東部ベーリング海、アリューシャン水域、及びアラスカ湾のギンダラの1983年の資源状態

Condition of sablefish stocks in the eastern Bering Sea, Aleutian Region, and Gulf of Alaska in 1983

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１９８４年　８月

August　１９８４

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東部ベーリング海、アリューシャン水域及びアラスカ湾のギンダラの1983年の資源状態

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北太平洋のギンダラ資源は、卓越した1977年級群の加入により、1980年以後急速に増大した（Narita, 1983, Sasaki, 1983, Umeda et al., 1983）。しかし、1984年の平衡漁獲量（EY）、あるいは生物学的許容漁獲量（ABC）の評価は（表1）、東部ベーリング海とアリューシャン水域で、日米間に大きな差はなかったが（Narita, 1983：Sasaki, 1983）、アラスカ湾については大きく異なった（Sasaki, 1983, Stauffer, 1983）。ここでは、1983年の日米共同はえなわ調査、及び1982年と1983年の日米共同トロール調査の結果をもとに、1983年の資源状態と1984年のABCについて検討した。

本報告の引用は下記に従うこと：
佐々木　喬　1984．　東部ベーリング海、アリューシャン水域及びアラスカ湾のギンダラの1983年の資源状態（北太平洋漁業国際委員会提出文書）．15頁．水産庁、東京．

This paper may be cited in the following manner :
Takashi Sasaki 1984. Condition of sablefish stocks in the eastern Bering Sea, Aleutian Region, and Gulf of Alaska in 1983. (Document submitted to the International North Pacific Fisheries Commission). 15p. Fisheries Agency of Japan, Tokyo 100 Japan.

はえなわ調査

1983年のギンダラの資源豊度は、東部ベーリング海では尾数で23％、重量で22％前年より減少した。（表2、3、図1）。アリューシャン水域では、1979年以後尾数、重量とも増大しており、1983年には尾数で7％、重量で16％前年より増大した。アラスカ湾では、1982年まで豊度は急激に増大したが、1983年には尾数で4％、重量で7％前年より減少した。1979年を基準にすれば、1983年の資源重量はアリューシャン水域で27％、アラスカ湾で58％それぞれ増えている。

東部ベーリングでは、操業中にシャチ群が付き、揚げなわ途中でギンダラが捕食されることがたびたびある。そのため、資源密度が過小に推定されているが、その影響は、シャチによる付かれ方により年によって異なり、1979年と1980年には大きな被害を受けたが、1981年と1982年には被害は比較的小さかった。1983年の調査では、水域Ⅰで3点、水域Ⅱで3点、水域Ⅲで2点の計8点でチャチ群に付かれたため、資源密度が大幅に過小に推定された。

アラスカ湾について海区別にみると（表2、3）、シュマギンとコディアックの両海区では、資源豊度は尾数、重量ともほぼ一貫して増大しており、1983年には資源重量が前者で27％、後者で5％それぞれ前年より増大した。チリコフ海区では、資源重量は1981年まで減少し、1982年に大幅（66％）に増大したが、1983年には前年より15％減少した。ヤクタット海区では、資源重量は1982年まで増大し、1983年には前年より24％減少した。サウスイースタン海区では、資源重量は1981年まで増えたが、1982年には12％、1983年に19％それぞれ前年より減少した。1983年における減少率は、ヤクタット海区で最も大きかったが、同海区では調査期間中に、はえなわ船が数隻同時に操業していたため、資源密度が過小に推定された可能性がある。その点を考慮すれば、アラスカ湾全体における1983年の資源重量の減小は、7％よりはやや小さかったと考えられる。

アラスカ湾で、わが国漁船がギンダラを対象に操業できる、401～1,000 *m*の水深帯における資源重量は（表3）、1982年まで増大したが、1983年には14％前年より減少した。海区別には、チリコフ、コディアック及びヤクタットの3海区では15～33％減少したが、シュマギン海区では12％増え、サウスイースタン海区ではほとんど変らなかった。

1983年の資源の体長組成をみると（図3、4、5）、東部ベーリング海では推定資源尾数の減少分だけ全体に山が低くなっているが、体長組成の形は前年とほとんど変らず、平均体長も59.4 *cm*で前年と変らなかった。アリューシャン水域では、体長組成の大型化が顕著にみられ、平均体長は61.6 *cm*で前年より2.1 *cm*大きくなるとともに、58.1 *cm*以上の魚の尾数が116％前年より増えた。アラスカ湾では、52.0 *cm*以下の魚が前年より59％増えたのに対して、1982年には資源尾数の69％を占めた、主として1977年級群から構成されていると考えられる、52.1～66.0 *cm*の体長階級の魚が18％減少した。66.1 *cm*以上の魚は、1980年には減少したが、その後年々増大し1983年には前年より尾数で5％、重量で4％増えた（表4）。

52.0 *cm*以下の小型魚の資源尾数の増大は、42.1～50.0 *cm*の体長階級において特に顕著で、前年より90％増大した。これらは、チリコフ、コディアック及びヤクタットの3海区の101～200 *m*の水深帯において顕著にみられた。これらの小型魚は3歳魚に相当するので、1980年級群が1978年以後の年級群のなかでは比較的高い豊度を持った年級群である可能性がある。しかし、東部ベーリング海では、卓越年級群である1977年級群が、1978年に1歳魚として陸棚上で大量にみられたのに対して（Umeda et al., 1983）、1981年の調査では1歳魚はほとんどみられなかったので（Umeda et al., 1983）、全水域を含めた1980年級群の豊度の評価は、今後の調査に待たねばならない。

以上検討したはえなわ調査の結果から、1983年の資源状態は以下のように総括される。東部ベーリング海では、1983年における相対資源重量がかなり過小に推定されていることから、資源状態は前年とほぼ同様と考えられ、アリューシャン水域の資源は前年に引き続き増加した。アラスカ湾では、資源は尾数で4％、重量で7％前年より減少したが、これは主として、1977年級群の減少によるもので、66.1 *cm*以上の成熟魚の資源重量は前年より4％増大した。海区別には、チリコフ、ヤクタット及びサウスイースタンの各海区で減少がみられた。50.0 *cm*以下の小型魚が大幅に増えたことから、1980年級群が強勢である可能性が示唆された。アリューシャン水域とシュマギン海区における資源の増大は、アラスカ湾の中部及び東部に生息している1977年級群の一部が、これらの水域に移動した結果と考えられる。

