IFISH6

Safety of small scale FRP fishing vessel through design, build and operation

Food and Agriculture Organization of the United Nations

STRENGTH

STABILITY

SAFETY

With a focus on small scale FRP fishing vessels

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Food and Agriculture Organization of the United Nations

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Strength

Structural failure
Inadequate Laminate
Internal frame reinforcement
Boatbuilding guidelines

Stability

Transverse stability
Dynamic stability

Safety

Precautionary measures

STRENGTH of a vessel through build quality and structural design

Often poor reinforcement and structure leads to structural failure and a shortened boat life.

Topside damage

Frame damage

Examples seen of poor laminate and structure

- Small scale fishers --local boat builders.
- These designs -- often outdated & not suitable climate change challanges.
- Going forward:
- Use new designs -- stronger, safer and climate resilient.
- Use existing expertise - commercial boat building industry.
- Available -- Vessel construction & Training materials for FRP boat quality
- Vessel designs and manuals produced disseminated globally via the recently launched FAO Fishing Vessel Design Database https://www.fao.org/fishery/en/collection/vesseldesign
- Use the International vessel safety standards guidance for fishers.

FAO/ILO/IMO. 2012. Safety Recommendations for Decked Fishing Vessels of Less than 12 meters in Length and Undecked Fishing Vessels. Rome, FAO. 254 pp.

Safety Recommendations for Decked Fishing Vessels of Less than 12 metres in Length and Undecked Fishing Vessels

IMO

Improvements to Structure Framing and Lamination Schedule for Fiberglass boats

Currently transverse frames only

Proposed example of longitudinal girders giving a boat improved strength along it's length

Improvement

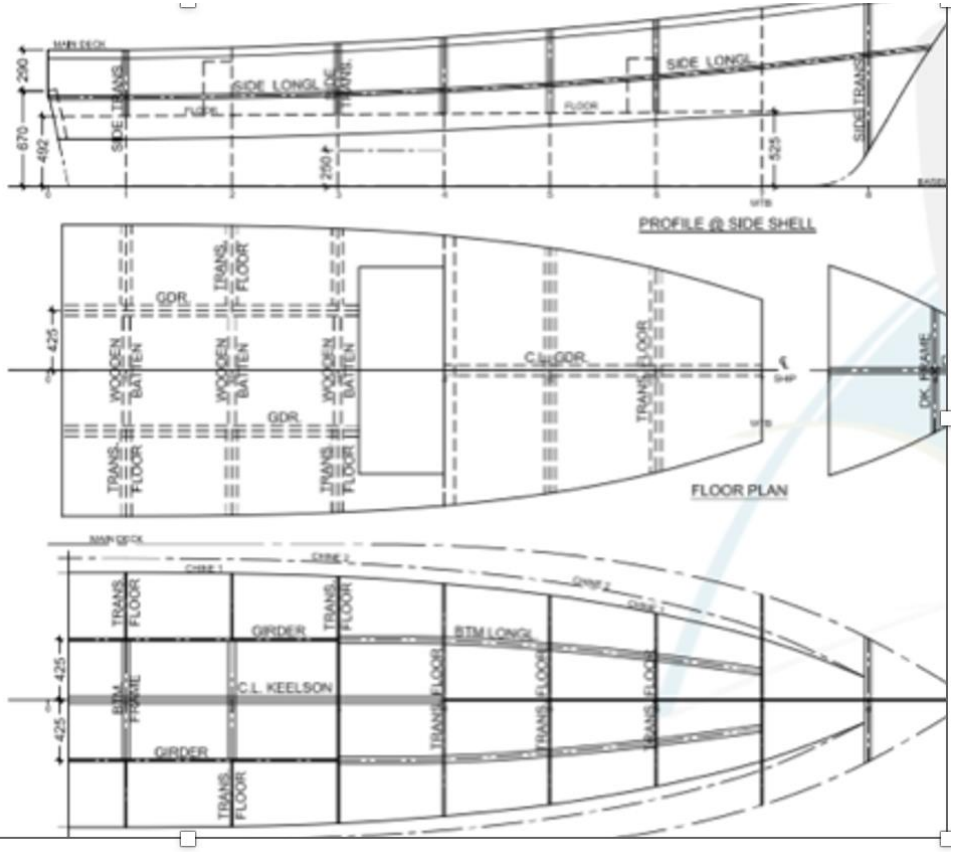
vessel strength and structural framework

longitudinal frames

fishers using bigger OBMs & higher speeds

launching in rougher waters,

longitudinal strength is paramount along with designed structural details.



Lamination Schedule designed for the vessel's intended operation, example below:

LAMINATE SCHEDULE (Layer 1 = Closest to Mould)		
LAYER	MATERIAL	WEIGHT (g/m²)
BOTTOM / SIDE LAMINATE		
OUT	GELCOAT	-
2	CSM	300
3	CSM	450
4	WR	610
5	CSM	300
6	CSM	300
7	WR	610
8	CSM	300
9	WR	610
IN	CSM	450
MAIN DECK LAMINATE		
OUT	GELCOAT	-
2	CSM	300
3	CSM	450
4	WR	610
5	CSM	450
6	WR	610
IN	CSM	300

STIFFENER SCHEDULE (Layer 1 = Closest to Mould)		
LAYER	NAME	WEIGHT (g/m²)
KEELSON / BOTTOM TRANS. HEIGHT = 75mm; WIDTH = 50mm;		
IN	CSM	300
2	WR	610
3	CSM	300
4	WR	610
OUT	CSM	300
SIDE TRANS. STIFF		
HEIGHT = 50mm; WIDTH = 50mm;		
IN	CSM	300
2	WR	610
3	CSM	300
4	WR	610
OUT	CSM	300
BTM / SIDE LONGL. STIFF.		
HEIGHT = 40mm; WIDTH = 40mm;		
IN	CSM	300
2	WR	610
OUT	CSM	300

IMO Standards can be implemented through:

- Training materials prepared for FRP boat quality assurance (including good lamination practices)
- Training courses conducted on FRP quality assurance in boat building for senior technical staff of boatyards as well as fisheries government inspectors.
- Monitoring the build process as per standards with a final certificate of conformity.
- Documents form above required for vessel registration.

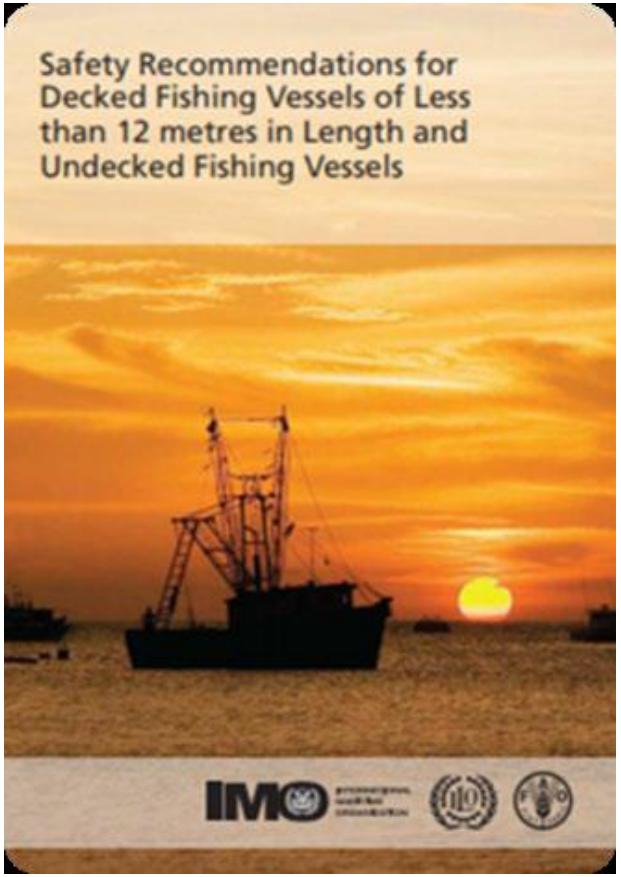
Guide and empower local boat boat builders with information and knowledge.

- International vessel safety standards guidance for fishers.

  FAO/ILO/IMO. 2012. Safety Recommendations for Decked Fishing Vessels of Less than 12 metres in Length and Undecked Fishing Vessels. Rome, FAO. 254 pp.

