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PRELIMINARY 1999 CATCH LIMIT RECOMMENDATIONS

December 8, 1998

This document contains preliminary 1999 staff catch limit recommendations. These recommendations, along with public and industry views on them, will be considered by Commissioners and their advisors at the IPHC Annual Meeting in Prince Rupert, BC Canada during January 25-28, 1999. These numbers may be updated for the annual meeting, as final data are included in the assessment, but are not expected to change significantly.

The presentation of staff recommendations for 1999 follows a format similar to that used in 1998. For 1999, we again present estimated exploitable biomass using two different assumptions about the selectivity for fish in the standardized setline surveys. However, we undertake constant exploitation yield (CEY) estimation only for the results obtained with the age-specific assumption. This is the same basis used for 1998 yield estimation. We also present the yields estimated from the 1998 assessment and the quota adopted by the Commission in 1998, for reference (Tables 1 and 2).

The first assumption is that the selection of the fish by the survey is based primarily on the size of the fish, because fish of different sizes are not equally vulnerable to the survey gear. For example, the fish might have to be of a certain minimum size to bite the size of hooks used in the fishery. Under this assumption, selectivity at length is held constant throughout the period of the assessment, even when growth rates change. The second assumption is that selectivity of fish by the survey gear is based primarily on the age of the fish and reflects the availability of fish of different ages on the grounds. For example, if recruitment were governed by the time halibut took to migrate to the fishing grounds, irrespective of size, then selectivity would be determined by age, rather than size. Under this assumption, it is the selectivity at age that is held constant over time. Both of these assumptions are plausible although neither may fully reflect the true underlying relationships.

For 1999, the analytic assessment model contains only one significant change from that presented last year. The IPHC has used an estimated rate of natural mortality of M=0.20 for some time. This value was an average of a wide range of estimates and some previous IPHC studies have employed estimates other than 0.2. New data with which to evaluate M are unlikely to be generated through any technique currently available.

An analysis conducted by staff during 1998 indicated that the consequences of mis-estimation of

M are not symmetric. Using an overestimate of M in the estimation of biomass increases the risk of over-harvest far more than using an underestimate of M would risk an under-harvest. The staff reviewed available evidence in consideration of these results and adopted a revised value of M=0.15, a 25% reduction from the previous value. This analysis also concluded that the harvest rate policy used by the IPHC (CEY equal to 20% of exploitable biomass) does not require adjustment in consideration of a different natural mortality rate.

Estimates from the assessment model continue to indicate a substantial biomass of halibut although there are some reductions in the estimates for the central and southern portions of the range. Exploitable biomass estimates that assume survey selectivity is a function of length are about 9-14% larger than those that assume selectivity is based on age.

Commercial CPUE decreased from 5-11% during 1998 for Areas 2A-3A but increased by a similar amount in Areas 3B and 4, respectively. Survey CPUE estimates declined more and increased less for the same areas. Recruitment of halibut in recent years has declined from the peak seen in 1995, when the 1987 year class began recruiting to the fishery. The abundance of age 8 recruits (the age at which halibut generally approach minimum legal size) has returned to mid-1970s levels in Area 3A but is higher and similar to the early 1980s period in Area 2B. In both areas the fishery will continue to be dominated by the 1987 cohort over the next several years. Exploitable biomass is expected to decline over the next 3-5 years as this year class passes out of the exploitable stock.

In summary, the analytic assessment, the standardized surveys, and the commercial fishery all indicate that the exploitable biomass remains at a relatively high level but that it has declined slightly in the central and southern portions of the halibut range. The major changes in the estimates of exploitable biomass for 1999 derive from the change in the estimate of natural mortality, rather than from stock condition indices. In developing catch limit recommendations based on these findings, the staff was also guided by consideration of other issues about the dynamics of the halibut stock and the need for a precautionary approach to management. The following items, some of which were expressed in previous recommendations, are of concern.

1. The present levels of halibut biomass and the associated setline yields are likely not sustainable. Halibut stocks are at a high level because recent exploitation rates have been low and a strong year class has recruited to the exploitable stock. The stock biomass is expected to decline, as a result of natural fluctuations in recruitment. This decline is expected to occur over the next 3-5 years and may lead to lower estimates of available yield.

2. Staff is concerned that the level of total removals suggested by the assessment is near the historic high from the history of the stock. Staff uses a harvest policy that aims to minimize the probability that the stock biomass will decrease below the historic minimum level, largely because we do not know the dynamics of the stock below this level. Similarly, we have limited experience with removals from the stock at present high levels and we wish to exercise caution.