トロール調査

1979年から実施されている日米共同トロール調査から得られたギンダラの資源量推定値は、表5に要約される（Umeda et al., 1983：Wakabayashi, 1984）。東部ベーリング海の斜面水域では、ギンダラ資源は1981年に1979年より223％増え、1982年には前年よりわずかながら（2％）増大した。アリューシャン水域では、1983年の資源量は1980年より282％増えたが、この増大率は、同じ期間におけるはえなわ調査から得られた相対資源重量の増大率27％と比較して著しく大きい。1980年の日本のトロール調査船は、使用漁具と操船上の問題があったため、他年度の調査船と比較して得られた結果が相対的に過小に推定されていると考えられている（山口、1981）。したがって、トロール調査の結果よりもはえなわ調査の方が、両年度における資源の変化をより正しく反映していると判断される。

1983年の資源量の推定

1982年と1983年のトロール調査結果が明らかになったため、はえなわ調査から得られた相対資源重量とトロール調査による資源量推定値の関係について、3つの組み合わせが利用可能となった（表6）。これらの関係を用いて、1983年の東部ベーリング海とアラスカ湾の資源量を推定すると、東

部ベーリング海について18,700～56,300トン、アラスカ湾について213,800～643,200トンが得られる（表7）。これらの推定値のうち、Aを用いた場合が最も小さい推定値を与えるが、BとCからは比較的近似した値が得られた。Aについては、先に述べたようにトロール調査による資源量推定値が過小と考えられることから、BあるいはCによって与えられた推定値の方がより正しいと判断される。また、東部ベーリング海における推定値は、はえなわ調査による相対資源重量が過小推定値であることから、いずれの関係を用いても過小に推定されている。

A　B　C

東部ベーリング海については、1983年の資源状態が、1982年と大きくは変らなかったと考えられる。関係Bを用いた、西経170°以東のアリューシャン列島北側を含む、東部ベーリング海の1982年の資源量推定値57,500トンと、アラスカ湾で修正された開発率0.05を用いて、ABCは3,000トンと推定される。

アリューシャン水域では、1983年の資源量推定値77,600トンに0.05の開発率を用いて、ABCは3,900トンと設定できる。

アラスカ湾では、資源尾数は減少しても資源量は増大すると考えられたが、1983年の資源量は前年より7％減少した。しかし、資源の減少は、大部分が1977年級群と考えられる52.1～66.0 *cm*の体長階級の魚の減少によるもので、52.0 *cm*以下及び66.1 *cm*以上の魚は増大した。資源の体長組成をみると、減少した体長階級の魚は前年にみられた山が切り取られたような形になった。特定な体長階級の魚だけを選択的に漁獲するような漁業はないので、このような体長組成の変化は、1977年級群の一部が他水域あるいは調査水深帯より深い水深に生息域を拡大した結果と考えられる。66.1 *cm*以上の親魚資源量は、1980年を除けば年々増大しており、1983年には1979年の資源量を43％上回った（表4）。

この増加量は、関係Bを用いた場合50,900トンに相当する。1983年の資源量は、依然として開発初期に近い高い水準にあり、1968年から1977年までの10年間におけるアラスカ湾における年平均漁獲量に等しい24,000トンのABCを変更する必要はない。24,000トンのABCは、新らたに得られた資源量推定値509,700トンの5％に相当する。

ここに示したABCは、資源は減少しても生物学的には心配ないという数値であり、親魚の資源量だけでも1979年の水準を50,900トン越えていることから、24,000トンの漁獲が資源に悪影響を与える心配はないと考えられる。

ABCを水域別に分けるとすれば、資源量の比に応じて、西部海区4,200トン、中部海区12,700トン、東部海区7,100トンと配分できる。1984年には、はえなわ調査が継続して実施されるほか、大規模なトロール調査が予定されているので、資源の変化及び資源量について、さらに新たな知見が得られるものと期待される。

References

Narita, R. E. 1983. Sablefish. In R. G. Bakkala and L. L. Low (editors), Condition of groundfish resources of the eastern Bering Sea and Aleutian Islands region in 1983. Unpubl. rep., 194 p. Northwest and Alaska Fisheries Center, Natl. Mar. Fish. Serv., NOAA. 2725 Montlake Boulevard East, Seattle, WA 98112 (submitted to the International North Pacific Fisheries Commission in October 1983).

Sasaki, T. 1983. Condition of sablefish stocks in recent years in the eastern Bering Sea, Aleutian Region and Gulf of Alaska based on the results of field surveys. Proceedings of the International Sablefish Symposium, Alaska Sea Grant Report 83-8, 255-264. University of Alaska.

Stauffer, G. D. 1983. Sablefish. In G. D. Stauffer (editor), Condition of groundfish resources of the Gulf of Alaska region as assessed in 1983. Unpubl. rep., Northwest and Alaska Fisheries Center, Natl. Mar. Fish. Serv., NOAA, 2725 Montlake Boulevard East, Seattle, WA 98112. (Document submitted to the International North Pacific Fisheries Commission in October 1983).

Umeda, Y. T., T. M. Sample, and R. G. Bakkala. 1983. Recruitment processes of sablefish in the eastern Bering Sea. Proceedings of the International Sablefish Symposium, Alaska Sea Grant Report 83-8, 291-303. University of Alaska.

Wakabayashi, K. 1984. Preliminary report on the joint Japan-U.S. groundfish survey in the Aleutian Islands waters in 1983. Unpubl. rep., Far Seas Fisheries Research Laboratory, Fisheries Agency of Japan, Shimizu, 424. (Document submitted to the bilateral scientific meeting between Japan and U.S. in April 1984).

Yamaguchi, H. 1981. Japan-U.S. joint groundfish trawl survey in the Aleutian Islands waters in 1980. (In Japanese). Proceedings of the Northern Japan Groundfish Section of GSK, 1980, 14-27. Fisheries Resources Investigations by the Scientists of the Fisheries Agency of Japan (GSK, Gyogyo Shigen Kenkyu Kaigi).

Table 1. ABC and EY estimates of sablefish for 1984 fishing season, in metric tons.

Region	Japan (ABC)	U.S. (EY)
Eastern Bering Sea	3,000-5,000	4,430
Aleutian Region	2,300	1,755
Gulf of Alaska		
Western	3.100	2,225
Central	12,500	4,075
Eastern	8,400	4,665-6,330
Total	24,000	10,965-12,630

Table 2. Relative population number (RPN) in whole depth range, 101-400 m, and 401-1,000 m depth zones in the eastern Bering Sea, Aleutian Region, and Gulf of Alaska, 1979-1983.