- Available in 11 languages https://www.fao.org/documents/card/en/c/3d78177f-bfeb-5566-ae97-a4cb55984b4f)

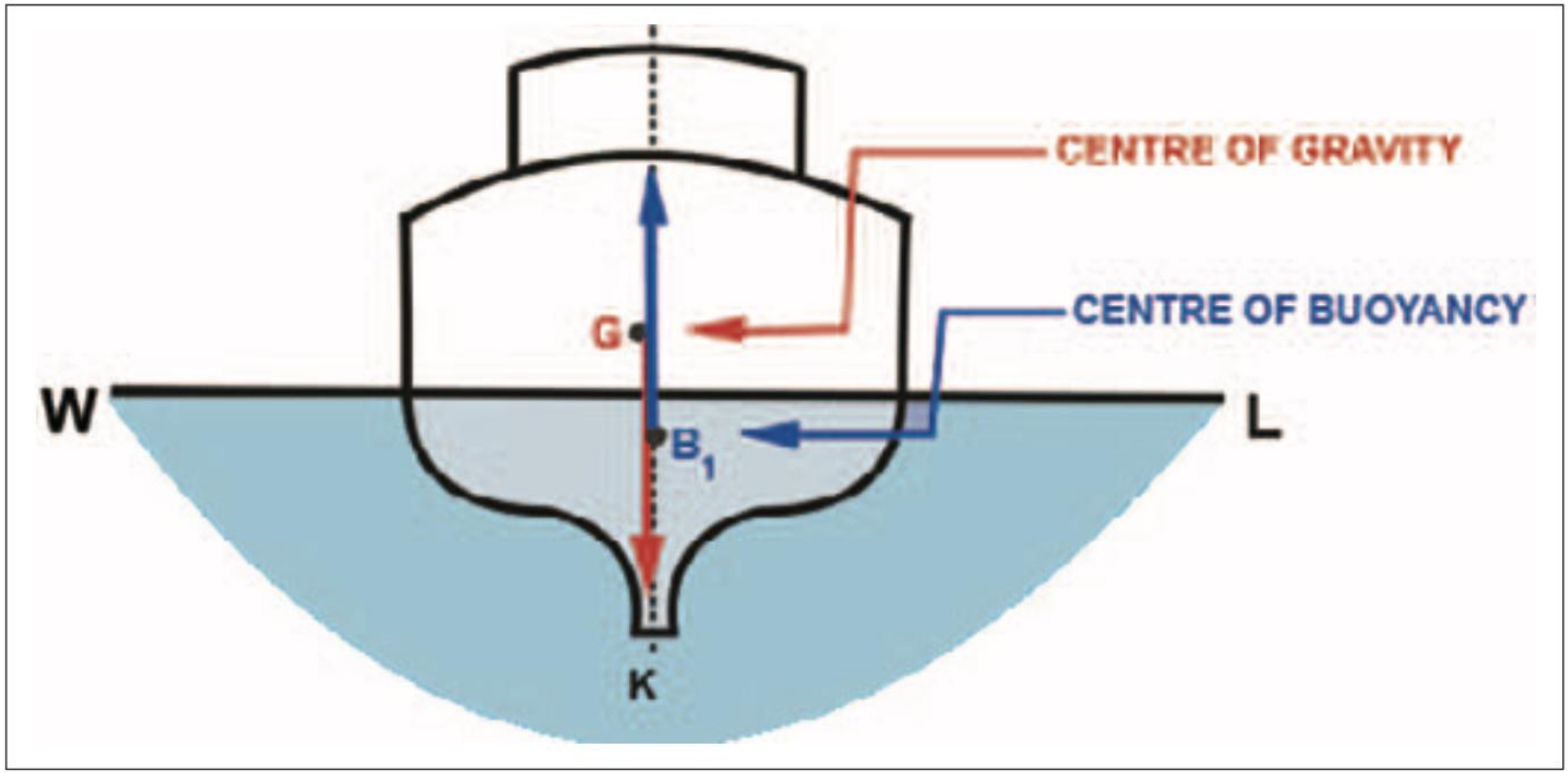
- QA procedures and documents printed and disseminated among boatyards and fishers



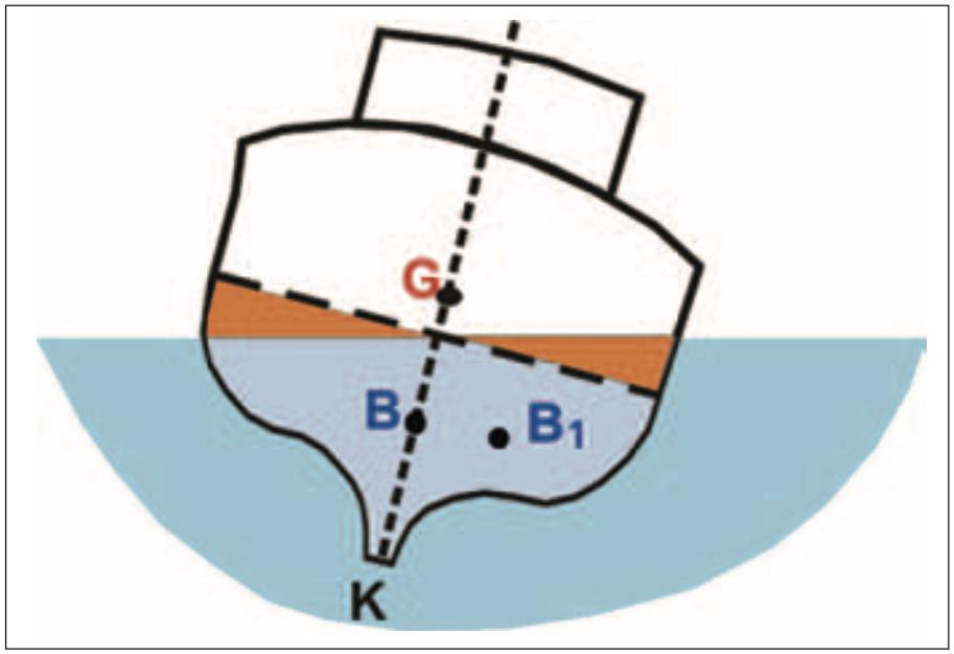
STABILITY

- This section introduces some basic principles on the stability of small fishing vessels.
- It provides simple guidance on the maintenance of adequate stability. However, please note, this is not a complete course on fishing vessel stability.
- Stability is one of the most important factors in every fishing vessel's overall safety. Every possible means should be used to prevent the capsizing of a vessel.
- The vessel itself is the best survival craft !!!

