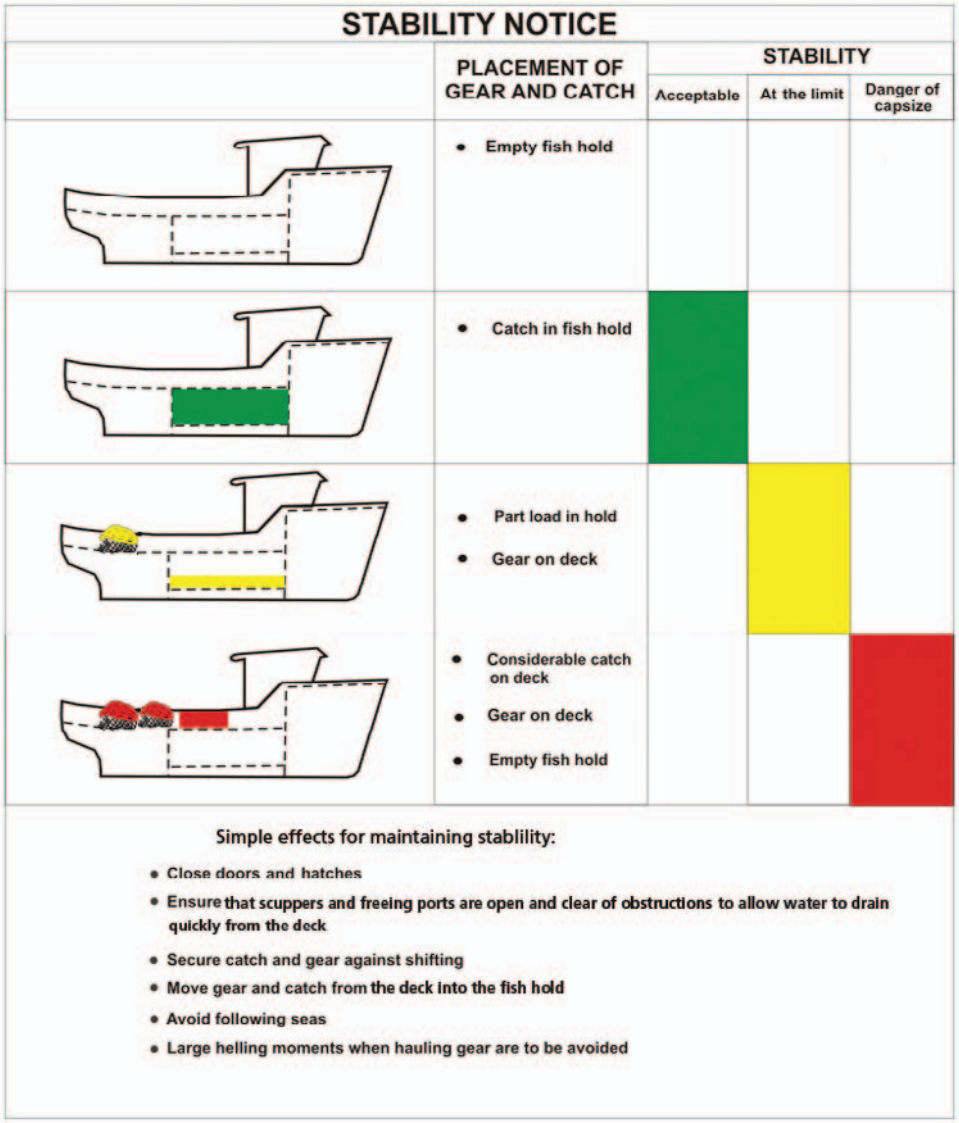
6. Stability documentation

Suitable stability information, prepared to the satisfaction of the competent authority, should be provided for each vessel to enable the skipper to easily assess the stability of the vessel under various operating conditions.

Stability notice such as the one below may be suitable for small vessels.



Stability information provided for larger vessels will often include the following:

a) operating conditions;
b) hydrostatic curves; and
c) cross curves.