Region and Area	Year	Total		101-400 m		401-1,000 m	
		RPN	Annual change (%)	RPN	Annual change (%)	RPN	Annual change (%)
Eastern Bering Sea	1982[a]	14,350	-23	6,061	+19	8,789	-52
	1983[b]	11,468		7,232		4,236	
Aleutian Region	1980	13,082	-12	4,709	-41	8,373	+ 4
	1981	11,491	+13	2,785	-10	8,706	+20
	1982	12,953	+ 7	2,507	+20	10,446	+ 4
	1983	13,909		2,998		10,911	
Gulf of Alaska							
Shumagin	1979	5,347	+53	3,454	+91	1,893	-18
	1980	8,163	+58	6,608	+60	1,555	+50
	1981	12,892	+28	10,557	+26	2,335	+37
	1982	16,542	+31	13,351	+34	3,191	+18
	1983	21,673		17,903		3,770	
Chirikof	1979	30,716	-16	27,958	-15	2,758	-24
	1980	25,947	-11	23,856	-15	2,091	+29
	1981	23,032	+59	20,336	+55	2,696	+94
	1982	36,655	-12	31,438	-12	5,217	-11
	1983	32,432		27,809		4,623	
Kodiak	1979	24,134	+20	19,874	+30	4,260	-27
	1980	28,877	-20	25,784	-28	3,093	+45
	1981	23,063	+50	18,580	+48	4,483	+58
	1982	34,595	+13	27,490	+18	7,105	- 6
	1983	39,085		32,398		6,687	
Yakutat	1979	14,873	+83	12,276	+99	2,597	+ 5
	1980	27,189	+ 4	24,456	- 2	2,733	+56
	1981	28,332	+12	24,070	+ 9	4,262	+26
	1982	31,714	-24	26,335	-23	5,379	-31
	1983	24,097		20,383		3,714	
Southeastern	1979	10,428	+38	7,055	+56	3,373	± 0
	1980	14,395	+33	11,015	+36	3,380	+24
	1981	19,177	- 5	14,990	- 7	4,187	+ 1
	1982	18,224	-22	13,980	-29	4,244	+ 1
	1983	14,260		9,978		4,282	
T o t a l	1979	85,498	+22	70,617	+30	14,881	-14
	1980	104,571	+ 2	91,719	- 3	12,352	+40
	1981	106,496	+29	88,533	+27	17,963	+40
	1982	137,730	- 4	112,594	- 4	25,136	- 8
	1983	131,547		108,471		23,076	

a RPN is a little underestimated because of interception of sablefish by killer whales.

b RPN is considerably underestimated because of interception of sablefish by killer whales.

Table 3. Relative population weight (RPW) in whole depth range, 101-400 m, and 401-1,000 m depth zones in the eastern Bering Sea, Aleutian Region, and Gulf of Alaska, 1979-1983.

Region and Area	Year	Total RPW	Total Annual change (%)	101-400 m RPW	101-400 m Annual change (%)	401-1,000 m RPW	401-1,000 m Annual change (%)
Eastern Bering Sea	1982[a]	33,538	-22	13,378	+ 21	20,160	- 51
	1983[b]	26,029		16,176		9,353	
Aleutian Region	1980	28,241		6,518		21,723	
	1981	27,500	- 3	5,076	- 22	22,424	+ 3
	1982	30,984	+13	5,216	+ 3	25,768	+ 15
	1983	35,388	+16	6,683	+ 28	29,206	+ 13
Gulf of Alaska							
Shumagin	1979	11,580		c		c	
	1980	17,319	+54	12,739		5,080	
	1981	27,351	+56	20,388	+ 64	6,963	+ 37
	1982	41,309	+48	31,353	+ 50	9,956	+ 43
	1983	52,409	+27	41,247	+ 32	11,162	+ 12
Chirikof	1979	61,237		c		c	
	1980	57,951	- 5	51,319		6,632	
	1981	52,437	-10	45,183	- 12	7,254	+ 9
	1982	87,115	+66	72,125	+ 60	14,990	+107
	1983	73,761	-15	61,006	- 15	12,755	- 15
Kodiak	1979	55,413		c		c	
	1980	57,945	+ 5	48,955		8,990	
	1981	51,640	-11	39,030	- 20	12,610	+ 40
	1982	79,715	+54	60,025	+ 54	19,589	+ 56
	1983	83,812	+ 5	67,807	+ 13	16,005	- 19
Yakutat	1979	35,148		c		c	
	1980	52,437	+49	44,994		7,443	
	1981	66,712	+27	55,991	+ 24	10,721	+ 44
	1982	67,076	+ 1	51,872	- 7	15,204	+ 42
	1983	51,175	-24	40,951	- 21	10,224	- 33
Southeastern	1979	25,324		c		c	
	1980	27,982	+10	18,658		9,324	
	1981	51,123	+83	38,510	+106	12,613	+ 35
	1982	44,752	-12	31,453	- 18	13,299	+ 5
	1983	36,329	-19	23,250	- 26	13,079	- 2
T o t a l	1979	188,702		c		c	
	1980	214,134	+13	176,665		37,469	
	1981	249,763	+17	199,602	+ 13	50,161	+ 34
	1982	319,967	+28	246,829	+ 24	73,138	+ 46
	1983	297,486	- 7	234,261	- 5	63,225	- 14

a RPW is a little underestimated because of interception of sablefish by killer whales.

b RPW is considerably underestimated because of interception of sablefish by killer whales.

c Not available because of incomplete size composition by depth.

Table 4. Relative population weight of mature sablefish larger than 66.1 cm in fork length in the eastern Bering Sea , Aleutian Region, and Gulf of Alaska, 1979-1983.

Region	Year	RPW	Annual change (%)
Eastern Bering Sea	1982	5,885	-12
	1983	5,180	
Aleutian Region	1980	11,138	+ 2
	1981	11,357	- 9
	1982	10,312	+31
	1983	13,514	
Gulf of Alaska	1979	69,598	-15
	1980	58,967	+36
	1981	80,302	+19
	1982	95,504	+ 4
	1983	99,301	

Table 5. Biomass estimates in metric tons obtained from U.S.-Japan cooperative trawl survey in the eastern Bering Sea and Aleutian Region, 1979-1983.