The Basic Principals – Transverse Stability

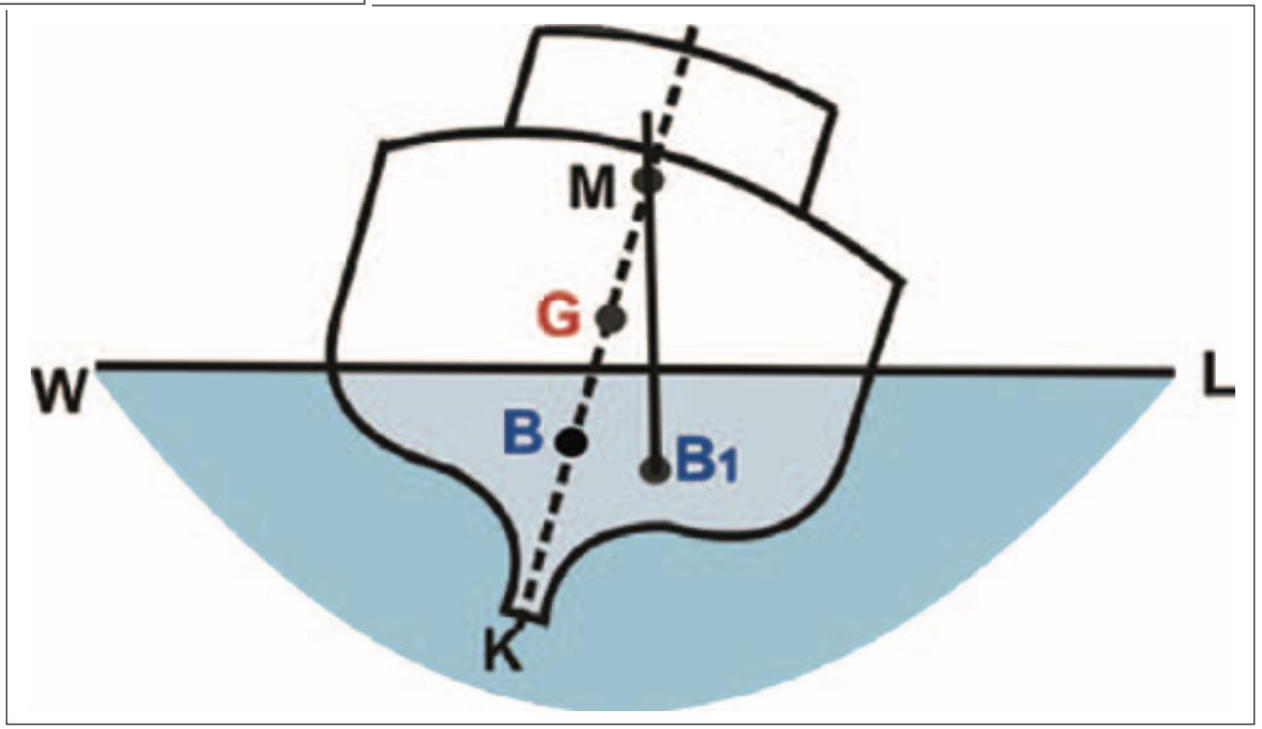


Vessel at equilibrium

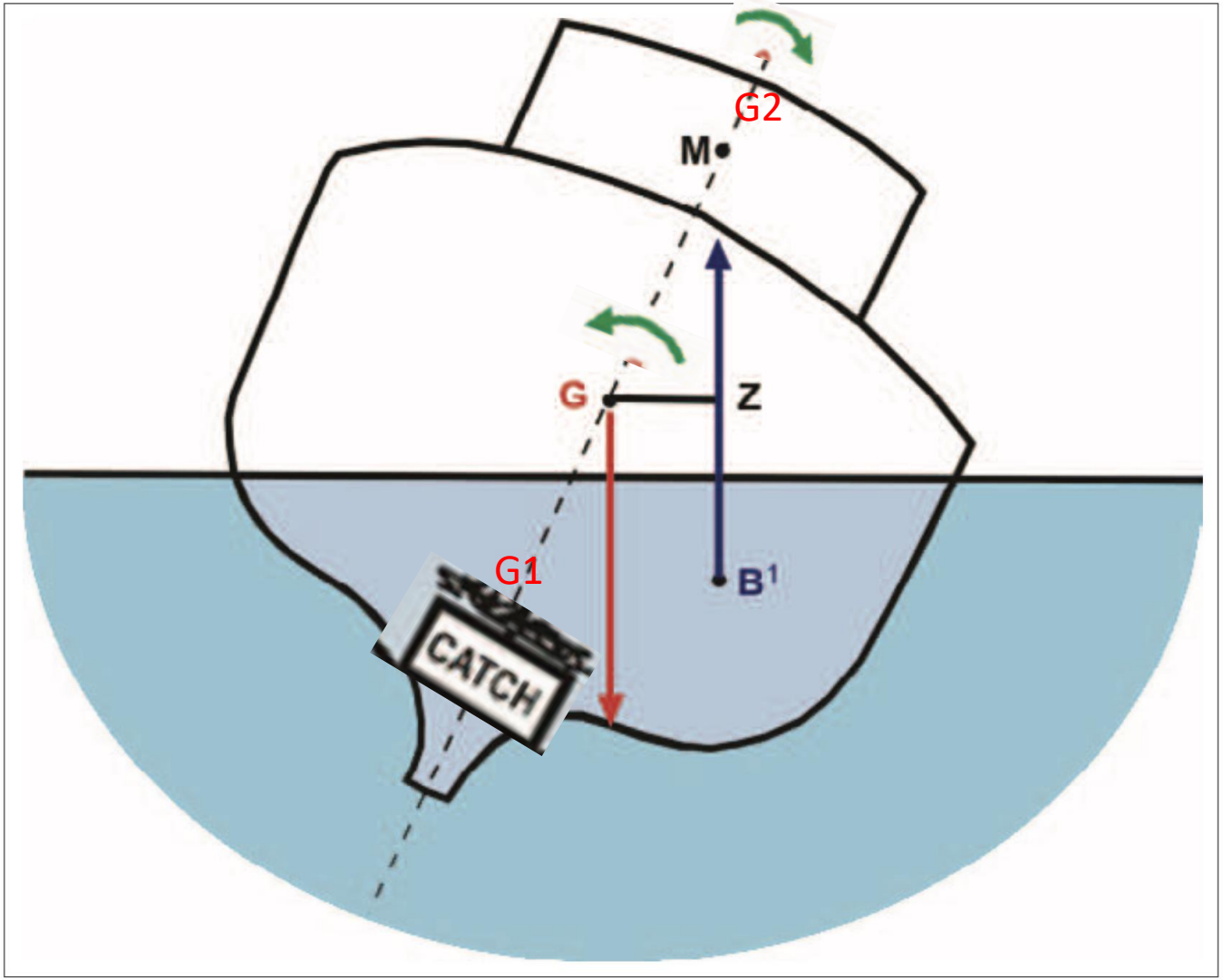


Heeling due to wind or waves causes a shift of buoyancy

The metacenter M is the point of intersection between centerline of the vessel and a vertical line above the shifted center of buoyancy B1.
It is also the pivot point around which the vessel rolls.

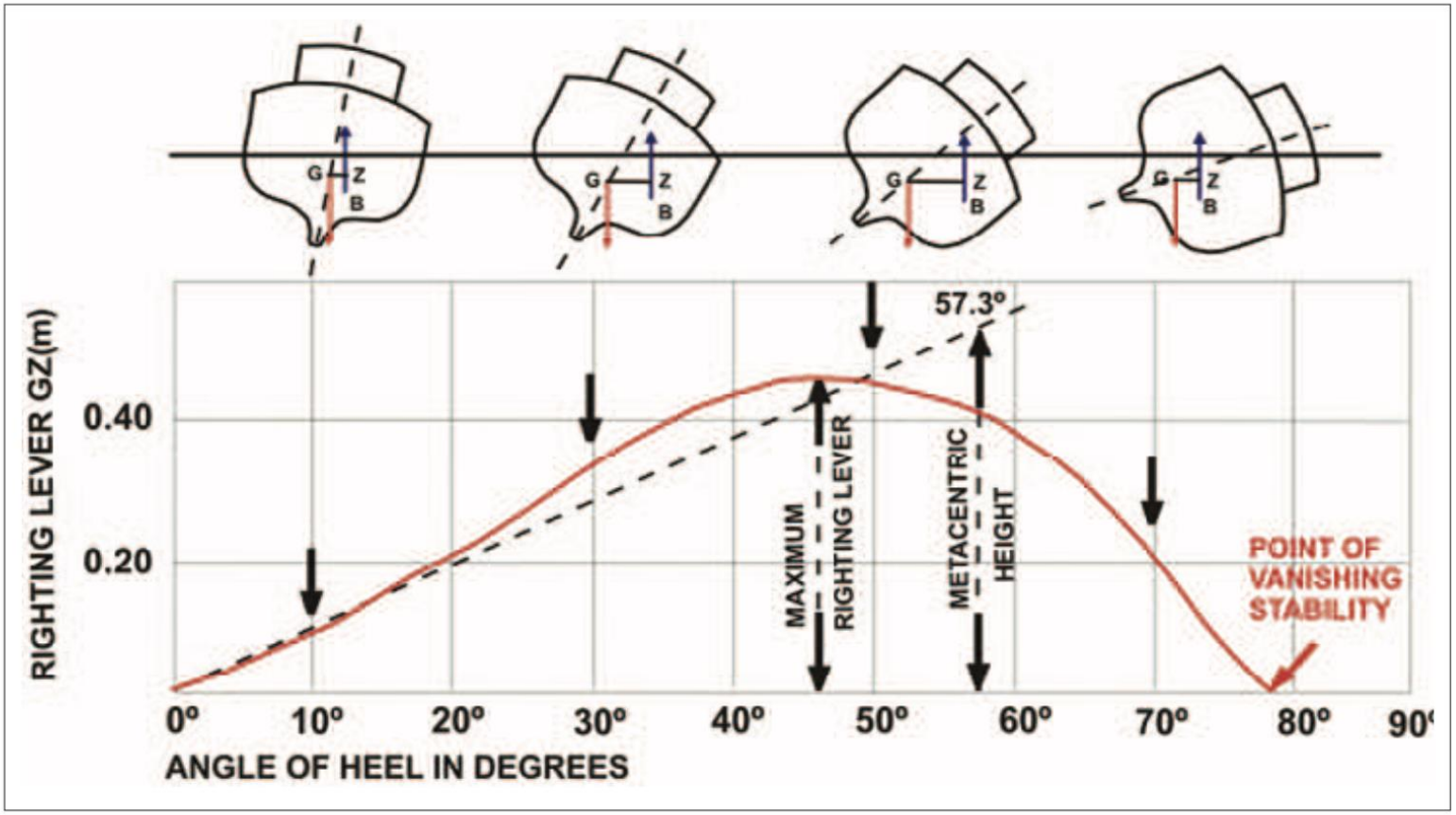


RIGHTING LEVER



G-Z is the righting lever that forces the boat back into an upright position of equilibrium.

