CHAPTER 4

ANALYSIS OF EXISTING TURKISH DESIGNS

On the basis of the data collected from the Sürmene Shipyard, the existing design of Turkish Black Sea fishing vessels has been analysed.

4.1 Parent vessel

A fishing vessel has been chosen to be a representative one of the existing design. The offset table and the corresponding body plans of this parent vessel are presented in Table 4.1 and Figure 4.1.

Main particulars of the parent vessel are as follows:

Length over all	L_{OA}=30m
Length water line	L_{WL}=27m
Length between perpendicular	L_{BP}=26.02m
Beam water line	B_{WL}=7.92m
Beam moulded	B=8.25m
Depth	D=3.00m
Displacement to DWL, 2m draught	Δ=197.3 tonnes
Main engine	BHP=550 HP
Midship is taken a midlength of L_{WL}	

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Sayın Oktay Gemberci;

Göndereceğiniz bu materyal büyük ölçüde istediğinizi karşılayacaktır diye ümit ediyorum.

Geç yanıt verdiğim için özür dilerim.

Çalışmalarınızda başarılar dilerim

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SECTION NO	HALF BREADTHS (mm)							
	WL1	WL2	WL3	WL4	WL5	WL6	DECK	PARAPET
A	-	-	-	-	2460	2970	2910	2950
0	-	-	-	0	2430	2760	2960	3030
1/2	-	-	1000	2560	3010	3150	3290	3350
1	120	300	2350	3150	3400	3500	3600	3650
1 1/2	240	1190	2950	3475	3650	3750	3830	3880
2	450	1750	3280	3650	3800	3880	3950	4000
3	660	2580	3700	3880	3980	4040	4050	4110
4	850	3050	3850	3990	4070	4130	4130	4200
5	980	3250	3900	4030	4100	4140	4140	4200
6	1010	3170	3800	3950	4040	4110	4110	4200
7	1010	2810	3390	3600	3750	3890	3930	4080
8	850	2130	2640	2910	3150	3360	3510	3780
8 1/2	690	1560	2060	2360	2630	2910	3200	3540
9	460	950	1350	1680	1980	2330	2800	3230
9 1/2	160	350	600	900	1200	1560	2280	2780
10	-	-	-	-	360	740	1880	2260

Distance (mm)	WL1	WL2	WL3	WL4	WL5	WL6
BOW (From Sec.9)	1610	1950	2330	2700	3080	3500
STERN (From Sec.1)	430	450	1880	2700	2810	2930