Region	Depth range (m)	Year				
		1979	1980	1981	1982	1983
Eastern Bering Sea[a]	201-1,000	12,200[c]	-	39,400[c]	40,100[c]	-
Aleutian Region[b]	101-1,000	-	20,300[d]	-	-	77,600[e]

a Not incleuded Aleutian side east of 170°W.
b Not incleuded Bowers Ridge area.
c Umeda et al. (1983).
d Data exchange between NWAFC and FSFRL.
e Wakabayashi (1984).

Table 6. Three combinations between biomass estimates from trawl surveys and relative population weight (RPW) from longline surveys, arranged in comparative fishing area.

Combination	Depth range (m)	Biomass (mt)	RPW
A (Aleutian Region, 1980)	101-1,000	20,300	28,241
B (Eastern Bering Sea, 1982)	201-1,000	40,100	23,404
C (Aleutian Region, 1983)	101-1,000	77,600	35,888

Table 7. Biomass estimates in metric tons of sablefish in the eastern Bering Sea and Gulf of Alaska in 1983, based on the three combinations shown in Table 6.

Combination	Eastern Bering Sea[a] (146-1,000 m)	Gulf of Alaska (101-1,000 m)
A	18,700	213,800
B	44,600	509,700
C	56,300	643,200

a Incleuded Aleutian side east of 170°W.

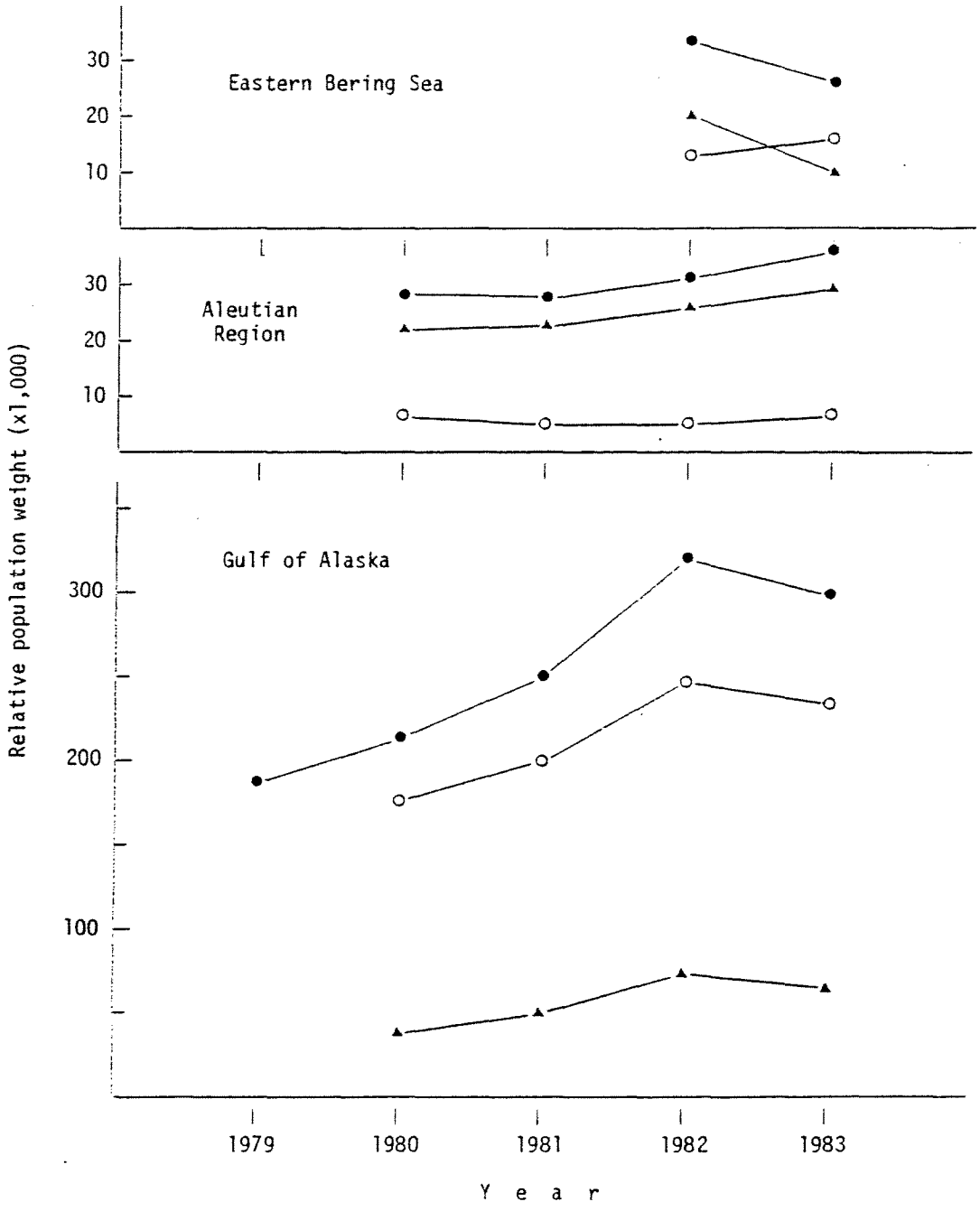

Figure 1. Yearly change in relative population weight (RPW) by region and by depth in the eastern Bering Sea, Aleutian Region, and Gulf of Alaska, 1979-1983.

● : Total.

○ : 101-400 m.

