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Fillet Yields of Dover Sole versus Depth of Capture and Length

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Abstract.—The fillet yield (100% × fillet weight ÷ round weight) of Dover sole (*Microstomus pacificus*) caught off central and northern California was examined with respect to fish total length and depth of capture. The yield from Dover sole caught at depths greater than 458 m was not related to fish length. However, the yield from fish caught at shallower depths was correlated with fish length; the maximum yield was obtained from fish 40–42 cm long. Fillet yield was substantially lower for fish larger than 42 cm. A comparison of the yields of shallow- and deep-caught fish showed that shallow-caught fish had a 4.1% higher yield.

Management of the groundfish resources of California, Oregon, and Washington has received increased attention since enactment of the Magnuson Fishery Conservation and Management Act of 1976. The Pacific Fishery Management Council (PFMC), created under the act, has since initiated a number of studies with the goal of producing equitable and optimal long-term management of the west coast groundfish fishery. My study was undertaken in 1977 to assist the PFMC to determine factors relevant to the long-run output of fish products from west coast groundfish stocks because few yield data were available for the fresh product.

One of the goals of management is to increase productivity. The groundfish plan development team of the PFMC equated long-term productivity of Dover sole (*Microstomus pacificus*), one of the most important groundfish, to the stock's estimated maximum sustainable yield (MSY). To achieve and maintain MSY, management measures may need to be instituted when Dover sole populations show signs of stress (Anonymous 1980). These management measures may include time or area closures, quotas, or gear limitations. Most Dover sole are caught in trawl nets, so it is likely that gear limitations would take the form of an increase in the minimum size of mesh allowed. Larger meshes presumably would allow more small fish to escape and be caught later when they are larger. Also, processors generally prefer larger fish, which they believe yield proportionately more flesh and hence are cheaper to process for that reason. Indeed, Gates and Norton (1974) found this to be true for the yellowtail flounder (*Limanda ferruginea*) fishery in New England.

The chief objective of this study was to determine if the fillet yield of Dover sole, as produced by professional filleters in commercial processing plants, was correlated with fish length. A second objective was to determine if Dover sole from deep water (defined here as deeper than 458 m) gave a lower fillet yield than those caught in shallower water. The fishery for Dover sole is conducted from shallow water out to depths of 1,280 m, and industry members think that those from shallow water yield about 5% more flesh.

Methods

I examined Dover sole landed at northern and central California ports from April 1977 to March 1978. Vessel captains were interviewed to learn whether or not their catches were made in shallow or deep water. At the processing plant, total lengths of fish were measured to the nearest centimeter and grouped into 2-cm size classes separated by 1-cm intervals. This was accomplished by excluding fish that fell within these 1-cm intervals. Each size class of fish was placed in a separate container that was designated as a sample. Only fish 34–54 cm long were measured because smaller fish normally are not filleted and larger fish are rarely caught. Sample weights varied because container size differed at the three processing plants where the study was conducted. Also, partly filled containers were used when no more fish were available. Mean sample weight was 16.8 kg (range, 5.0–27.1 kg) for shallow-water Dover sole and 14.9 kg (range, 3.0–21.2 kg) for Dover sole taken from deep water (Table 1). After the containers were weighed, they were passed to experienced filleters in the plants. The fish were distributed to as many different experienced filleters as possible to reduce bias. When the finished fillets were retrieved, they were weighed and counted to assure that their

TABLE 1.—Number of fish in a sample (*N*), total sample weights (*W*, kg), and number of samples (*n*) related to the total length of Dover sole caught at depths above and below 458 m.

		Depth, sampling date (season)[a]							
		Depth < 458 m, 1977–1978						Depth > 458 m, 1977	
Total-length group (cm)	Variable	Apr 25 (1)	May 2 (1)	Jun 21 (1)	Sep 11 (2)	Dec 20 (3)	Mar 20 (4)	Sep 13 (2)	Dec 21 (3)
34–36	*N*	104	103	185	340	79	55	98	252
	W	46	43	75	138	34	22	46	110
	n	2	2	2	10	3	2	3	7
37–39	*N*	0	256	131	231	103	97	294	232
	W		144	60	121	55	51	158	133
	n	0	6	3	8	4	4	11	8
40–42	*N*	0	292	0	174	79	108	269	151
	W		207		116	55	74	194	106
	n	0	9	0	8	4	5	13	7
43–45	*N*	57	259	0	278	40	49	150	76
	W	48	220		233	34	44	142	66
	n	2	9	0	16	2	3	9	5
46–48	*N*	0	95	74	94	24	78	58	29
	W		96	66	96	25	89	62	31
	n	0	4	3	8	2	6	4	2
49–51	*N*	0	22	35	34	6	40	32	12
	W		28	41	42	8	56	44	15
	n	0	2	3	3	1	4	3	1
52–54	*N*	4	7	24	3	3	17	10	2
	W	6	9	34	5	5	27	16	3
	n	1	1	2	1	1	2	1	1

[a] Seasons: 1 = April–June; 2 = July–September; 3 = October–December; 4 = January–March.

number was equal to twice the number of fish in the sample.