STABILITY CURVES (GZ CURVES)



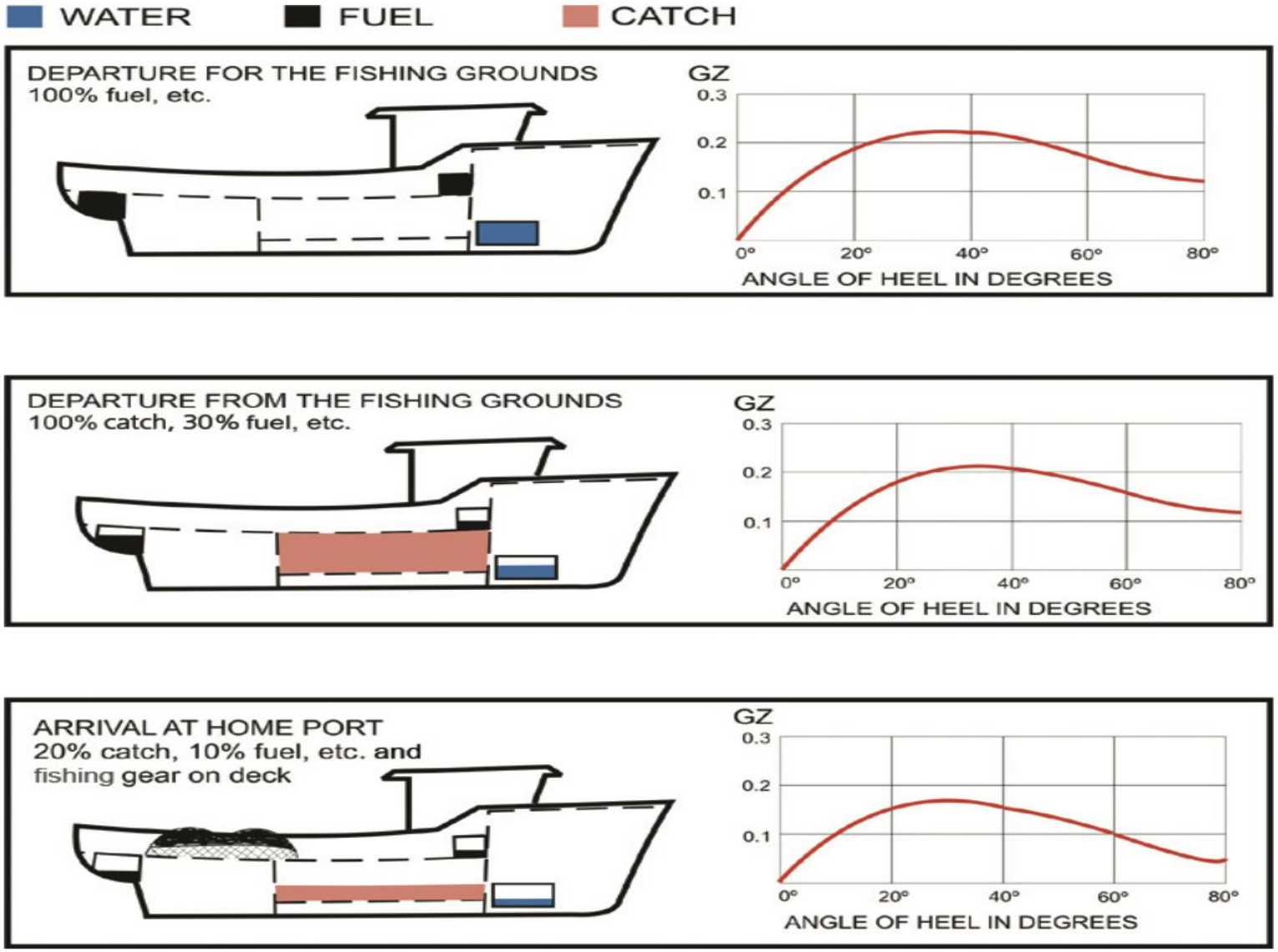
The stability GZ curves depict graphically the vessel's ability to return to equilibrium from various angles of inclination. Factors to be noted are GM the metacentric height, the maximum value of the rightening lever GZ and the point of vanishing stability at which the vessel would capsize.

Dynamic Stability

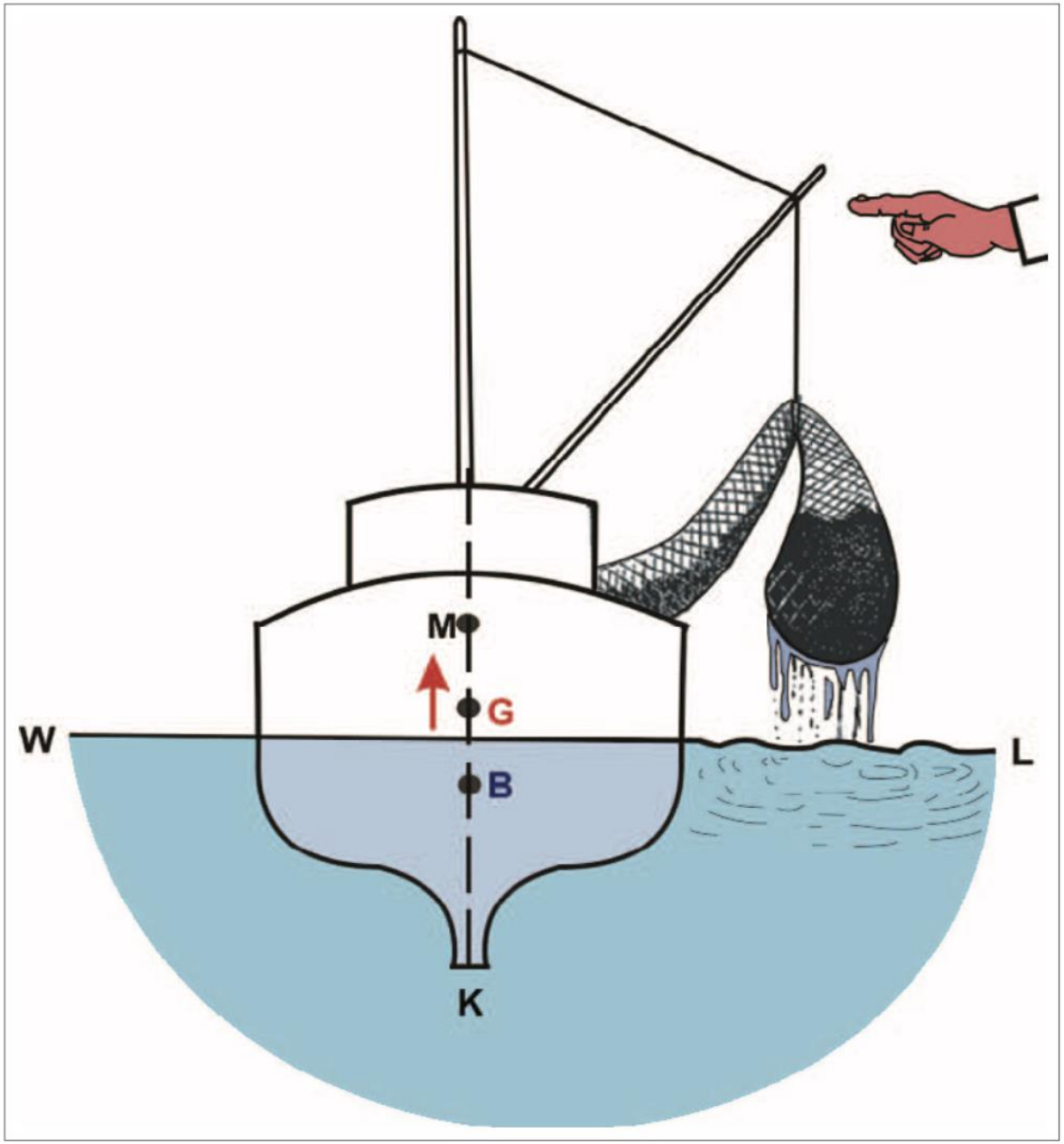
- Stability characteristics of a moving (rolling) vessel
- Energy required to incline a vessel counteracting statical stability
- Dynamic stability determined by area under the GZ curve,
- Larger the area greater is the energy required to heel the boat.
- Waves are the most common external force
- Most dangerous are steep waves with short wavelengths, particularly breaking waves.
- A vessel's dynamic stability and wave energy is complex.
- Depends on a vessel's speed and course to wave direction and speed.
- In general, smaller vessels cope with smaller waves.
- Weather forecasts give the skipper the time to avoid conditions that threaten vessel safety.