▲ : 401-1,000 m

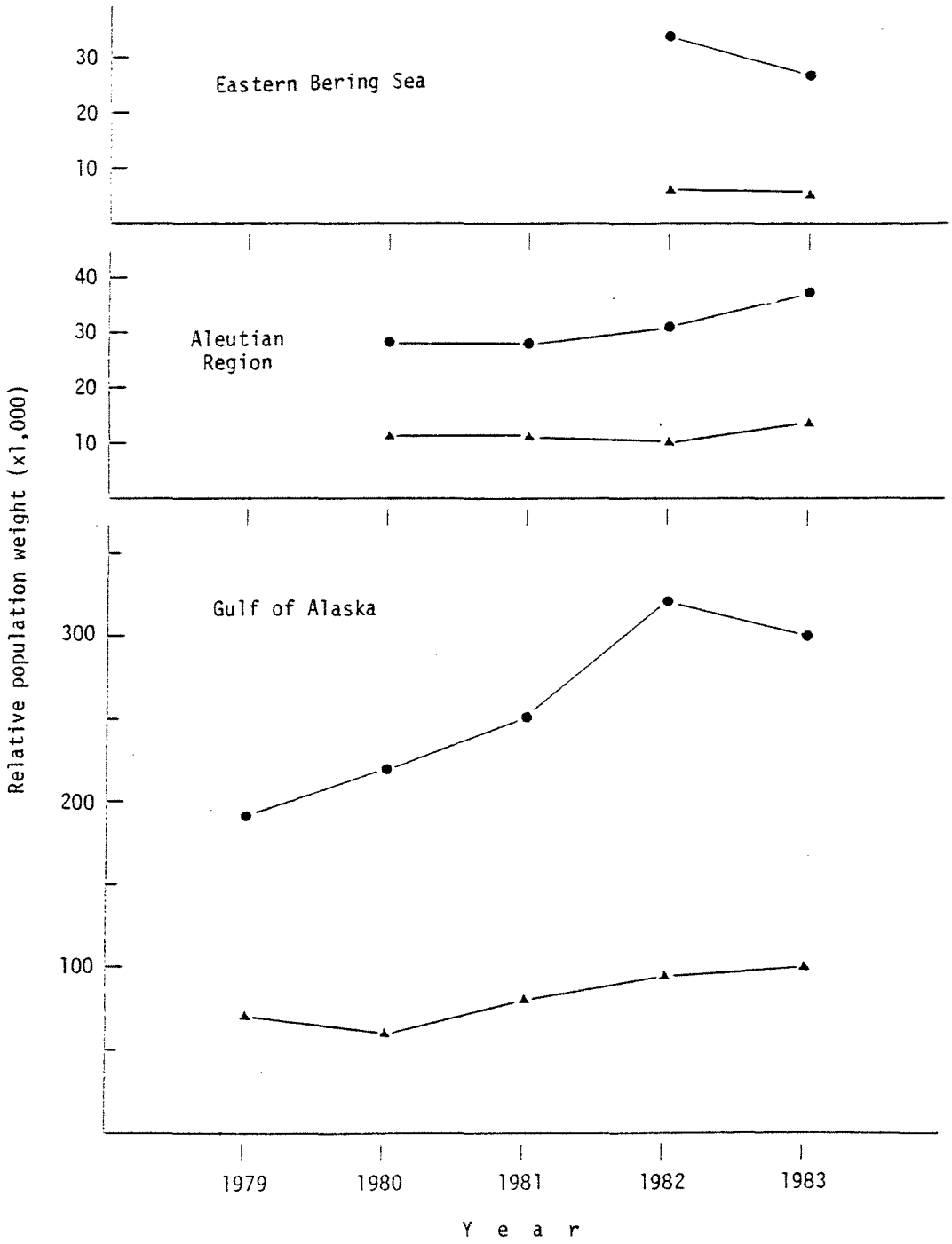

Figure 2. Yearly change in relative population number (RPW) by region in the eastern Bering Sea, Aleutian Region, and Gulf of Alaska, 1979-1983.

● : Total.

▲ : Adult population (larger than 66.1 cm).

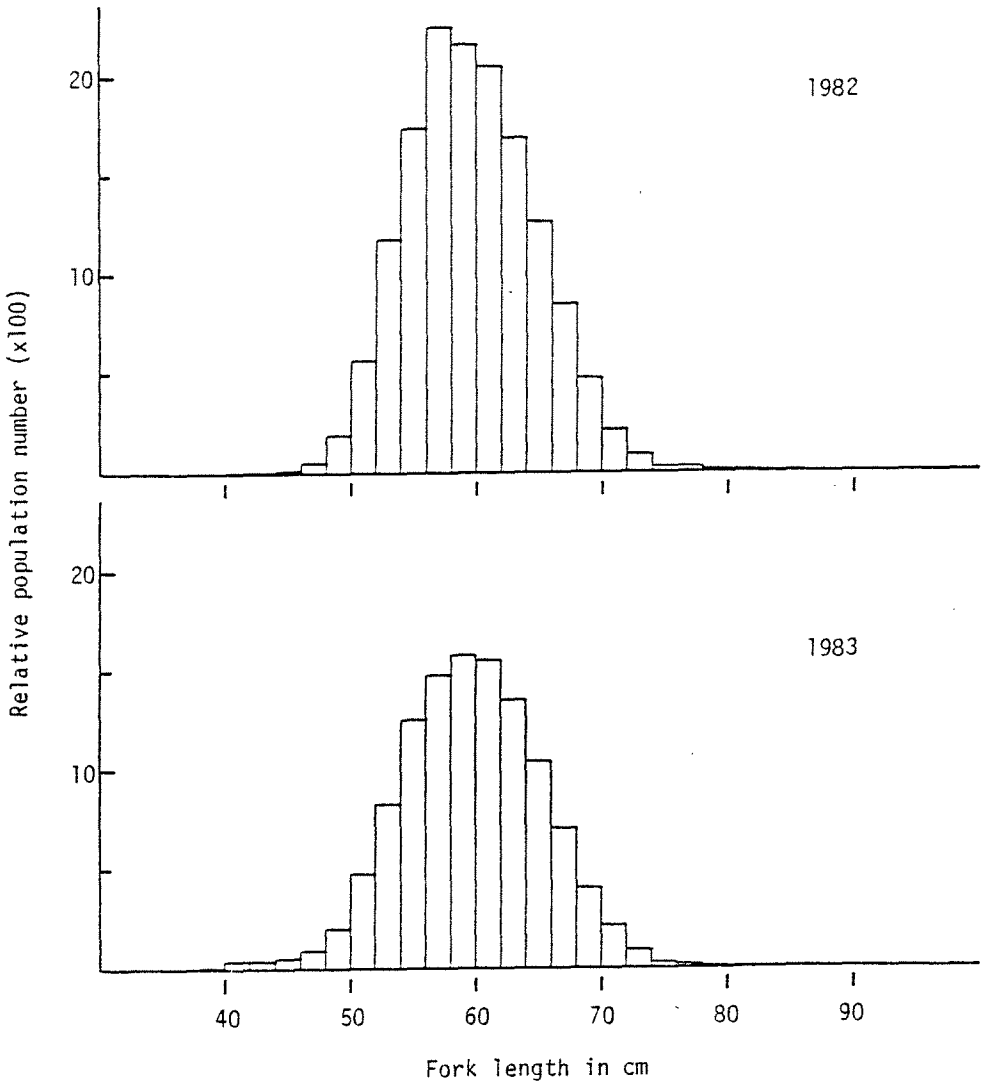

Figure 3. Size structure of sablefish population weighted by relative population numbers as an index of stock size in 101-1,000 depth range of the eastern Bering Sea in 1982 and 1983.