Table 4.1 Offset table of the parent vessel

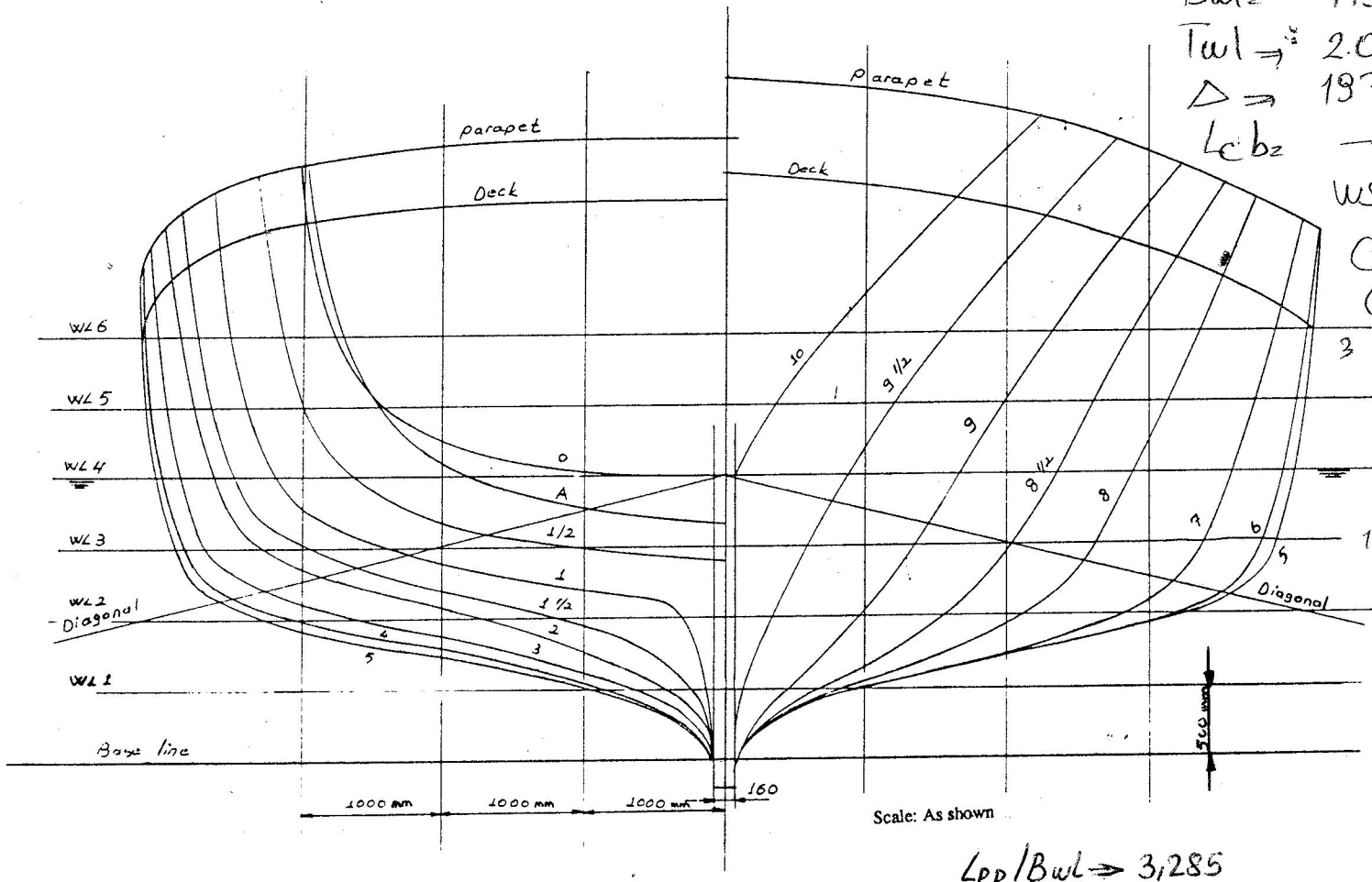

Figure 4.1 Body plan of the parent vessel

$L_{wl} = 27\ m$
$L_{pp} \Rightarrow 26{,}02\ m$
$B_{wl} = 7{,}92\ m$
$T_{wl} \Rightarrow 2.00\ m$
$\Delta \Rightarrow 197{,}292$
$LCB = -0{,}11\ m$
$WS \Rightarrow 220{,}638\ m^2$
$C_b = 0{,}428$
$C_x = 0{,}613$
$C_{up} = 0{,}769$
$C_b = 0{,}461$

$L_{pp}/B_{wl} \Rightarrow 3{,}285$
$L_{wl}/B_{wl} \Rightarrow 3{,}409$
$B_{wl}/T_{wl} \Rightarrow 3{,}960$
$L_{pp}/Vol \Rightarrow 4{,}640$
$S/Vol \Rightarrow 6{,}843$
$Vol/L_{wl} \Rightarrow 9{,}300$

