

MARINE FISHERIES AND THE LAW OF THE SEA: A DECADE OF CHANGE

IV. Appendix 1

FISHING COST METHODOLOGY

The basis for the cost estimates for the construction of larger fishing vessels (Table 24) can be considered fairly reliable, since information on new construction is available at shipyards. The prices refer to vessels of different length and it has been necessary to convert them to tonnage classes for the purpose of this exercise. Average unit values for the different tonnage classes have been derived from cost information on new construction, by size and type of vessel within each class. The resulting estimate of the replacement costs of the global fishing fleet are shown in Table 25. For the three million vessels included in the calculation, the estimated cost to replace these vessels at 1989 prices is approximately US\$ 320 000 million.

In order to calculate operating costs for these vessels, the replacement value is considered to be the "best" measure. Without knowledge of the age structure of the fleet, the use of depreciation rate formulas may not be realistic and cannot be cross-referenced. The use of market value as the basis for the estimate would incur the same risk, while the insured value would cover only a percentage of the fleet. The following operating costs have therefore been derived on the basis of percentages of actual replacement values.

Tables 26 and 27 present estimates of annual operating costs for maintenance and repairs, insurance, supplies and gear, fuel and labour, based on percentage of the replacement costs calculated above, as assessed by staff of the FAO Fisheries Department, Fishing Technology Service. These costs are derived on the basis of vessels normally insured and subject to regular surveys, especially "in class" vessels²⁴. The total annual costs for routine maintenance and

²⁴"In class" refers to vessels that are certified by an international classification society.

TABLE 24

Cost of representative fishing vessels			
Vessel type	Length (m)	Material	Cost in 1988 (...US\$'000...)
Super trawler	100	Steel	80 000
Tuna seiner	65	Steel	15 000
Freezer trawler	50	Steel	11 000
Purse seiner	45	Steel	5 800
Stern trawler	35	Steel	4 200
Scottish seiner	25	Steel	2 250
Scottish seiner	23	Wood	1 900
Shrimp trawler	25	Steel	900
Shrimp trawler	23	FRP ¹	700
Gillnetter	15	FRP	600
Trawler	13	Ferrocement	350
Fast potter	10	FRP	120
Pirogue (inboard engine)	10	Wood	4

¹ Fibre-reinforced plastic.

Source: Fitzpatrick, J. *Fishing technology, fisheries resources and future demand; in Report of the World Symposium on Fishing Gear and Fishing Vessel Design*, St. John's, Newfoundland, Canada, 21-24 November 1988.

TABLE 25

Capital investment in global marine fishing fleet			
Vessel tonnage class (.....GRT.....)	Number of vessels	Average replacement cost	Total replacement cost
		1989 (US\$ '000)	(US\$ million)
>1 000	3 010	40 000	120 400
500-999.9	2 100	8 000	16 800
100-499.9	30 600	3 000	91 800
<100, decked	1 100 000	80	88 000
<100, undecked	2 100 000	1	2 100
TOTAL	3 235 710		319 100

Source: FAO.



TABLE 26

Annual operating costs					
GRT Classes	Maintenance and repair	Insurance	Supplies and Gear	Fuel	Labour
Percentages of Replacement Cost					
>1 000	7.50	1.625	1.5	1.46	2.2
500 - 999	9.00	2.275	4.0	4.46	7.5
100 - 499	10.50	2.275	6.0	4.16	8.0
<100 decked	11.25	3.000	11.0	6.00	9.3
<100 undecked	6.00	6.000	40.0	99.00	150.0
Costs in US\$ million					
> 1 000	9 030	1 957	1 806	1 758	2 649
500 - 999	1 512	382	672	749	1 260
100 - 499	9 639	2 088	5 508	3 819	7 344
< 100 decked	9 900	2 640	9 680	5 280	8 184
< 100 undecked	126	126	840	2 079	3 150
TOTAL	30 207	7 193	18 506	13 685	22 587

Source: FAO

repair (US\$ 30 000 million) may appear to be high, but these should be viewed against insurance costs, whereby a good maintenance record is necessary to attract reasonable insurance premiums. The estimated annual total operating costs are US\$ 92 000 million.