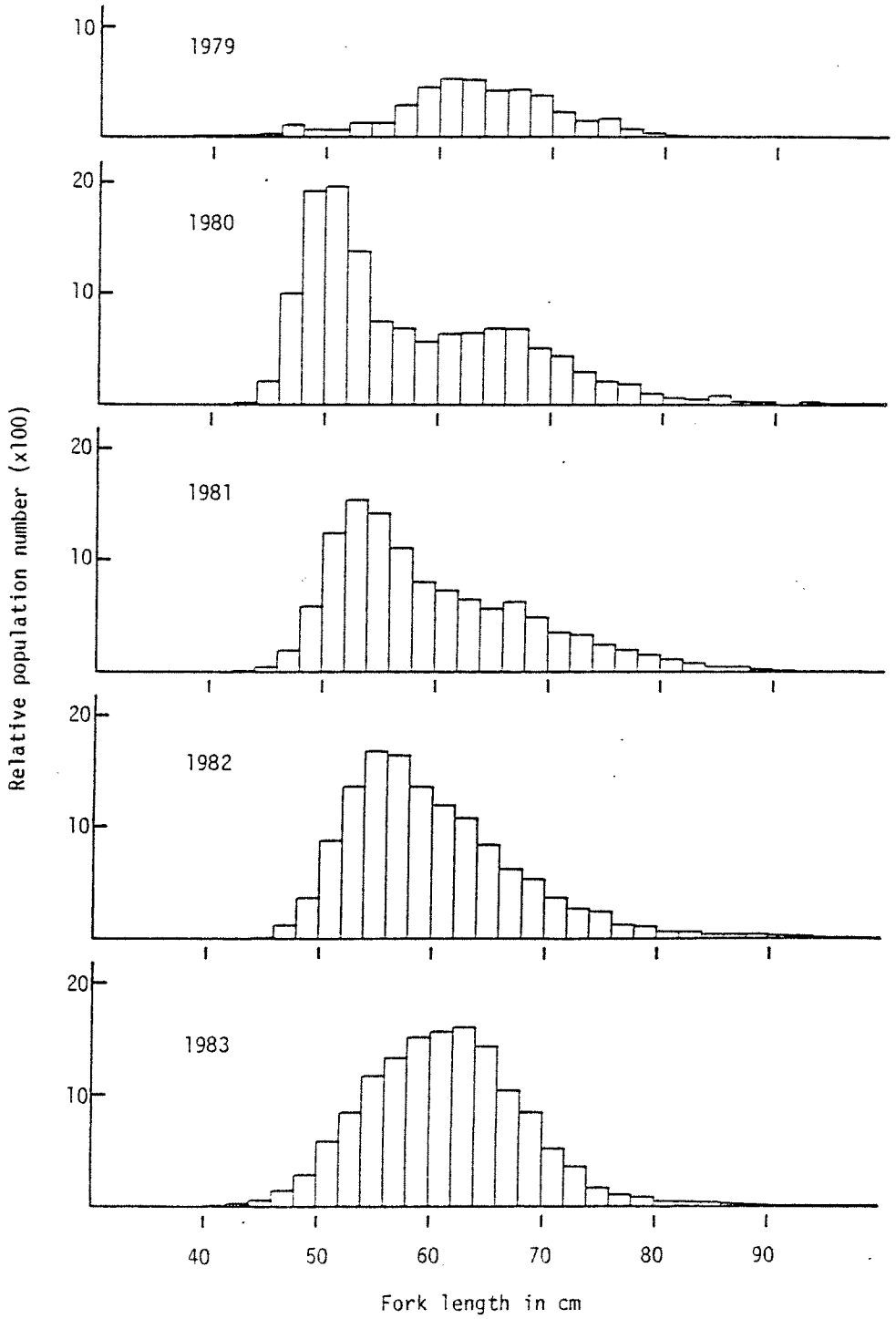

Figure 4. Size structure of sablefish population weighted by relative population numbers as an index of stock size in 101-1,000 m depth range of the Aleutian Region, 1979-1983. The graph of 1979 is in the eastern part of the Aleutian Region.