WL (m)	MLD DISP (tonnes)	FULL DISP (tonnes)	LCB (m)	LCF (m)	VCB (m)	TPC (Tonnes/cm)	WSA (m^2)
1.400	96.635	98.073	0.595	-0.271	0.977	1.472	175.318
1.425	100.341	101.800	0.562	-0.348	0.993	1.492	177.863
1.450	104.107	105.588	0.527	-0.446	1.009	1.515	180.681
1.475	107.924	109.426	0.491	-0.518	1.025	1.535	183.180
1.500	111.788	113.310	0.455	-0.583	1.041	1.553	185.596
1.525	115.695	117.236	0.419	-0.641	1.057	1.570	187.909
1.550	119.642	121.202	0.383	-0.693	1.072	1.587	190.148
1.575	123.629	125.206	0.347	-0.740	1.088	1.602	192.326
1.600	127.653	129.247	0.312	-0.777	1.104	1.616	194.368
1.625	131.709	133.319	0.278	-0.808	1.120	1.629	196.324
1.650	135.794	137.420	0.245	-0.836	1.135	1.642	198.225
1.675	139.909	141.549	0.213	-0.860	1.151	1.653	200.068
1.700	144.053	145.708	0.182	0.880	1.166	1.664	201.851
1.725	148.225	149.894	0.152	-0.897	1.182	1.674	203.576
1.750	152.425	154.108	0.123	-0.910	1.197	1.683	205.241
1.775	156.650	158.346	0.095	-0.919	1.212	1.691	206.856
1.800	160.894	162.603	0.068	-0.927	1.227	1.700	208.447
1.825	165.157	166.880	0.042	-0.933	1.242	1.707	210.018
1.850	169.438	171.173	0.017	-0.938	1.357	1.715	211.574
1.875	173.738	175.485	-0.005	-0.943	1.272	1.722	231.112
1.900	178.054	179.814	-0.028	-0.946	1.287	1.729	214.641
1.925	182.386	184.159	-0.050	-0.948	1.302	1.736	216.160
1.950	186.736	188.521	-0.071	-0.950	1.317	1.743	217.667
1.975	191.101	192.898	-0.091	-0.951	1.331	1.749	219.163
2.000	195.482	197.292	-0.110	-0.951	1.346	1.756	220.638
2.025	199.889	201.716	-0.129	-0.993	1.361	1.768	222.710
2.050	204.322	206.163	-0.149	-1.017	1.376	1.777	224.519
2.075	208.776	210.631	-0.167	-1.034	1.390	1.786	226.239
2.100	213.250	215.118	-0.186	-1.044	1.405	1.793	227.871
2.125	217.742	219.623	-0.203	-1.048	1.419	1.800	229.419
2.150	222.251	224.145	-0.221	-1.052	1.434	1.806	230.953
2.175	226.774	228.680	-0.237	-1.056	1.449	1.812	232.495
2.200	231.312	233.231	-0.252	-1.058	1.463	1.819	234.023
2.225	235.864	237.796	-0.269	-1.060	1.477	1.824	235.537
2.250	240.432	242.376	-0.284	-1.060	1.492	1.830	237.036
2.275	245.015	246.971	-0.298	-1.060	1.506	1.836	238.520
2.300	249.611	251.579	-0.312	-1.058	1.521	1.841	239.990
2.325	254.221	256.201	0.326	-1.055	1.535	1.846	241.447
2.350	258.845	260.837	-0.339	-1.051	1.549	1.850	242.891
2.375	263.482	265.486	-0.351	-1.046	1.563	1.855	244.322
2.400	268.130	270.146	-0.363	-1.042	1.578	1.860	245.758