The calculation for some of the above costs can be cross-referenced. The estimated cost of US\$ 7 000 million for insurance is

approximately 2% of the replacement cost of the fleet. Fuel costs can also be derived and these are given in Table 27. The estimated annual fuel consumption in tons per vessel in each tonnage class is determined by multiplying columns 2, 3, 4 and 5 by 24 hours. This, multiplied by the number of vessels in each tonnage class and the price of fuel at US\$ 300/t,

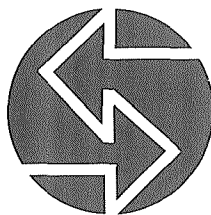
TABLE 27

Fuel cost estimates									
GRT Classes	Days at Sea	Specific fuel consumption (gram/hour)	Total Installed bhp	Operational Constant ^a	Number of Vessels	Fuel Consumption (Tons/Year)		Fuel Costs	
						Per Vessel	Per Vessel Class	Per Ton	Per Vessel Class/Year
1	2	3	4	5	6				
>1 000	250	160	3 000	0.60	3 010	1728.00	5 201 280	300 ¹	1 560.4
500 - 999	250	160	2 000	0.60	2 100	1152.00	2 419 200	"	725.8
100 - 499	220	180	800	0.55	30 600	418.18	12 796 300	"	3 838.9
<100 decked	180	200	50	0.40	1 100 000	17.28	19 008 000	"	5 702.4
<100 undecked	180	200	20	0.20	2 100 000	3.456	7 257 600	" ²	2 177.3
TOTAL							46 682 380		14 004.8

¹ Large vessels using bunker oil would have a lower cost per ton (US\$ 150 - 200)

² Small vessels usually pay higher costs (no duty free) for diesel (US\$ 350 - 400) and those using petrol even higher costs.

³ Estimated % of 24 hours at which the full power rating is applied.



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V. Appendix 2 FISHERIES STATISTICS

TABLE 30

Eastern central Atlantic catch by coastal distant-water states

Year	Coastal developing states	Former USSR	Spain	Other distant-water states	All countries
(.....Tonnes.....)					
1970	814 181	612 729	224 545	791 056	2 442 511
1971	897 373	790 440	223 381	833 554	2 744 748
1972	985 287	849 405	243 748	857 061	2 935 501
1973	1 079 282	943 367	373 263	773 278	3 169 190
1974	1 023 266	1 145 974	413 605	730 668	3 313 513
1975	1 026 651	1 165 972	382 427	768 073	3 343 123
1976	1 042 433	1 315 543	408 112	623 862	3 389 950
1977	1 079 761	1 134 433	440 288	932 632	3 587 114
1978	1 144 232	769 500	485 414	635 556	3 034 702
1979	1 117 329	526 011	370 543	542 978	2 556 861
1980	1 142 958	942 334	448 841	839 681	3 373 814
1981	1 253 953	780 597	406 735	586 503	3 027 788
1982	1 242 635	955 801	415 314	438 208	3 051 958
1983	1 401 704	935 833	386 986	331 804	3 056 327
1984	1 404 434	662 736	372 035	249 097	2 688 302
1985	1 454 896	708 120	383 362	294 157	2 840 535
1986	1 621 130	854 177	268 776	278 803	3 022 886
1987	1 578 559	1 062 954	201 413	347 213	3 190 139
1988	1 616 997	1 395 028	192 707	329 080	3 533 812
1989	1 590 932	1 629 005	173 031	308 737	3 701 705

Note: FAO is credited as the source for all fishery statistics presented in this appendix.