The curves can also be presented in the form of tables, as illustrated below:

TABLE 1

HYDROSTATIC CURVES

Draught T_{kc} m	Displacement mass DISM t	KM m	MTC tm/cm	XB m	XF m	Max. KG m
…	…	…	…	…	…	…
1.35	14.68	1.909	0.129	3.940	3.842	1.347
1.36	14.91	1.906	0.130	3.939	3.841	1.344
1.37	15.14	1.904	0.131	3.937	3.840	1.341
1.38	15.36	1.901	0.133	3.935	3.839	1.337
1.39	15.59	1.898	0.134	3.934	3.838	1.333
1.40	15.82	1.895	0.135	3.932	3.837	1.329
1.41	16.06	1.892	0.136	3.930	3.836	1.326
1.42	16.30	1.890	0.137	3.928	3.835	1.324
1.43	16.54	1.887	0.138	3.926	3.834	1.323
1.44	16.77	1.884	0.139	3.925	3.833	1.322
1.45	17.01	1.882	0.140	3.923	3.832	1.321

TABLE 2

CROSS CURVES (LK CURVES)

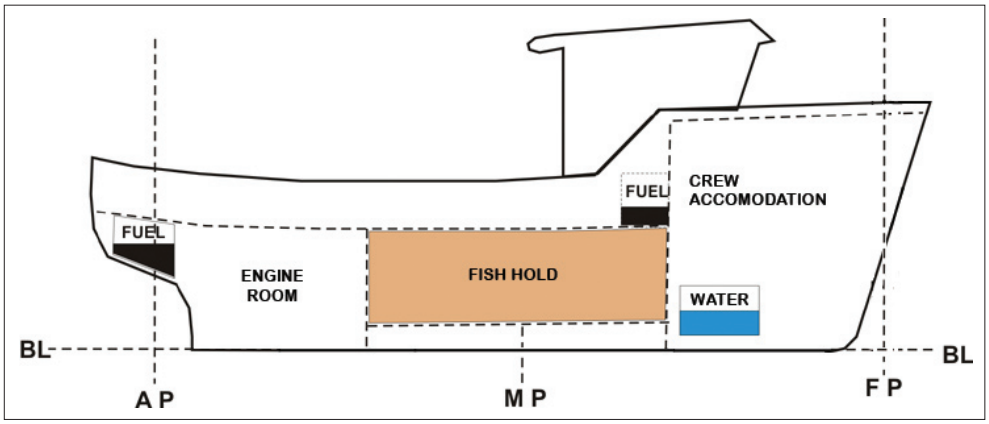
Draught T_{kc} m	LK 10° m	LK 20° m	LK 30° m	LK 40° m	LK 50° m	LK 60° m	LK 70° m
…	…	…	…	…	…	…	…
1.36	0.328	0.634	0.872	1.058	1.217	1.339	1.428
1.37	0.327	0.633	0.871	1.057	1.216	1.339	1.428
1.38	0.326	0.632	0.869	1.056	1.216	1.338	1.428
1.39	0.325	0.629	0.866	1.054	1.215	1.338	1.428
1.40	0.324	0.627	0.864	1.053	1.215	1.338	1.428
1.41	0.323	0.626	0.863	1.052	1.214	1.338	1.428

OPERATING CONDITIONS

In order to assess the vessel's stability, planning for different operating conditions should be prepared. For example, this can be done by creating a form similar to the one below and thereafter calculating the stability particulars as required by the competent authority.

EXAMPLE:

Operating condition: Departure from the fishing grounds with full catch.



Item	Mass t	XG m (from AP)	LMOM t m	ZG m (above BL)	VMOM t m	$i_B \rho$ t m
Water	0.03	6.50	0.195	0.40	0.012	0
Fuel	0.22	0.00	0.000	1.30	0.286	0
Fuel	0.03	5.80	0.174	1.90	0.057	0
2 crew	0.16	4.00	0.640	2.60	0.416	0
Catch	5.00	4.50	22.500	1.15	5.750	0
Deadweight	5.44	-	23.509		6.521	0
Lightship weight	10.15	4.17	42.326	1.38	14.007	0
Displacement mass	15.59		65.835		20.528	0