Changes in stability during a voyage

A fishing vessel's stability changes during it's voyage with changes in loading and operating conditions



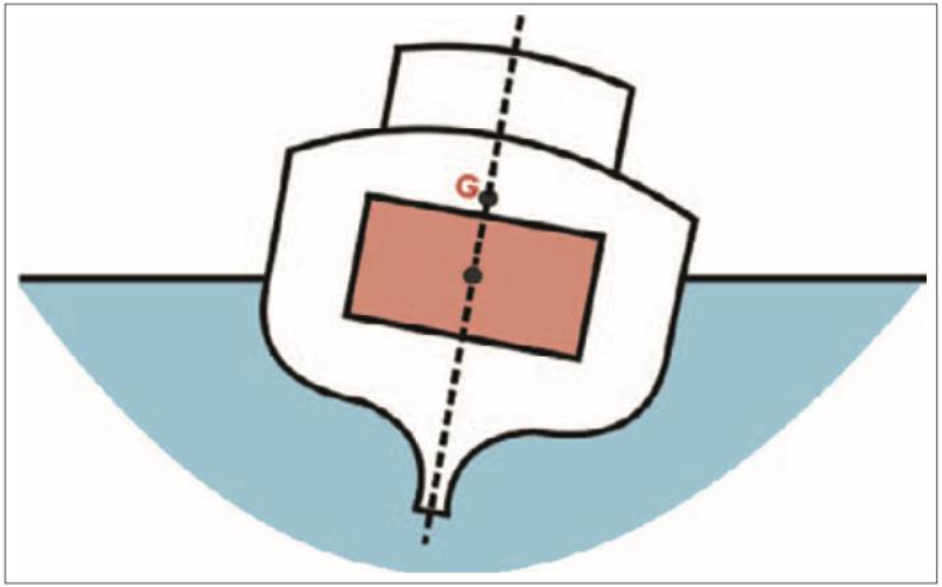
Safety and Precaution

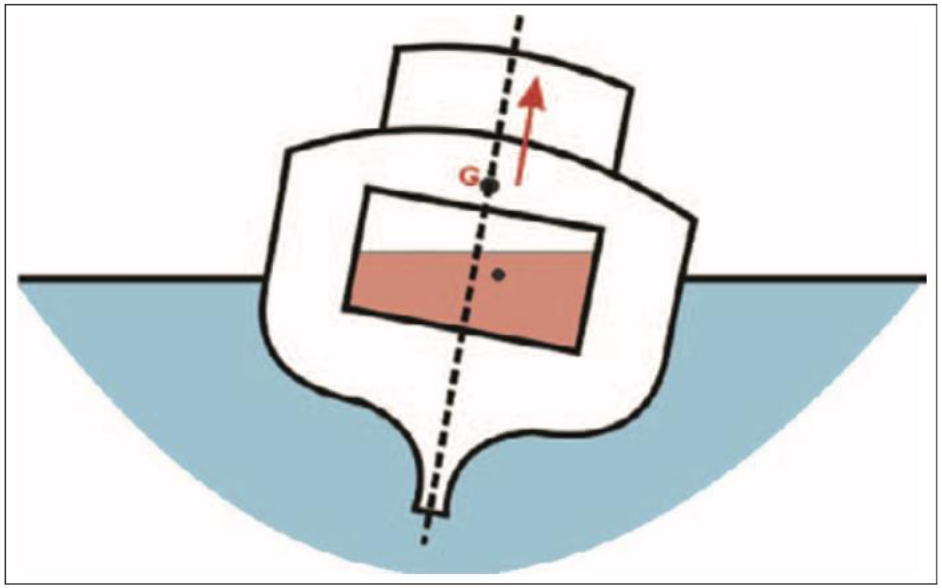


- Suspended weights; if not at the centerline could exert a heeling force on the vessel causing it to capsize under unfavorable circumstances.

Free surface effect

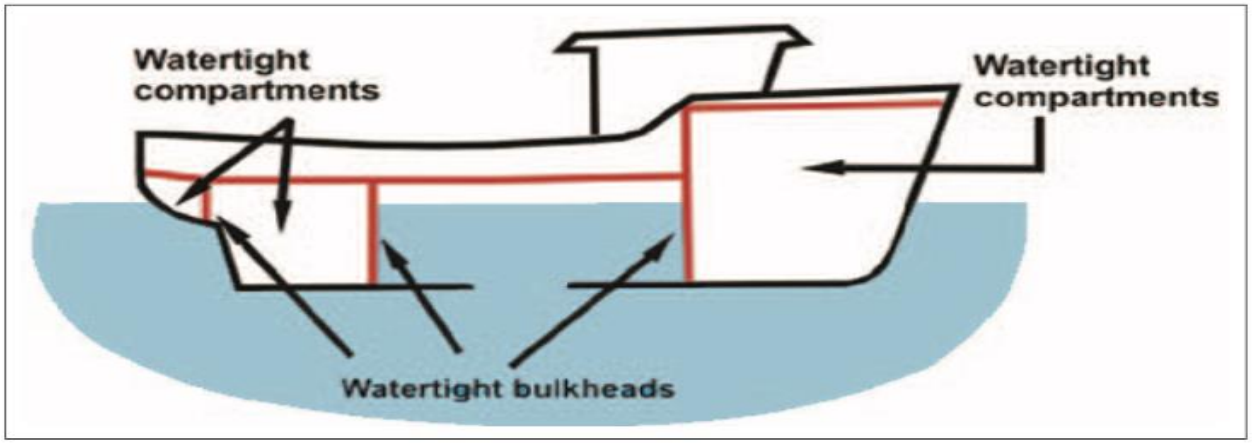
When a vessel with a full tank of liquid is heeled there is no change in the center of gravity, however, liquid in partially filled tanks move in the direction of heel adversely affecting the vessel's stability.