WL (m)	BMT (m)	GMT (m)	BML (m)	MCT (tm/cm)	CB	CP	CM	CW
1.400	5.602	3.869	54.661	1.894	0.302	0.646	0.468	0.645
1.425	5.512	3.795	54.437	1.959	0.308	0.648	0.476	0.654
1.450	5.425	3.724	54.567	2.038	0.314	0.650	0.484	0.664
1.475	5.339	3.654	54.252	2.101	0.320	0.652	0.491	0.672
1.500	5.255	3.586	53.850	2.160	0.326	0.654	0.499	0.681
1.525	5.170	3.517	53.359	2.215	0.332	0.657	0.506	0.688
1.550	5.089	3.452	52.805	2.267	0.338	0.659	0.513	0.695
1.575	5.010	3.389	52.207	2.316	0.344	0.662	0.520	0.702
1.600	4.932	3.327	51.496	2.358	0.349	0.664	0.526	0.708
1.625	4.855	3.266	50.740	2.397	0.355	0.666	0.533	0.714
1.650	4.780	3.206	49.969	2.433	0.360	0.669	0.539	0.719
1.675	4.707	3.148	49.183	2.467	0.366	0.671	0.545	0.724
1.700	4.633	3.090	48.384	2.499	0.371	0.674	0.551	0.729
1.725	4.560	3.032	47.575	2.527	0.376	0.676	0.557	0.733
1.750	4.486	2.974	46.756	2.554	0.381	0.678	0.562	0.737
1.775	4.413	2.916	45.937	2.578	0.387	0.680	0.568	0.741
1.800	4.342	2.860	45.138	2.601	0.391	0.683	0.574	0.745
1.825	4.272	2.805	44.361	2.623	0.396	0.685	0.579	0.748
1.850	4.204	2.752	43.608	2.645	0.401	0.687	0.584	0.751
1.875	4.138	2.700	42.874	2.666	0.406	0.689	0.589	0.754
1.900	4.074	2.652	42.162	2.686	0.410	0.691	0.594	0.758
1.925	4.013	2.605	41.473	2.706	0.415	0.693	0.599	0.761
1.950	3.953	2.560	40.803	2.725	0.419	0.695	0.604	0.764
1.975	3.895	2.517	40.152	2.744	0.424	0.697	0.608	0.766
2.000	3.838	2.475	39.518	2.762	0.428	0.698	0.613	0.769
2.025	3.784	2.435	39.372	2.815	0.432	0.700	0.617	0.774
2.050	3.731	2.397	39.027	2.852	0.437	0.702	0.622	0.779
2.075	3.680	2.360	38.624	2.884	0.441	0.704	0.626	0.782
2.100	3.630	2.325	38.167	2.911	0.445	0.706	0.630	0.786
2.125	3.580	2.290	37.663	2.933	0.449	0.708	0.634	0.789
2.150	3.532	2.257	37.167	2.954	0.453	0.709	0.638	0.791
2.175	3.486	2.225	36.693	2.976	0.457	0.711	0.642	0.794
2.200	3.440	2.194	36.226	2.996	0.461	0.713	0.646	0.797
2.225	3.396	2.164	35.764	3.016	0.464	0.714	0.650	0.799
2.250	3.353	2.135	35.307	3.035	0.468	0.716	0.654	0.802
2.275	3.310	2.107	34.855	3.053	0.472	0.718	0.657	0.804
2.300	3.268	2.079	34.407	3.071	0.475	0.719	0.661	0.806
2.325	3.227	2.052	33.965	3.087	0.479	0.721	0.664	0.809
2.350	3.186	2.026	33.529	3.103	0.482	0.722	0.668	0.811
2.375	3.147	2.001	33.098	3.118	0.486	0.724	0.671	0.813
2.400	3.108	1.976	32.683	3.133	0.489	0.725	0.675	0.815

Table 4.4 Hydrostatic characteristics of parent vessel

4.4 Resistance and propulsion

A model of the parent vessel has been built on the basis of the offset table presented in Table 4.3. The scale of the model is 1/12.5. The model has been run in the tank of Department of Naval Architecture and Ocean Eng. of Glasgow University at various speeds and corresponding resistance values (total drag) measured. These figures are shown in the Table 4.5.

Model speed (m/s)	Model resistance (Kg)
0.50	0.0549
0.75	0.1917
1.00	0.3294
1.25	0.6589
1.50	1.5374
1.75	2.7173
2.00	5.6004
2.25	8.5601
2.50	9.5516

Table 4.5 Resistance values of the model vessel

On the basis of the above information, the coefficients of the resistance components for the model and full size vessel have been calculated to compute the effective power required for the parent vessel. These values are presented in Table 4.6 and Table 4.7 based on the ITTC skin friction line.