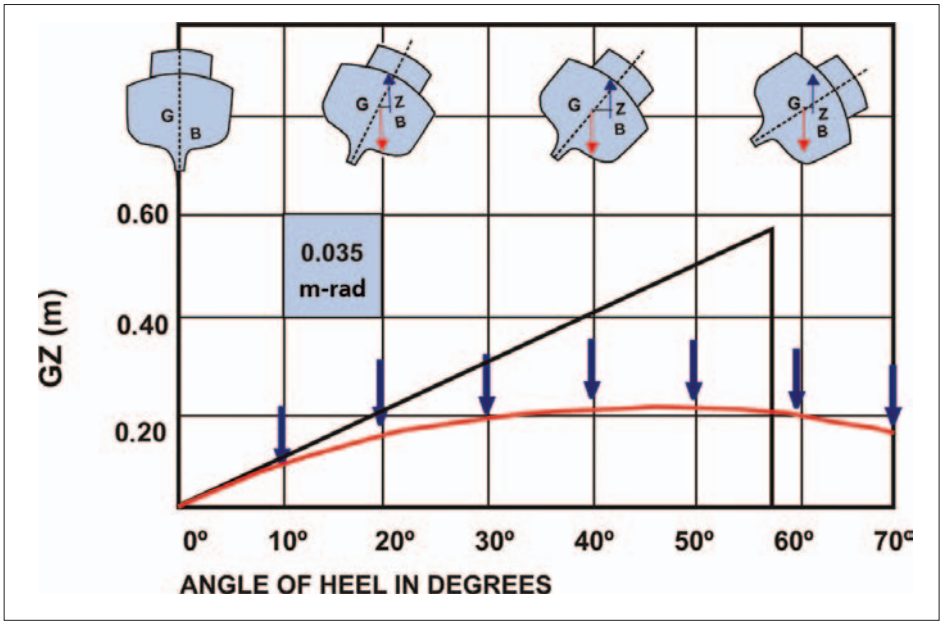
Calculate **KG**:
KG = VMOM/Mass = 20.528/15.59 = **1.317 m** above the base line, **BL**.
From the vessel's mass displacement of **15.59 tonnes** the values for the reference draught $\mathbf{T_{KC}}$ and the **KM** can be found from the table of hydrostatic curves on page 38.
T_{KC} = 1.39 m and KM = **1.898 m** above **BL**.

Calculate **GM**: **GM** = KM – KG = 1.898 – 1.317 = **0.581 m**.

From the reference draught 1.39 m the values for LK for all angles of heel (ϕ) can be found from the table of cross curves on page 38. Thereafter calculate the GZ:
GZ = LK – KG x sin ϕ

ϕ (°)	10	20	30	40	50	60	70
sin ϕ	0.174	0.342	0.500	0.643	0.766	0.866	0.940
LK (m)	0.325	0.629	0.866	1.054	1.215	1.338	1.428
KG x sin ϕ (m)	0.229	0.450	0.659	0.847	1.009	1.141	1.238
GZ (m)	0.096	0.179	0.208	0.207	0.206	0.197	0.190

STABILITY CURVE



Various methods can be used to calculate the area under the stability curve (**GZ**). The simplest is to divide the area under the curve into a suitable number of trapezes and calculate their total area (the trapezoidal rule). The area may also be calculated by the so-called "Simson's rules" which is demonstrated below:

ϕ (°)	10	20	30	40	
GZ (m)	0.096	0.179	0.208	0.207	
SM I	3	3	1		
GZ-SM I	0.288	0.537	0.208		SUM I : 1.033
SM II	4	2	4	1	
GZ-SM II	0.384	0.358	0.832	0.207	SUM II : 1.781

Area 0°-30°: 0.0654 x SUM I = 0.0654 x 1.033 = 0.068 m-rad
Area 0°-40°: 0.0582 x SUM II= 0.0582 x 1.781 = 0.104 m-rad
Area 30°-40°: = 0.104 – 0.068 = 0.036 m-rad

Compare the calculated stability values with the stability criteria in Chapter 5.

Stability value	Calculated	Criteria
Area under the curve 0°-30°	**0.068 m-rad**	0.055 m-rad
Area under the curve 0°-40°	**0.104 m-rad**	0.090 m-rad
Area under the curve 30°-40°	**0.036 m-rad**	0.030 m-rad
GZ max	**0.21 m**	
Angle where GZ max occurs	**37°**	25°
Angle where GZ > 0.20 m occurs	**37°**	30°
Metacentric height (GM)	**0.581 m**	0.350 m
The point of vanishing stability	**>70°**	