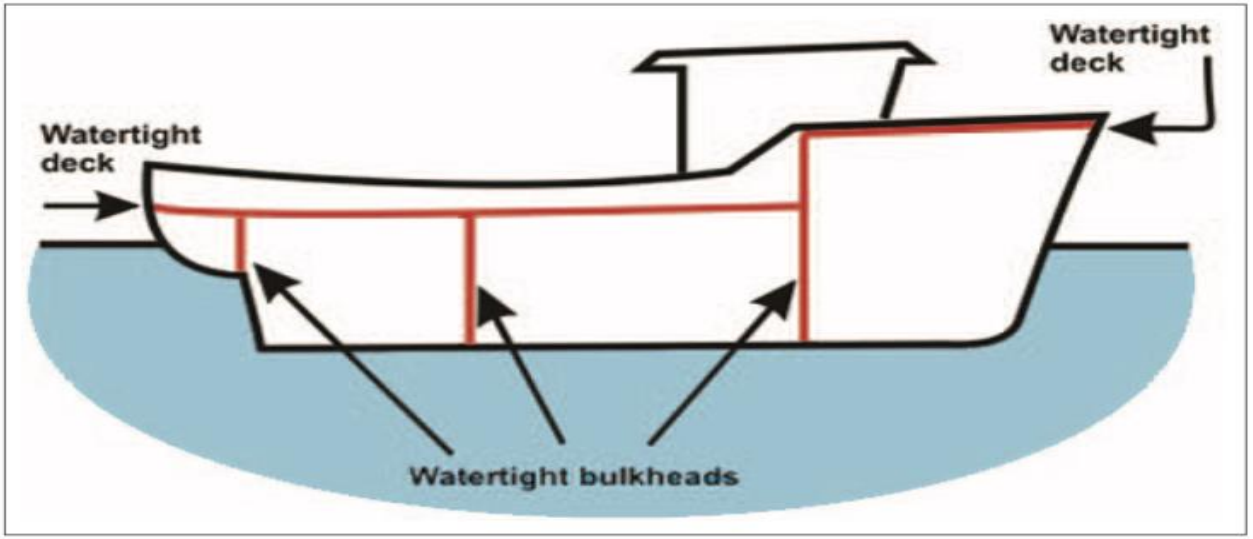




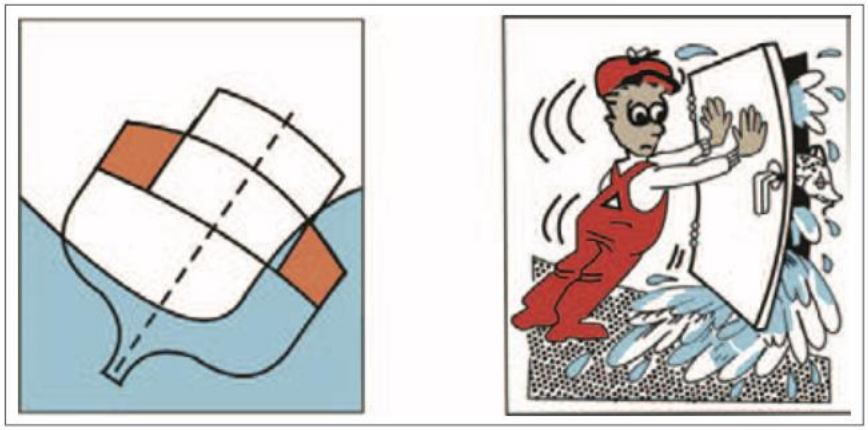
Watertight and Weathertight Integrity

- Bulkheads divide the vessel into compartments minimizing the effects of water flowing from one part of the vessel to another.
- Closing devices toall openings to the hull and deck house help maintain the watertight integrity of a vessel in adverse weather.

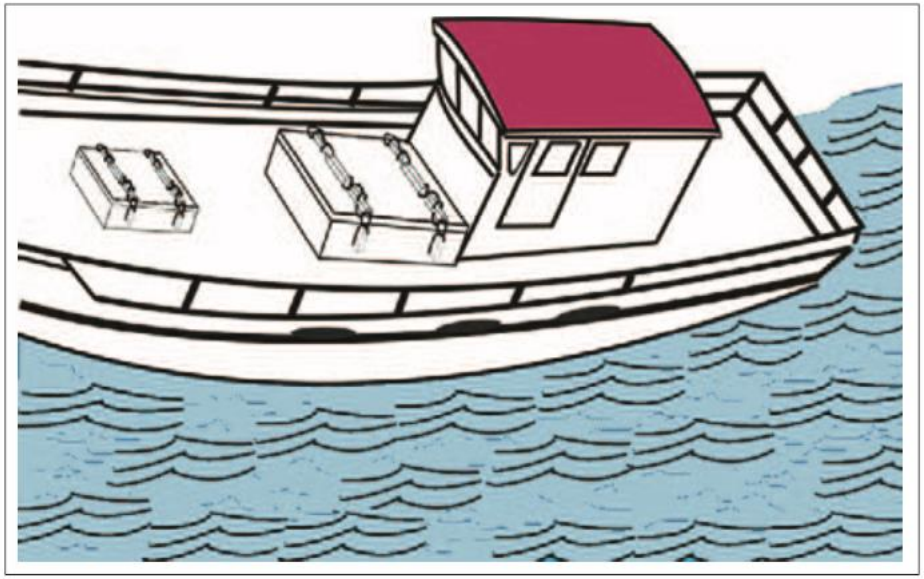




- When a vessel is heeled to large angles in adverse weather, a watertight superstructure's buoyancy contributes righting the vessel.

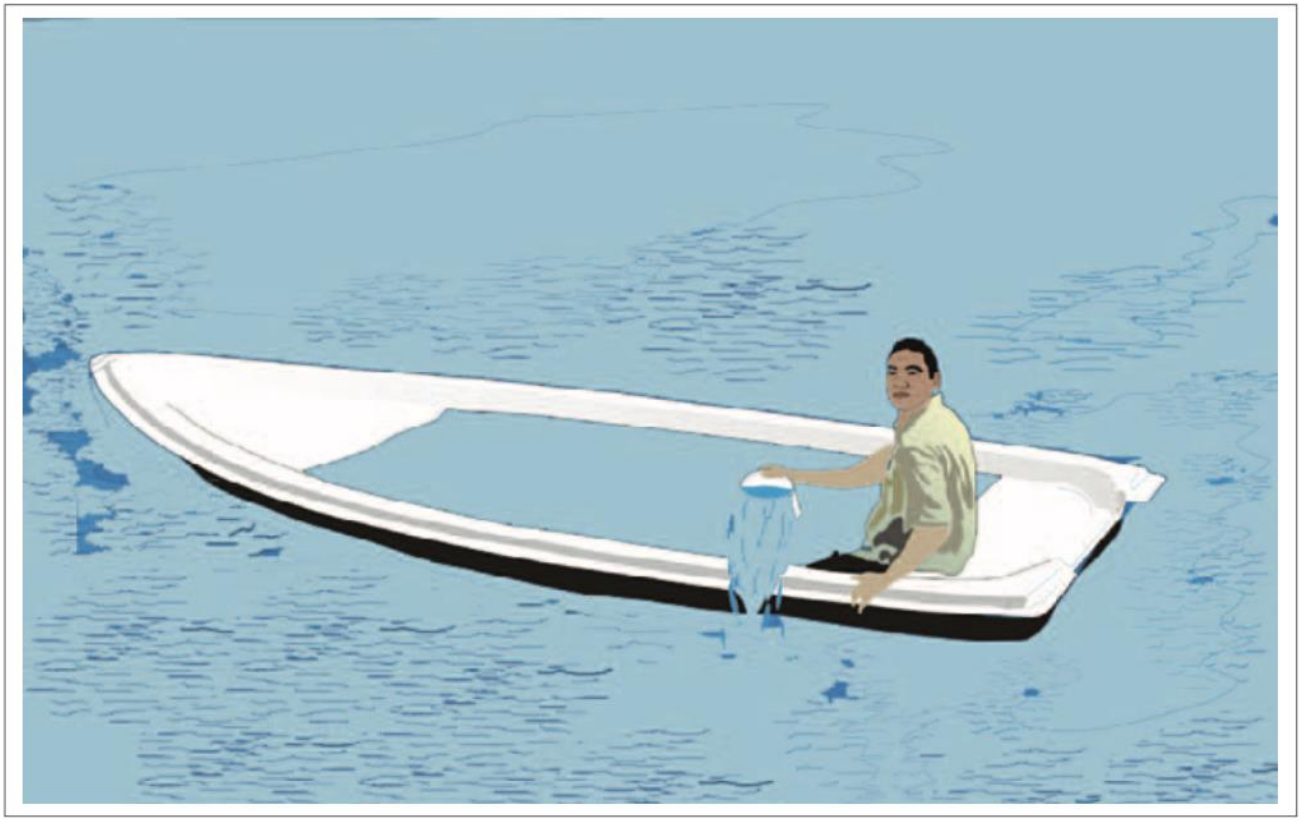


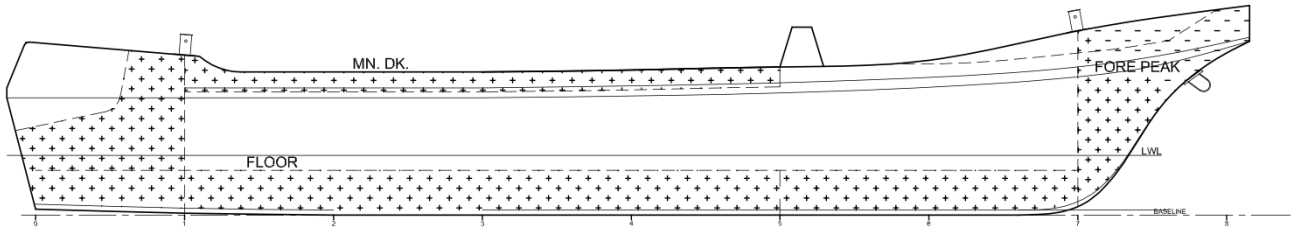
- Hence all hatches, doorways, ventilators and other such openings should be kept closed to maintain the watertight integrity of the superstructure.