TABLE 31

Southeast Atlantic catch by state

Year	Coastal states	Former USSR	Spain	Other distant-water states	Total
(.....Tonnes.....)					
1970	1 664 701	422 200	246 000	186 073	2 518 974
1971	1 564 622	438 600	223 600	239 186	2 466 008
1972	1 833 210	719 800	201 500	266 094	3 020 604
1973	1 982 209	648 600	211 900	336 213	3 178 922
1974	1 922 236	447 480	157 987	309 226	2 836 929
1975	1 618 716	420 734	199 891	346 844	2 586 185
1976	1 334 897	841 250	202 964	393 616	2 772 727
1977	1 162 861	1 047 226	175 935	409 553	2 795 575
1978	1 165 964	1 496 362	161 265	474 029	3 297 620
1979	1 126 491	850 664	146 861	439 163	2 563 179
1980	957 954	825 208	128 132	283 222	2 194 516
1981	1 010 296	904 000	193 995	311 978	2 420 269
1982	947 934	887 840	188 623	360 602	2 384 999
1983	1 058 662	631 459	176 505	482 328	2 348 954
1984	833 862	702 998	163 094	466 503	2 166 457
1985	876 348	697 944	188 054	363 888	2 126 234
1986	904 860	679 222	199 451	363 767	2 147 300
1987	1 554 488	670 462	195 596	328 063	2 748 609
1988	1 444 633	634 559	192 559	249 475	2 521 226
1989	1 020 006	654 283	195 638	246 984	2 116 911

TABLE 32

Northeast Pacific catch by six major states

Year	United States	Japan	Former USSR	Canada	Korea, Rep.	Poland
(.....Tonnes.....)						
1970	396 600	1 390 800	739 500	116 700	0	0
1971	350 900	1 188 000	656 000	112 800	0	0
1972	358 500	1 358 300	869 200	161 800	0	0
1973	366 900	964 100	379 800	183 200	0	2 400
1974	360 832	1 087 273	697 700	141 124	0	44 651
1975	352 613	1 113 803	572 597	132 965	3 267	58 738
1976	443 278	1 105 067	496 704	180 880	109 171	30 714
1977	481 875	808 695	185 120	204 317	64 143	24 509
1978	516 375	765 928	248 834	200 581	116 565	29 372
1979	593 507	846 221	210 259	159 803	119 713	63 972
1980	653 674	813 374	59 208	143 451	182 246	115 954
1981	806 594	936 527	2 589	183 127	265 870	159 942
1982	845 010	859 539	3 300	157 835	260 679	9 971
1983	1 017 703	801 630	2 400	191 540	362 757	13 805
1984	1 270 603	722 030	22 816	169 160	399 541	81 185
1985	1 614 024	551 548	10 971	214 732	399 147	91 675
1986	2 035 720	329 120	8 998	219 420	518 438	93 245
1987	2 571 670	218 331	11 202	247 228	320 129	58 842
1988	2 811 564	53 945	12 109	260 890	135 245	44 798
1989	2 786 566	46 578	12 869	265 431	140 143	19 284



TABLE 46

**Former USSR: Alaska pollack
catch and other marine catch**

Year	Alaska pollack	Other marine catch
(.....Tonnes.....)		
1970	697 000	5 577 600
1971	861 900	5 405 102
1972	1 029 400	5 735 507
1973	1 339 200	6 303 767
1974	1 754 200	6 590 840
1975	1 958 116	6 996 526
1976	2 090 869	7 159 108
1977	1 975 140	6 288 429
1978	2 011 918	6 292 536
1979	2 048 833	6 197 314
1980	2 111 669	6 638 624
1981	2 137 875	6 630 032
1982	2 497 907	6 638 588
1983	2 747 044	6 184 037
1984	3 449 559	6 243 402
1985	3 343 034	6 216 497
1986	3 584 140	6 727 498
1987	3 421 719	6 723 312
1988	3 369 858	6 960 112
1989	3 133 152	7 039 120

