may be shown by calculations or physical tests. The standard sets out to ensure that the boat can carry a maximum designated load, with adequate stability to handle offset loads, and adequate freeboard to any downflooding openings.

8.3 SUMMARY

Whilst most countries do not regulate small vessels, those that have imposed regulations on their industry appear to fall into two groups: those applying standard IMO criteria and those that have developed specific small craft requirements. For the latter, there is a common theme, with minimum freeboard, range of stability, and ability to withstand heeling moments applied by the fishing operations generally considered to be important. It is interesting to note the similarity between these requirements and the findings of Research project 509 described in section 5.

9. SMALL CRAFT REGULATION OR INFORMATION?

9.1 PROBLEMS WITH REGULATION

In many industries, accident rates have been reduced by a combination of regulation and a change to the safety culture. For the fishing industry, introduction of regulations alone is unlikely to have the desired effect for a number of reasons:

- The regulations may not address the hazards.
- Industry resistance may impede their introduction, and the resulting hostility degrades respect for the value of the requirements.
- The diversity of the fleet, environments and fishing methods may require complex regulation. This would be unrealistic with a large fleet and few surveyors.
- If standards are set high, existing vessels cannot comply and must be given exemption. If they are set low enough to include existing vessels, new vessels will be built to the required minimum standard. In either case, safety may not be improved.
- The industry may adjust to avoid the effects of regulation.

The latter has been the case in the past, as demonstrated convincingly by Figure 3, which shows the tendency for large powerful vessels to be built just below the 10 metre limit, above which, catch restrictions become far more onerous. Some of these ‘rule beaters’ have proportions outside the normal envelope and give particular cause for concern. Some operate offshore with heavy trawl gear, and probably are more vulnerable than larger vessels conducting similar operations. There is no justification for them being exempt from stability assessment. Project 529 recommended that the requirements for larger vessels be extended to encompass these rule beating vessels, perhaps using the product of length, beam and depth to set the lower limit.

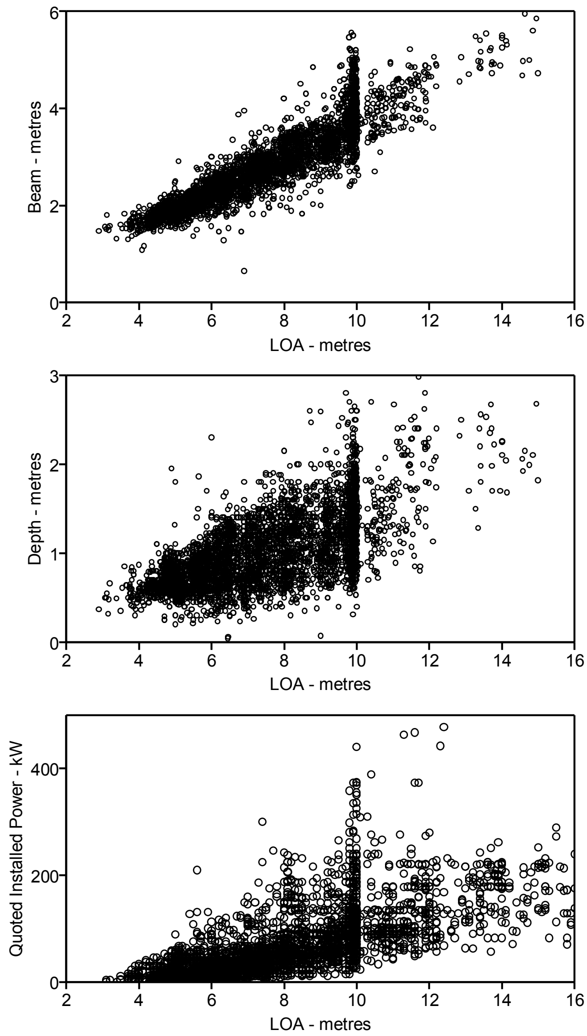


Figure 3 Characteristics of the UK small vessel fleet

9.2 PROBLEMS WITH SAFETY CULTURE

When a vessel capsizes there are unlikely to be survivors, and so fishermen tend not to learn from the experience. Their only experience is of not capsizing, regardless of how they load and operate their vessel. Fishermen may blame the misfortune of others on an unseaworthy vessel, bad practice or freak conditions, and usually as a one-off incident that will not happen to them.

It is widely believed that a history of safe operation is evidence of safe practice. This is a fallacy, implying that all vessels are safe until the day they capsize, at which time they become unsafe.