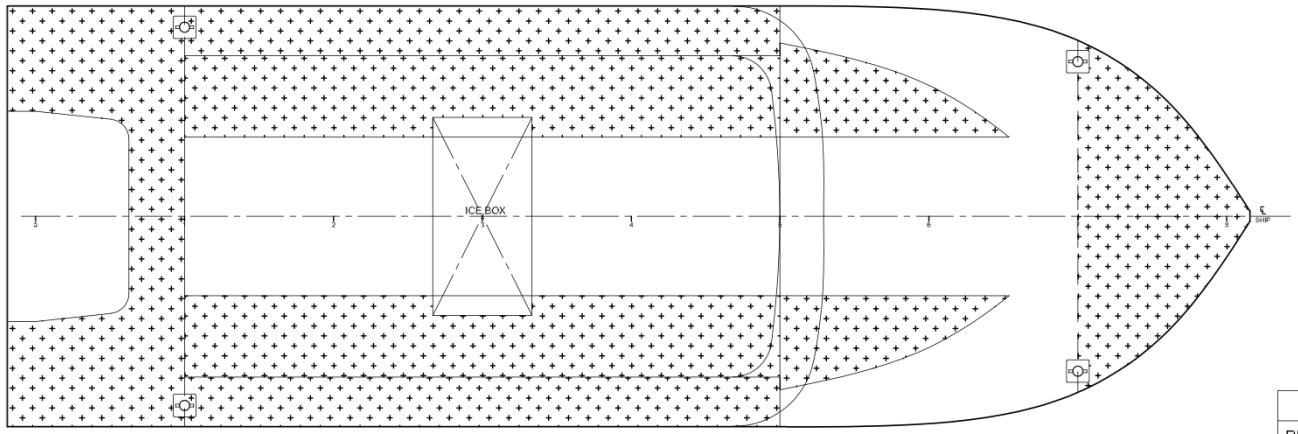


Built-in-Buoyancy for Un-decked vessels

- Undecked vessels do not have a fixed enclosed deck hence lack watertight and weathertight integrity.
- Sealed compartments with solid buoyancy material provides safety against sinking when swamped.
- The distribution of buoyancy compartments should ensure the vessel stays afloat on an even keel hence easy to bail out water.

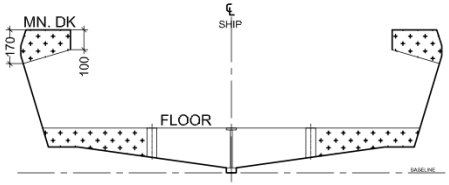




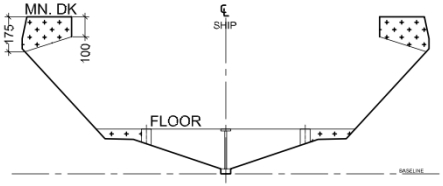


PLAN

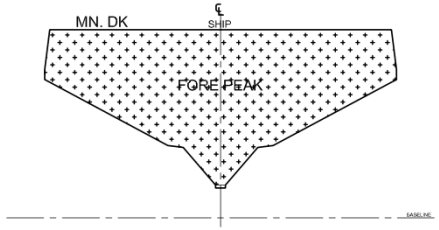
DESCRIPTION	VOLUME m³
REQUIRED RESERVE BUOYANCY AS PER WEIGHT ESTIMATE	1.509
10% RESERVE BUOYANCY	0.151
TOTAL BUOYANCY FOAM REQUIRED	1.660
TOTAL RESERVE BUOYANCY PROVIDED	1.728



TYPICAL SECTION
IWO AFT



TYPICAL SECTION
IWO MID COMPT.



TYPICAL SECTION
IWO FORE PEAK

NOTE:

1. BUOYANCY MATERIAL - CLOSED CELL POLYURETHANE FOAM
2. FLOOR / DECK TO BE SELF DRAINING TYPE

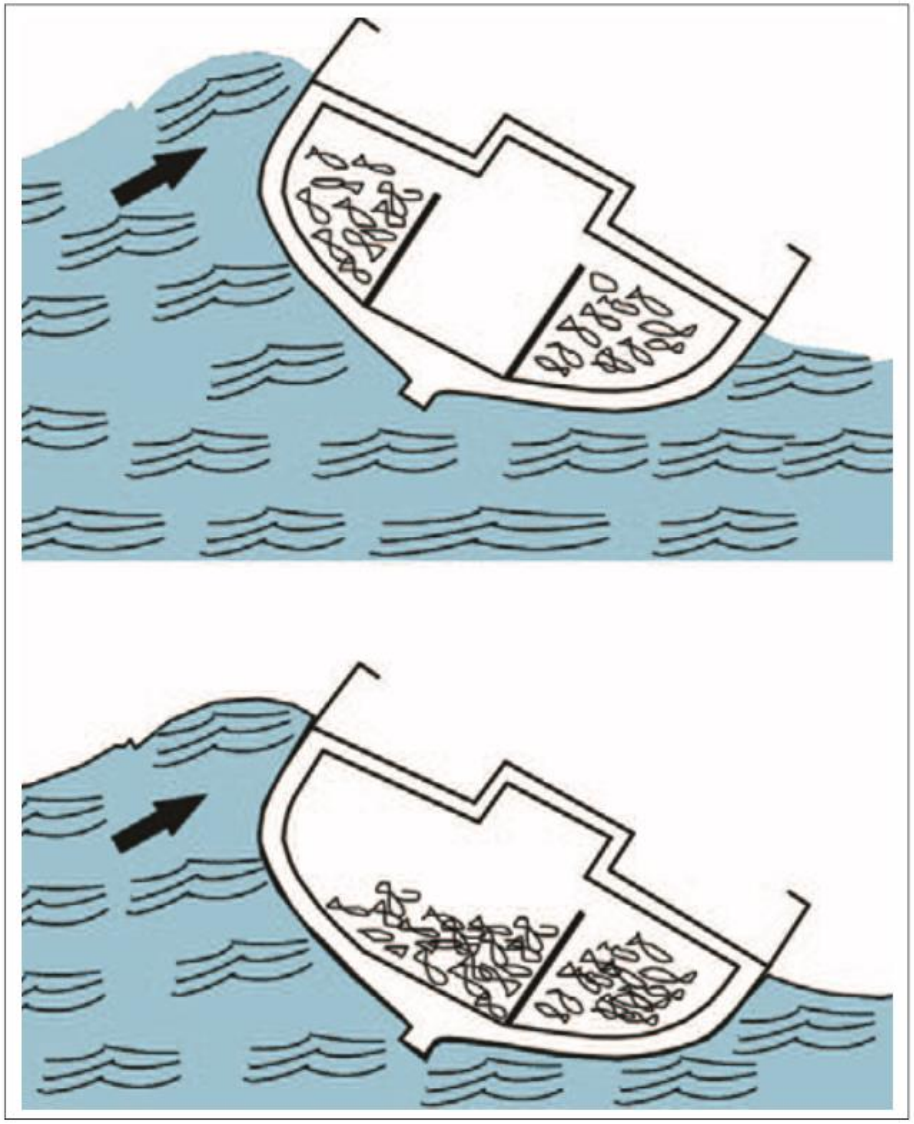
FOOD & AGRICULTURE ORGANIZATION OF THE UNITED NATIONS
SRI LANKA

CLIENT	MINISTRY OF FISHERIES, SRI LANKA						
PROJECT	20FT UN-DECKED FISHING BOAT					PROJECT No.: GCP/GLO/352/NOR	
TITLE	BUOYANCY PLAN						
SCALE	SHT	DRN	CHKD	DESIGN BY	DATE	DRG. NO.	RE
01 : 25	A3	SH	RB	ARCHETYPE	DEC.'22	FAO/20FUB/05	-