TABLE 47

Norway: total marine catch by selected species groups

Year	Total cod and haddock	Atlantic mackerel	Total herring	Sand eel (sandlance)	Atlantic salmon	Other	Capelin
(.....Tonnes.....)							
1970	825 000	278 800	368 100	600	1 000	107 307	1 301 000
1971	881 900	202 600	315 000	2 100	1 300	212 285	1 371 200
1972	922 600	159 800	309 900	18 800	1 800	145 736	1 556 400
1973	821 600	337 600	216 100	17 200	1 900	171 099	1 332 100
1974	906 803	287 806	117 037	77 968	2 001	145 764	1 030 158
1975	904 959	243 440	206 682	54 139	2 142	79 915	980 202
1976	898 633	212 119	150 587	44 408	2 530	73 161	1 972 289
1977	873 198	181 742	54 635	78 761	3 321	65 041	2 137 200
1978	911 581	92 897	122 252	93 971	4 357	73 451	1 280 630
1979	998 815	125 497	99 479	102 433	5 917	78 558	1 232 177
1980	862 994	76 920	94 675	148 444	5 875	88 471	1 118 069
1981	942 396	62 099	32 108	54 319	9 797	90 904	1 347 258
1982	1 023 693	74 069	71 434	47 738	11 782	107 680	1 152 945
1983	983 824	79 970	91 444	12 442	18 572	144 115	1 492 672
1984	998 571	142 538	173 456	30 291	23 236	140 210	945 567
1985	891 484	115 358	256 598	15 653	30 796	157 043	640 810
1986	870 810	156 749	335 297	87 675	46 160	130 758	272 632
1987	863 973	157 174	356 521	198 869	48 466	162 193	142 414
1988	783 618	162 139	350 722	191 653	81 380	180 081	72 671
1989	818 853	143 415	274 004	194 425	116 164	228 351	108 270



TABLE 48

United States: northeast Pacific whitefish catch¹

Year	Pacific cod	North Pacific hake	Sablefish	Flatfish ²	Pacific halibut	Yellowfin sole	Other
(.....Tonnes.....)							
1970	1 300	4 100	1 600	15 100	15 600	0	17 500
1971	2 800	4 800	1 200	13 900	12 800	0	14 500
1972	4 800	1 900	4 200	19 700	11 600	0	17 200
1973	3 800	1 200	4 500	20 700	10 400	0	19 400
1974	4 542	2 382	4 125	21 210	8 407	0	15 906
1975	5 551	1 524	5 080	21 114	9 626	0	14 962
1976	5 870	1 911	4 302	22 860	8 231	0	19 483
1977	4 966	1 616	5 995	22 855	7 967	0	24 166
1978	4 952	3 138	7 754	19 999	7 926	0	22 507
1979	6 323	13 925	14 706	24 096	9 573	0	32 112
1980	8 923	5 438	7 609	20 422	8 603	0	43 826
1981	29 063	48 649	8 796	26 277	12 111	15 975	56 528
1982	45 938	74 589	16 888	35 358	14 296	17 414	62 337
1983	66 186	79 969	14 850	37 964	19 935	22 529	54 825
1984	90 950	85 582	21 247	42 659	21 652	33 025	73 262
1985	90 929	38 910	25 345	63 747	27 594	134 518	74 984
1986	113 390	93 253	35 789	81 695	35 195	152 312	78 779
1987	136 900	229 576	43 753	75 170	34 464	181 403	98 421
1988	232 729	142 907	46 369	148 181	36 939	218 793	80 178
1989	213 224	211 082	41 923	52 451	34 076	152 777	130 080

¹ Excluding Alaska pollack.² Not elsewhere included.