Results

The fillet yield (100% × weight of fillets ÷ total weight) was calculated for each sample. Although seasonal food availability, sexual mix, and reproductive cycles could have an effect on fillet yield, the shape of the yield curve remained constant. Seasonality could not be separated from location of capture and place of filleting, nor were sexes determined. Therefore, seasonal differences were not statistically compared and all data were combined for each of the two depth strata. The shallow-depth strata combined the data from the four seasons (1 = April–June; 2 = July–September; 3 = October–December; and 4 = January–March) and the deep-depth strata combined seasons 2 and 3. Analysis of variance (Table 2) indicated no significant relationship between fish length and yield for deep-caught fish. However, the yield from shallow-water fish was linked to fish length.

The greatest fillet yield was obtained from fish 40–42 cm in total length (Figure 1). The yield was 1.1% lower for fish 34–36 cm long and 3.7% lower for fish 52–54 cm long. Actual yields are not given because processors who allowed this study to be made in their plants asked that these figures remain proprietary and confidential.

Comparison of season 2 (July–September) fillet yields showed that fish caught in shallow water yielded more fillet flesh than did fish from deep water (Table 2). The relationship between fillet yield and length was not significant. The mean fillet yield was 4.1% greater for shallow-water than for deep-water fish. I do not know why this occurred, but processors believe that flesh of deep-dwelling fish has a higher water content. The reason fish larger than 43 cm had lower fillet yields also is unknown. Perhaps age also affects water content of the flesh, or else gonad development and stomach contents contribute proportionately more to the total weight of larger fish.

Management Implications

The fillet yield of Dover sole appears to be related to size of fish as well as depth of the habitat. Therefore, management measures probably can influence the amount of product that the fishery can produce. For example, restricting fishing to waters shallower than 458 m may provide a 4% greater fillet yield than would be the case if the

TABLE 2.—Analysis of variance for fillet yield of Dover sole as a variable and depth of capture and length as treatments. Asterisks denote $P < 0.05$.

Source	Sum of squares	df	Mean square	F
Depth > 458 m				
Seasons 2 and 3[a]	0.947	1	0.947	0.249
Fish length	32.088	5	6.418	1.641
Error[b]	262.014	67	3.911	
Depth < 458 m				
Seasons 1–4[a]	2,744.927	3	914.976	126.298*
Fish length	201.960	6	33.660	4.646*
Error[b]	963.531	133	7.245	
Depth < 458 m versus depth > 458 m				
Depth strata (season 2)	744.493	1	744.493	174.432*
Fish length	2.878	4	0.720	0.169
Error[b]	58.520	84	4.268	

[a] Seasons: 1 = April–June; 2 = July–September; 3 = October–December; 4 = January–March.

[b] Error terms include all interactions that were not significant.

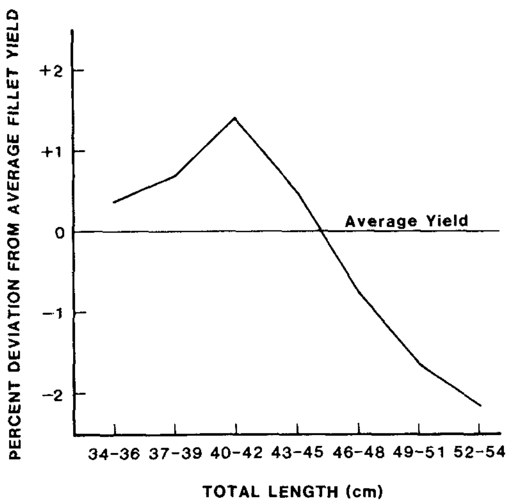

FIGURE 1.—Percent deviation of fillet yield from the average by total-length class of Dover sole caught at depths less than 458 m.

entire fishery were conducted in deep water, provided that annual catch totals do not change. At 1981 prices and landings, the difference would be about $1.5 million worth of product per year to processors. To increase yield, the mesh size of trawl nets also could be altered to select for fish near 40–42 cm long, which produce the greatest fillet yield, or perhaps fishing could be directed to areas where these individuals are abundant.

Unfortunately, Dover sole are not always available in shallow waters, and fish that produce the greatest fillet yield may not be concentrated on discrete fishing grounds. Furthermore, economic gains made possible by an increased mesh size may be offset by losses in catches of shortspine thornyhead (*Sebastolobus alascanus*), longspine thornyhead (*S. altivelis*) and sablefish (*Anoplopoma fimbria*), which are usually caught together with Dover sole in deep water. In order to better gauge the economic impact of changes in mesh size, data are needed on length-frequency distributions of Dover sole, the two thornyheads, and sablefish, as well as all other species taken in the trawl fishery for Dover sole. These data need to be collected from shallow as well as deep fishing grounds.

References

Anonymous. 1980. Pacific coast groundfish plan. Pacific Fishery Management Council, Portland, Oregon.

Gates, J. M., and V. J. Norton. 1974. The benefits of fisheries regulation: a case study of the New England yellowtail flounder fishery. University of Rhode Island, Marine Technical Report 21, Kingston.