MODEL						
Speed (m/s)	Resist. (kg)	Resist. (N)	Re	Ct	Cf	Cr
0.50	0.0549	0.539	948000	0.0030505	0.0047423	-0.0016919
0.75	0.1917	1.881	1422000	0.0047340	0.0043487	0.0003853
1.00	0.3294	3.231	1896000	0.0045757	0.0040984	0.0004773
1.25	0.6589	6.464	2371000	0.0058578	0.0039185	0.0019393
1.50	1.5374	15.082	2845000	0.0094915	0.0037805	0.0057111
1.75	2.7173	26.657	3319000	0.0123252	0.0036694	0.0086558
2.00	5.6004	54.940	3793000	0.0194487	0.0035770	0.0158717
2.25	8.5601	83.975	4267000	0.0234880	0.0034985	0.0199895
2.50	9.5516	93.701	4741000	0.0212289	0.0034303	0.0177986

Table 4.6 Resistance particulars for the model

VESSEL						
Speed (m/s)	Re	Cf	Cr	Ct	Resist. (kN)	Power (kW)
1.7681	40227000	0.0023877	-0.0016919	0.0006959	0.2460	0.43
2.6522	60227000	0.0022451	0.0003853	0.0026305	2.0924	5.55
3.5363	80455000	0.0021505	0.0004773	0.0026278	3.7161	13.14
4.4203	100455000	0.0020820	0.0019393	0.0040212	8.8850	39.27
5.3044	120455000	0.0020283	0.0057111	0.0077394	24.6248	130.62
6.1884	140682000	0.0019841	0.0086558	0.0106399	46.0775	285.15
7.0725	160682000	0.0019473	0.0158717	0.0178190	100.7915	712.85
7.9566	180682000	0.0019158	0.0199895	0.0219053	156.8188	1247.74
8.8406	200909000	0.0018878	0.0177986	0.0196865	173.9902	1538.18

Table 4.7 Resistance particulars for the full size vessel

In Figure 4.3, the effective horse power for the parent vessel calculated in Table 4.7 has been plotted against speed (knots) along with the power curve of Model 149A[4] for comparison purpose. The Model 149A of 75 ft.(22.86m), 100 ton, 10 knot was designed from a hydrodynamic point of view, incorporating a bulbous bow, 2-bladed propeller, and steerable nozzle which replaces the rudder. Tests of this model showed exceptionally low resistance, exceptionally high propulsive efficiency, and a high efficiency when trawling. Test results were expanded to all sizes for ready comparison with existing vessel. To facilitate comparisons with existing vessel of all sizes, the effective powers and speeds for model 149A were plotted on a log-log basis versus displacement from 10 tons to 1,000 tons in Fig.4.4 to 4.6. Each figure refers to a different load condition, and secondary scales along the bottom show the waterline lengths, in feet and meters, for salt water.

Speed(Knots)	EHP
6.5	20
7.0	26
7.5	33
8.0	41
8.5	55
9.0	70
9.5	90
10.0	105
10.5	140
11.0	165
11.5	240
12.0	350
12.5	495
13.0	650
13.5	850

Table 4.8 Effective power values for Model 149A read off from Fig.4.6

For comparison, the power curve for Model 149A was evaluated from Fig.4.6, which most nearly fits the displacement and length of the parent vessel (197.3 ton, 27m). At this displacement and length (from the bottom scale) powers and speeds, which are shown in Table 4.8, were read off and plotted in Fig.4.3. As can be seen from this figure that effective powers of parent vessel and Model 149A show a good agreement with each other. Maximum difference between effective powers of these curves is round about 55HP (32%) and occurs around at 11knots speed. Outside of this speed the discrepancy between the two curves gets gradually smaller.

The required engine power has been calculated on the basis of the effective power curve (Fig.4.3) for a chosen free running speed of 10 knots with a single screw propeller. The propulsion calculations are demonstrated in Chapter 5. It has been found that the required engine power (350HP) is far below the engine power that the parent vessel has got already on board (550HP). It has also been found that the engine power for the Black Sea fishing vessels is relatively high in comparison to similar fishing vessels of the world. In Fig.4.7, curves of engine power for typical fishing vessels are shown. It generally may be said that there is a strong tendency among the Black Sea fishermen to increase the power in relation to size with not much respect to economy. The effect of variation of machinery size on the economy is dealt with in Chapter 6.