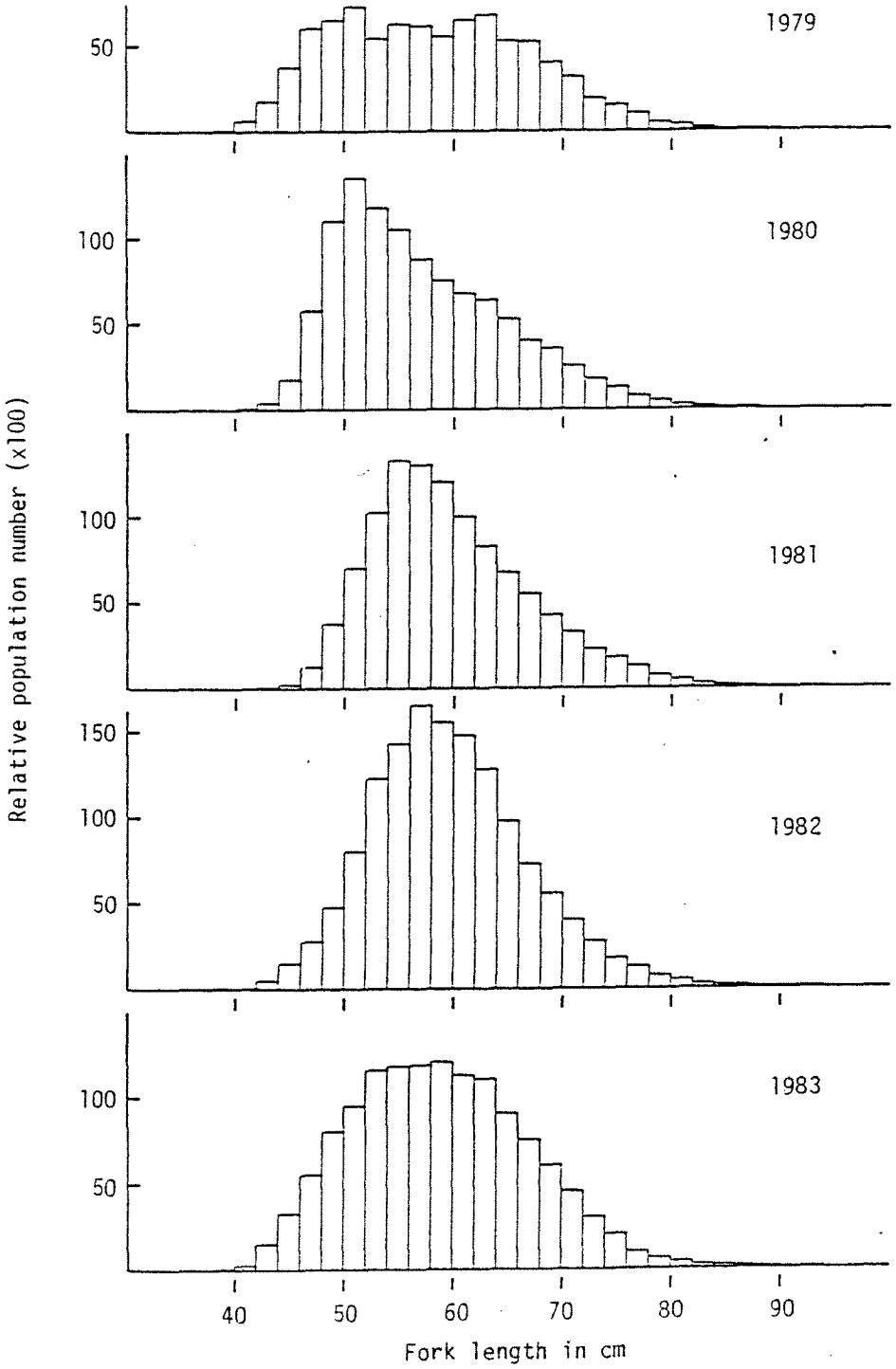

Figure 5. Size structure of sablefish population weighted by relative population numbers as an index of stock size in 101-1,000 m depth range of the Gulf of Alaska, 1979-1983.

Not to be cited by INPFC
Document number

INPFC
Doc. 2788
Rev. 1

TRANSLATION

CONDITION OF SABLEFISH STOCKS IN THE EASTERN BERING SEA, ALEUTIAN REGION, AND GULF OF ALASKA IN 1983

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1984 August

THIS PAPER MAY BE CITED IN THE FOLLOWING MANNER:
Sasaki, Takashi. 1984. Condition of sablefish stocks in the eastern Bering Sea, Aleutian region, and Gulf of Alaska in 1983. (Document submitted to the International North Pacific Fisheries Commission.) 7 p. Fisheries Agency of Japan, Tokyo, Japan 100.

The stock of sablefish in the North Pacific Ocean has increased rapidly since 1980 because of the recruitment of the dominant 1977 year class (Narita 1983; Sasaki 1983; Umeda et al. 1983). Although the evaluations of the equilibrium yield (EY) or allowable biological catch (ABC) of sablefish in the Bering Sea and Aleutian region in 1984 (Table 1) did not show a large difference between Japanese and United States estimates (Narita 1983; Sasaki 1983), it differed largely in the Gulf of Alaska (Sasaki 1983; Stauffer 1983). Here, the condition of the sablefish stock in 1983 and the allowable biological catch of the species in 1984 are considered based on the results of the Japan-U.S. joint longline survey in 1983 and the Japan-U.S. joint trawl survey in 1982 and 1983.

Longline survey

The abundance of the sablefish stock in 1983 decreased by 23% in numbers and 22% in weight from the previous year in the eastern Bering Sea (Tables 2 and 3, and Fig. 1). However, in the Aleutian region, the population numbers and weight of sablefish has increased since 1979 and in 1983 the numbers have increased by 7% and the weight increased by 16% from the previous year. In the Gulf of Alaska, abundance has increased rapidly up to 1982 but the numbers decreased by 4% and the weight decreased by 7% from the previous year in 1983. The population weight of sablefish in 1983 increased by 27% in the Aleutian region and by 58% in the Gulf of Alaska from the levels of 1979.

In the eastern Bering Sea, sablefish are frequently chased by killer whales during operations and are intercepted by them during line retrieval. Therefore, the population density is underestimated but the influence varies by year and by numbers of chases by killer whales. In 1979 and 1980 there was great damage but in 1981 and 1982 the damage was relatively small. Since in the 1983 survey killer whales pursued sablefish three times in Area 1, three times in Area 2, and twice in Area 3; 8 times in total, the population density was thus greatly underestimated.

In the Gulf of Alaska by area (Tables 2 and 3), in the Shumagin and Kodiak Areas, the abundance of sablefish has increased consistently in both numbers and weight, and the population of sablefish in 1983 increased by 27% in numbers and 5% in weight, respectively, from the previous year. In the Chirikof Area, the population weight decreased to 1981, increased greatly (66%) in 1982, but decreased by 15% in 1983. In the Yakutat Area, the population weight increased to 1982 but decreased by 24% from 1982. In the Southeastern Area, the population weight increased to 1981 but then decreased by 12% in 1982 and by 19% in 1983. Although the rate of decrease in 1983 was highest in the Yakutat Area, the population density was possibly underestimated because several longliners were operating at the same time during the survey period in the same area. When we consider that point, it is considered that the decrease of the population weight of sablefish in the Gulf of Alaska in 1983 is somewhat smaller than 7%.

Although the population weight at depths of 401 to 1,000 m, in which Japanese fishing vessels can conduct fishing for sablefish in the Gulf of Alaska (Table 3) had increased up to 1982, it decreased by 14% from the previous year in 1983. The population weight of sablefish decreased by 15 to 33% in three areas, Chirikof, Kodiak, and Yakutat, but increased by 12% in the Shumagin Area and was almost the same in the Southeastern Area.

When we look at the body length composition of the sablefish stock in the eastern Bering Sea in 1983 (Fig. 3), the peak of the body length composition is lower, as a whole, as the estimated population numbers decreased but the shape of the length composition was almost the same as in 1982 and average length was 59.4 cm, similar to that in 1982.