Fishermen have an intuitive feel for the stability of their vessel. They know that overloading it, adding weights high up, or applying large heeling moments can be dangerous. They may claim to be the best qualified to understand the dangers of their operations. For some aspects that may be the case, and if they understand the danger but fail to take appropriate precautions there is little that can be done without a change to the safety culture.

9.3 THE VALUE OF INFORMATION

Fishermen resent the imposition of restrictions on their operations, and want to remain responsible for their safety. Unfortunately, they have no information on their level of safety with regard to stability, and perhaps should not be blamed for pushing their vessel too far.

Some vessels are mush less safe than others, but if they are operated with caution in sheltered conditions they may maintain an adequate level of safety. They need not necessarily be prevented from operation but their limitations must be made clear to the fisherman.

If the information is also made clear to the crew, by posting it clearly on the vessel, they may be less inclined to accept a skipper's disregard for safety.

If the information is made clear to the family and wider community, by marking a minimum recommended freeboard for example, other pressures may be brought to bear on the fisherman. This might help to improve the safety culture within a community.

10. INFORMATION RECOMMENDED FOR SMALL VESSELS

10.1 FREEBOARD AND LOADING

It is clear that the loading and freeboard of a vessel are fundamental to its safety. Increased freeboard gives greater maximum righting levers and range of stability, and reduces vulnerability to water on deck, downflooding and the effects of accidental flooding. It is not considered worthwhile to introduce a complicated derivation of a minimum value, because there is no such thing as a minimum 'safe' value. Greater freeboard will always provide greater safety. A typical minimum value adopted in other countries for decked vessels is 0.2 metre, and this might provide a basis for guidance on small UK vessels. A greater value would be appropriate for open boats. If a mark were clearly visible on the outside of the hull, the fishermen and their community would be able to monitor the loading of the vessel on departure and arrival. The dangers of loading the vessel beyond this mark would need to be made clear.

In some cases it may be more useful to advise a maximum load, perhaps in the case of a potter, where the number of pots carried may represent the greatest hazard and is clearly defined. A value could be determined simply from the principal dimensions of the vessel and its unladen freeboard.

10.2 APPLIED MOMENTS

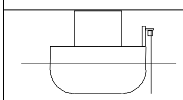
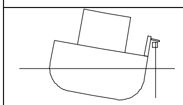
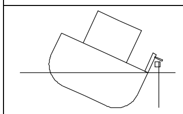
It is recommended that a maximum safe lift be advised for all vessels fitted with lifting devices. A distinction should be made between the lifting devices associated with different fishing methods. Where more than one lifting point is used, or where vessels are fitted with moving derricks, such as beam trawlers, a combination of lifting situations may need to be considered.

It is anticipated that the assignment of specified maximum lifts would be related to the resultant angle of heel and/or the reduction in freeboard. For example, immersion of the deck edge would be readily observed and might represent a dangerous situation.

10.3 STABILITY NOTICE

As for the larger vessels, the guidance information should be presented clearly on a single page, preferably in a pictorial form which the crew will be readily absorb. The format illustrated in Figure 1 should be suitable, and could be modified to incorporate advice on lifting where that represents a hazard. See Figure 4.

STABILITY NOTICE

Vessel Name, number, port, length, Owner's name, etc.	LOADING & HAULER USE	STABILITY		
		Acceptable	On the Limit	Danger of Capsize
	• Good margin of residual freeboard			
	• Loading or hauling reduces freeboard to 20cm			
	• Excessive load on hauler causes deck edge immersion			

Simple efforts for maintaining stability:

- Maximum number of pots to be carried: 20
- Secure pots and gear against shifting
- Close hatches
- Vessel is unsafe if minimum freeboard mark becomes permanently immersed
- Ensure scuppers are open and clear of obstructions to allow water to drain
- Avoid areas of breaking waves
- Vessel may become unsafe if lifting block is moved or a larger hauler is installed

Photograph of vessel profile

This notice was prepared on 17^{th} September 2004, for the vessel configured as in this photograph

Figure 4 Example stability notice for a small potter

11. CONCLUSIONS

Safety of the vessel is variable, may be inadequate, and is under the control of the fisherman. This message must be conveyed clearly to fishermen.

All fishing vessels should carry a stability notice, but this need not require complex analysis of the stability. It should convey recommendations on the minimum freeboard or maximum load, and the maximum safe lift. The detailed format of these notices is the subject of ongoing projects for the MCA.

Current stability regulations apply to vessels over 12 metres, but there are a number of vulnerable vessels under 10 metres that should be assessed on an equivalent basis.

12. REFERENCES

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13. AUTHOR'S BIOGRAPHY

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