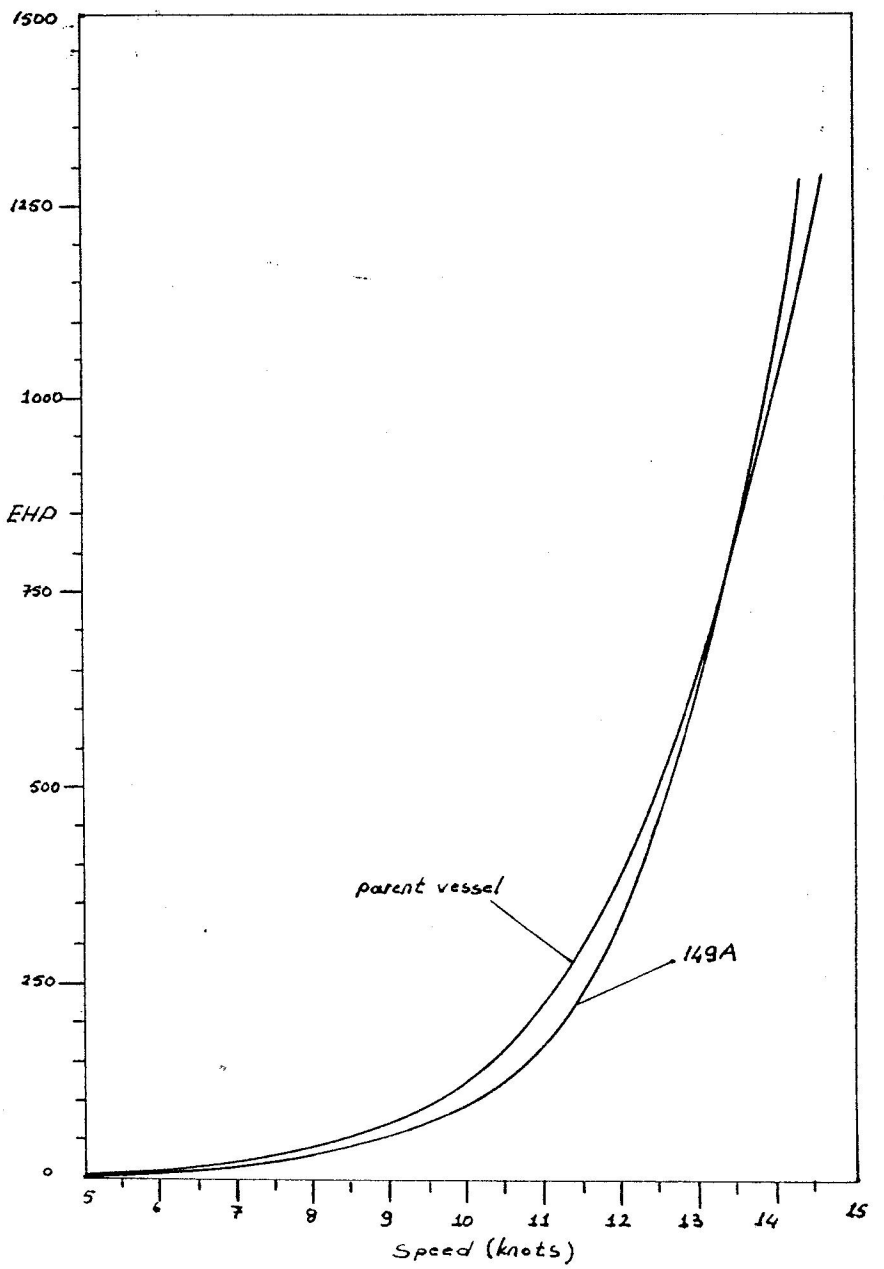

Figure 4.3 Effective power curves for parent vessel and Model 149A