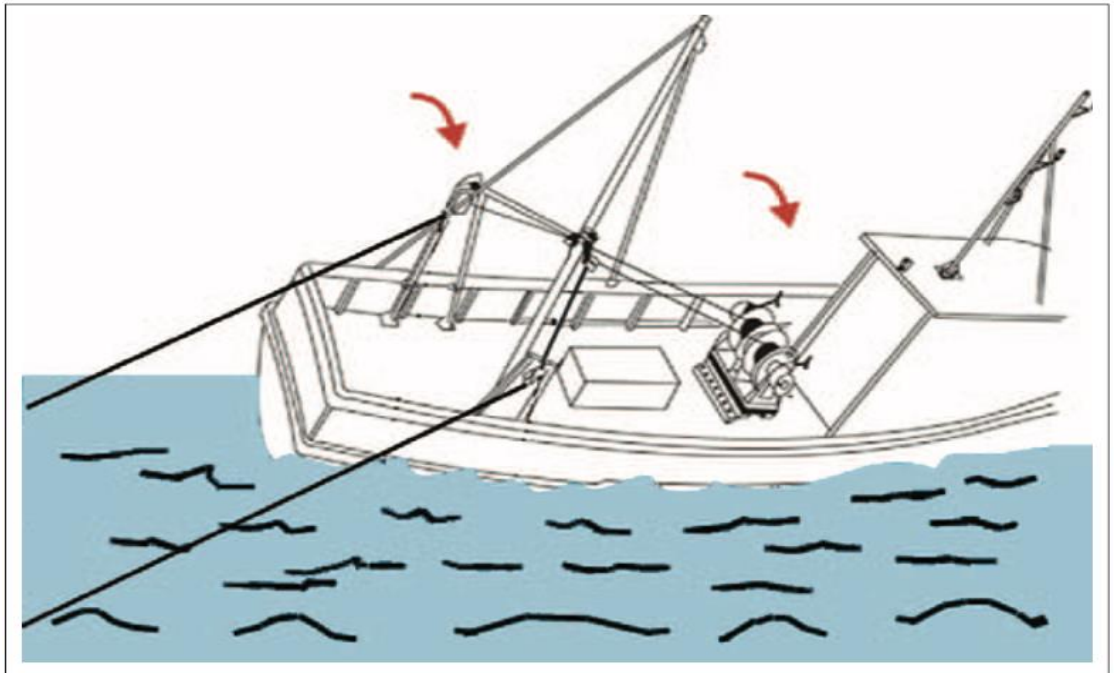
Handling of Fishing gear and Catch

- Securing heavy materials and fishing gear.
- These should be placed low and prevented from moving to.

- Catch should be stowed evenly to prevent any extreme heel or inadequate freeboard.
- In a manner to prevent movement.



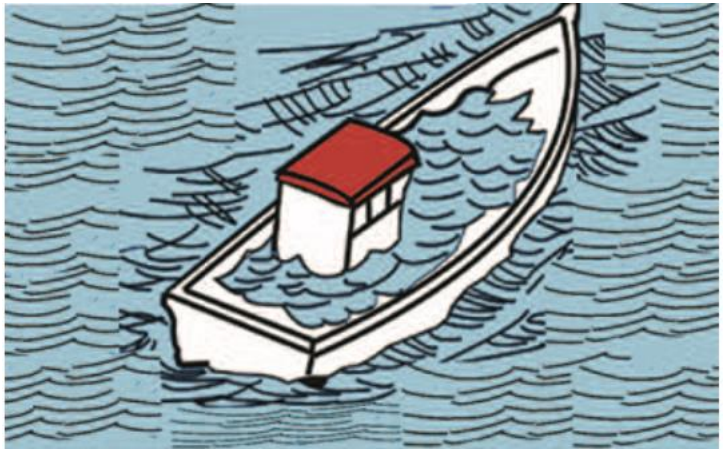
Effects of fishing gear on stability

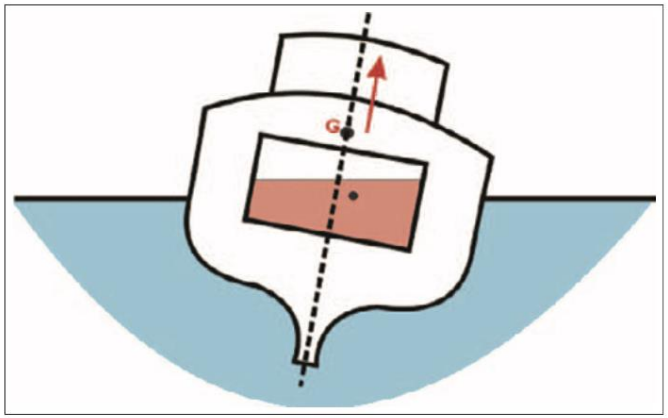


- Attention and care towards the pull from fishing gear.
- Gear snagging on the bottom could negatively effect stability.
- Point of pull on the vessel should be as low as possible.
- Factors increasing heel and risk capsizing are heavy fishing gear, powerful winches, high point of pull, increased propulsion power, adverse weather and vesselhanging by its gear.

Free surface effect

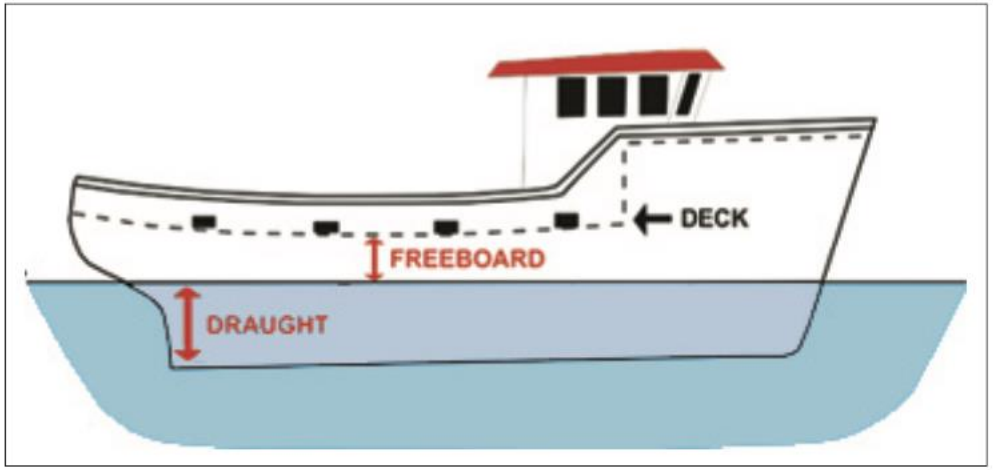
- Always ensure the quick release of water trapped on deck by keeping freeing ports and their locking devices open.
- Slots of a suitable size to allow water to flow when decks are fitted with dividing pounds.
- Partially filled tanks can be dangerous and are to be avoided or kept to a minimum at least.





Freeboard

- Freeboard is the vertical distance from the side of the working deck to the waterline of a vessel.



- Care should be taken to maintain adequate freeboard in all loading conditions.
- By reducing the freeboard the vessel's ability to return to an upright position from larger angles of heel will be reduced compromising her stability.

Concluding remarks

a. The structural strength of small-scale fishing vessels is often inadequate for the challenges of high waves, rough weather and storms at sea. Design and construction needs to improve!
b. Most small-scale fishing vessels lack sufficient buoyancy. They will sink when filled with water. Increasing buoyancy capability in new designs is essential.
c. Many accidents at sea happen due to instability of the fishing vessels. Fishers and boat builders need to increase their knowledge about stability and how to improve their vessels stability.
d. FAO Naval architects and boat builders stand ready to support you in making small-scale fishing vessels safer, stronger and increase their stability.

FAO looks forward to collaborate with you and achieve together these fundamental objectives.

Thank You!

References from FAO technical paper 517 Safety practices related to small scale fishing vessels

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