In the Aleutian region (Fig. 4), a significant increase in length composition was observed. The average body length was 61.6 cm in 1983, an increase of 2.1 cm from 1982. At the same time, the numbers of sablefish larger than 58.1 cm increased by 116% from the previous year.

In the Gulf of Alaska (Fig. 5), sablefish smaller than 52.0 cm in length increased by 59% from the previous year. In comparison, fish in the length range 52.1 to 66.0 cm, which constituted 69% of the population numbers in 1982 and might be those of 1977 year class, decreased by 18%. Although sablefish larger than 66.1 cm decreased in 1980, thereafter they increased year by year and increased by 5% in numbers and 4% in weight in 1983 (Table 4).

The increase in population numbers of the small-sized fish less than 52.0 cm was particularly significant in 42.1 to 50.0 cm fish which increased by 90% from the previous year. This phenomenon was significant in the depth zone of 101 to 200 m in the Chirikof, Kodiak, and Yakutat Areas. Since these small-sized sablefish were equivalent to 3 years old, the 1980 year class might be a relatively high abundant year class among the year classes since 1978. However, the 1977 year class, which was a dominant year class, occurred in large quantities on the continental shelf as 1-year-olds in 1978 (Umeda et al. 1983) but no 1-year-old fish were observed by the survey in 1981 (Umeda et al. 1983). Therefore, evaluation of abundance of the 1980 year class in all areas requires future surveys.

From the results of the longline survey, the stock condition of sablefish in 1983 can be summarized as follows: because the relative population weight in 1983 was underestimated considerably in the Bering Sea, the condition of sablefish stock was considered to be almost the same as in the previous year. The sablefish stock increased in the Aleutian region as was the case in the previous year. Although the sablefish stock decreased by 4% in numbers and 7% in weight from the previous year due mainly to a decrease of the 1977 year class, the population weight of mature sablefish larger than 66.1 cm in body length increased by 4% from the previous year. By area, decreases were observed in the Chirikof, Yakutat, and Southeastern Areas. Because small-sized sablefish, less than 50.0 cm in length, increased greatly it was suggested that the 1980 year class

might be strong. The increase of sablefish stock in the Aleutian region and Shumagin Area is considered to be the result of a part of the 1977 year class which inhabited the central and eastern Gulf of Alaska moving to these areas.

Trawl survey

The estimated biomass of sablefish obtained from the Japan-U.S. joint trawl survey which has been conducted since 1979 is summarized in Table 5 (Umeda et al. 1983; Wakabayashi 1984). In the eastern Bering Sea slope area, the sablefish stock in 1981 increased by 223% from 1979 and in 1982 it increased slightly (2%) from the previous year. Although the biomass in 1983 increased by 282% from 1980 in the Aleutian region, this increase was significantly larger than the increase (27%) in relative population weight obtained from the longline survey which was conducted in the same period. The results of the survey by the Japanese trawl research vessel in 1980 were considered to be underestimated due to some problems with the gears used and the operational troubles with the research vessel (Yamaguchi 1981). Therefore, it is considered that the results of the longline survey reflect the change of stock in both years better than do those of the trawl survey.

Estimated biomass of sablefish in 1983

Since the results of the trawl surveys in 1982 and 1983 were clarified, for examining the relationship between the relative population weights obtained from the longline survey and the estimated biomass by the trawl survey, three combinations (A, B, C) were available (Table 6). The biomasses of sablefish estimated in the eastern Bering Sea and Gulf of Alaska in 1983, using these relationships, were 18,700 to 56,300 t for the eastern Bering Sea and 213,800 to 643,200 t for the Gulf of Alaska (Table 7). Of these estimated values, the smallest was obtained using A and from the

values of B and C other relative approximate values were obtained. For the value of A, since the estimated biomass from the trawl survey was considered to be an underestimate, as indicated before, it is judged that the values obtained by B and C are much better. Also, the estimated biomass in the eastern Bering Sea is considered to be underestimated using any type of relationships because the relative population weight from the longline survey was an underestimated value.

Allowable biological catch

It is considered that the condition of the sablefish stock in the Bering Sea in 1983 is not greatly changed from the previous year. Allowable biological catch of sablefish is estimated to be 3,000 t using the relationship B, the estimated biomass (57,500 t) in the eastern Bering Sea including the north side of the Aleutian Islands east of 170°W in 1982, and the exploitation rate (0.05) corrected by using results of the survey in the Gulf of Alaska. The allowable biological catch is estimated to be 3,900 t in the Aleutian region using the estimated biomass (77,600 t) and the exploitation rate (0.05) in 1983.

In the Gulf of Alaska, it was previously considered that even if the population numbers decreased, the biomass would increase. The actual biomass of sablefish in 1983, however, decreased by 7%. The decrease of biomass was caused by the decrease of fish in the length range of 52.1 cm to 66.0 cm which were considered to be mainly the 1977 year class, and fish smaller than 52.0 cm and larger than 66.1 cm increased. In the body length composition of the sablefish stock, the peak observed in 1982 appeared to have been cut off in 1983. Since there is no fishery existing which selectively caught only fish of a specific body length range, such a change in the length composition is considered to be caused by the expansion of the area inhabited by part of the 1977 year class from the survey area to other areas or from the survey depth zones to deeper depth zones. The biomass of spawners

larger than 66.1 cm has increased year by year except for 1980 and in 1983 increased by 43% from the biomass in 1979 (Table 4). This increase is equivalent to 50,900 t in the case of relationship B. Because the biomass of sablefish in 1983 is still at a high level close to the level at the beginning of exploitation, it is not necessary to change the allowable biological catch (24,000 t) which is the same as the annual average catch in the Gulf of Alaska for 10 years from 1968 to 1977. The allowable biological catch of 24,000 t is equivalent to 5% of the estimated biomass (509,700 t) newly obtained.

It is considered that an annual 24,000 t catch will not affect the stocks of sablefish because the ABC value shown here means that such a decrease by catch is not biologically worrisome, and further, considering even only spawners, the biomass in 1983 exceeded by 50,900 t the level in 1979. If we divide the allowable biological catch into areas we obtain 4,200 t for the western area, 12,700 t for the central area, and 7,100 t for the eastern area. Since the longline survey is scheduled to be continued in 1984 and the large scale trawl survey is also scheduled to be conducted, it is possible to obtain additional findings on the changes in population and the biomass.

REFERENCES, TABLES 1 TO 7 AND FIGS. 1 TO 5

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