TABLE 49

United States: total catch by group¹

Year	Total Fish-meal fish	Total tuna	Total salmon	Total shrimp	Other	East coast whitefish	West coast whitefish	Alaska pollack (walleye pollack)
(.....Tonnes.....)								
1970	993 900	214 000	186 000	163 900	198 800	260 300	55 200	200
1971	1 109 900	213 800	150 900	176 100	212 500	240 500	50 000	100
1972	1 034 400	241 300	105 200	174 500	229 900	228 400	59 400	100
1973	1 053 300	236 100	100 600	169 600	209 700	255 000	60 000	0
1974	1 074 370	252 591	91 388	165 277	232 356	248 788	56 572	57
1975	1 054 465	259 153	91 627	152 454	228 337	249 586	57 857	21
1976	1 140 975	301 039	140 649	183 304	245 794	254 201	62 657	229
1977	1 008 427	212 010	152 247	211 628	310 065	266 979	67 565	323
1978	1 283 794	251 428	183 475	186 842	330 377	291 175	66 276	1 765
1979	1 345 540	218 273	243 180	148 430	345 501	305 567	100 735	3 132
1980	1 337 029	225 886	278 422	157 651	382 182	321 513	94 821	1 409
1981	1 145 160	221 105	294 129	156 129	354 026	286 121	197 399	60 691
1982	1 411 553	198 193	275 522	132 191	333 175	268 636	266 820	130 365
1983	1 447 093	264 446	289 980	117 305	299 766	276 501	296 258	284 486
1984	1 416 299	264 165	313 622	133 065	302 943	261 572	368 377	455 149
1985	1 356 857	233 775	329 722	148 577	321 973	208 122	456 027	656 446
1986	1 199 949	251 126	298 696	175 889	350 058	201 906	590 413	963 271
1987	1 346 653	282 521	255 031	159 106	382 036	195 638	799 687	1 307 722
1988	1 123 811	272 843	256 443	146 103	414 020	186 214	906 096	1 396 849
1989	1 072 819	242 169	352 806	156 918	418 643	160 360	835 613	1 359 146

¹ Excluding clams.



TABLE 54

Spain: catch of major tuna by area

Year	Northeast and western central Atlantic	Eastern central Atlantic	Western Indian Ocean
	(.....Tonnes.....)		
1970	26 616	20 045	0
1971	31 971	31 016	0
1972	26 497	38 580	0
1973	21 999	42 340	0
1974	26 392	59 771	0
1975	23 010	52 027	0
1976	27 249	57 172	0
1977	26 110	68 387	0
1978	28 750	68 259	0
1979	32 861	65 612	0
1980	26 622	74 488	0
1981	21 533	98 055	542
1982	27 740	101 687	69
1983	34 886	90 330	0
1984	23 486	101 153	22 684
1985	23 699	113 799	38 426
1986	26 742	117 285	42 959
1987	30 476	113 417	57 685
1988	31 742	110 144	98 868
1989	28 583	105 006	115 021

TABLE 55

Total catch by states in non-local areas

Year	Total catch (all states)
	(.....Tonnes.....)
1970	7 544 137
1971	7 478 677
1972	8 549 749
1973	8 144 732
1974	8 360 756
1975	8 080 103
1976	8 268 868
1977	7 945 652
1978	7 333 889
1979	6 662 499
1980	7 392 884
1981	7 215 932
1982	7 375 155
1983	7 276 798
1984	6 989 962
1985	6 959 703
1986	8 004 878
1987	8 525 497
1988	8 701 362
1989	8 958 413

TABLE 56

Catch by major distant-water states in non-local areas, 1970

Country	Catch
	(.....Tonnes.....)
Former USSR	3 053 029
Japan	2 049 300
Spain	750 945
Poland	247 600
Portugal	214 702
Germany, Fed. Rep.	206 300
Others	1 022 261
TOTAL	7 544 137

TABLE 57

Catch by major distant-water states in non-local areas, 1989

Country	Catch
	(.....Tonnes.....)
Former USSR	4 547 530
Japan	1 492 727
Spain	634 722
Korea, Rep.	580 234
Poland	410 991
Taiwan, Province of China	327 719
Others	964 490
TOTAL	8 958 413