3. Areas 4 and 3B have limited or no history of standardized surveys and/or commercial catch sampling sufficient for a detailed analytic assessment. We therefore use the relative abundance from standardized stock assessment surveys as an index of biomass distribution. Variability in these survey estimates within a year is low (5-10% coefficient of variation (CV) in mean catch rate) but among-year variation can be substantially higher (30-40% CV). This latter variation is of greatest significance for those areas where the yield recommendations are based on survey partitioning, i.e. Areas 3B and 4. We are particularly concerned about the estimation of yield for Area 4, where the biomass is widely distributed at low densities but the fishery is concentrated in small areas of higher catch rates.

4. The observed distribution of fish during 1998 surveys may reflect a broad-scale shift in fish distribution in response to environmental features. We note that distributions of some other marine species (e.g. hake and sardine) were shifted notably northward during the summer of 1998 and may have been associated with environmental forcing. We do not know whether this has occurred for halibut but the influence of survey and fishery catch rates on yield estimation suggests caution.

5. Uncertainty concerning the appropriate assumption for the selectivity of the surveys, either age-specific or length-specific, remains. Resolution of this uncertainty may not be possible within the near future and it is possible that the correct assumption may embody elements of both age and size specificity. We choose to focus our attention on the age-specific results because they are the more conservative basis for yield recommendations.

Staff catch limit recommendations in 1998 incorporated a cautious approach to the increased yields suggested by the revised analytic model. We recognize the sensitivity of estimates from the model-based assessment to changes in parameters. We would like to avoid large shifts in yield recommendations while we conduct additional evaluations of model structure and assumptions. Due to the lifespan and slow recruitment of halibut, a large proportion of yield forgone in one year can be recovered in subsequent years if underharvesting has occurred. For this reason, staff will continue to exercise caution and recommend slow increases in catch limits when biomass estimates increase, but more rapid decreases in catch limits when biomass estimates decrease (a “slow up – quick down” response).

The analytic assessment model has been used to calculate exploitable biomass for Areas 2A-3A. For 1999, we have incorporated an additional change in the model (lower M) that reduces the estimates of exploitable biomass for these areas. The range in estimated exploitable biomass for areas 2A-3A is 290-326 Mlb for the two selectivity assumptions. Our framework for catch limit recommendations in Areas 2A-3A is to adopt the most conservative of the two estimates from the analytic assessment. This results in recommended catch limits that are lower than the 1998 quotas by 14-20% in Areas 2A and 2B, marginally greater in Area 2C, and lower by 6.5% in Area 3A (Tables 1 and 2).

For Areas 3B and 4A/B, we use a modified procedure that was first introduced in 1998. For 1998, the procedure scaled the estimates of exploitable biomass and setline CEY in Areas 2A-3A

(the reference area), by the relationship between estimated survey biomass in either Areas 3B or 4A/B to that in Areas 2A-3A. For 1999, we use Area 3A as the reference area because this area is the centre of stock distribution, has a diverse base of data for assessment, and is closer to the areas of application for the procedure. While the relationship of estimated survey and model abundance should not change among areas, the proximity of Areas 3A, 3B, and 4A/B should result in the greatest coherence of underlying dynamics in the reference and application areas.

The estimates of exploitable biomass in Areas 3B and 4 generated using this modified procedure (Table 3) and the CEY associated with these estimates are similar to those generated in 1998 (Tables 1 and 2). This occurred because the decrease in estimated biomass, associated with a lower natural mortality rate, was offset by higher CPUE values for the surveys in these areas.

In 1998, we recommended increasing yields by 33% of the difference between the 1997 catch limits and the estimated setline CEYs from the assessment. Estimated 1999 setline CEYs for Areas 3B and 4A/B are similar to those estimated in 1998. For 1999, we continue to advocate a cautious approach to harvests from these areas. Standardized surveys covered less of Area 4 in 1998 than 1997 and their application is therefore less comprehensive. In addition, commercial fishery data from Area 3B continue to indicate much higher levels of fishing in the eastern portions of the area. Staff have concerns about the long-term effects of localized harvest of the majority of the quota from this smaller area. Accordingly, the yield recommendations for Areas 3B and 4A/B are increased by 15% of the difference between 1998 quotas and the estimated 1999 CEY using the age-specific survey selectivity assumption (Tables 1-3).

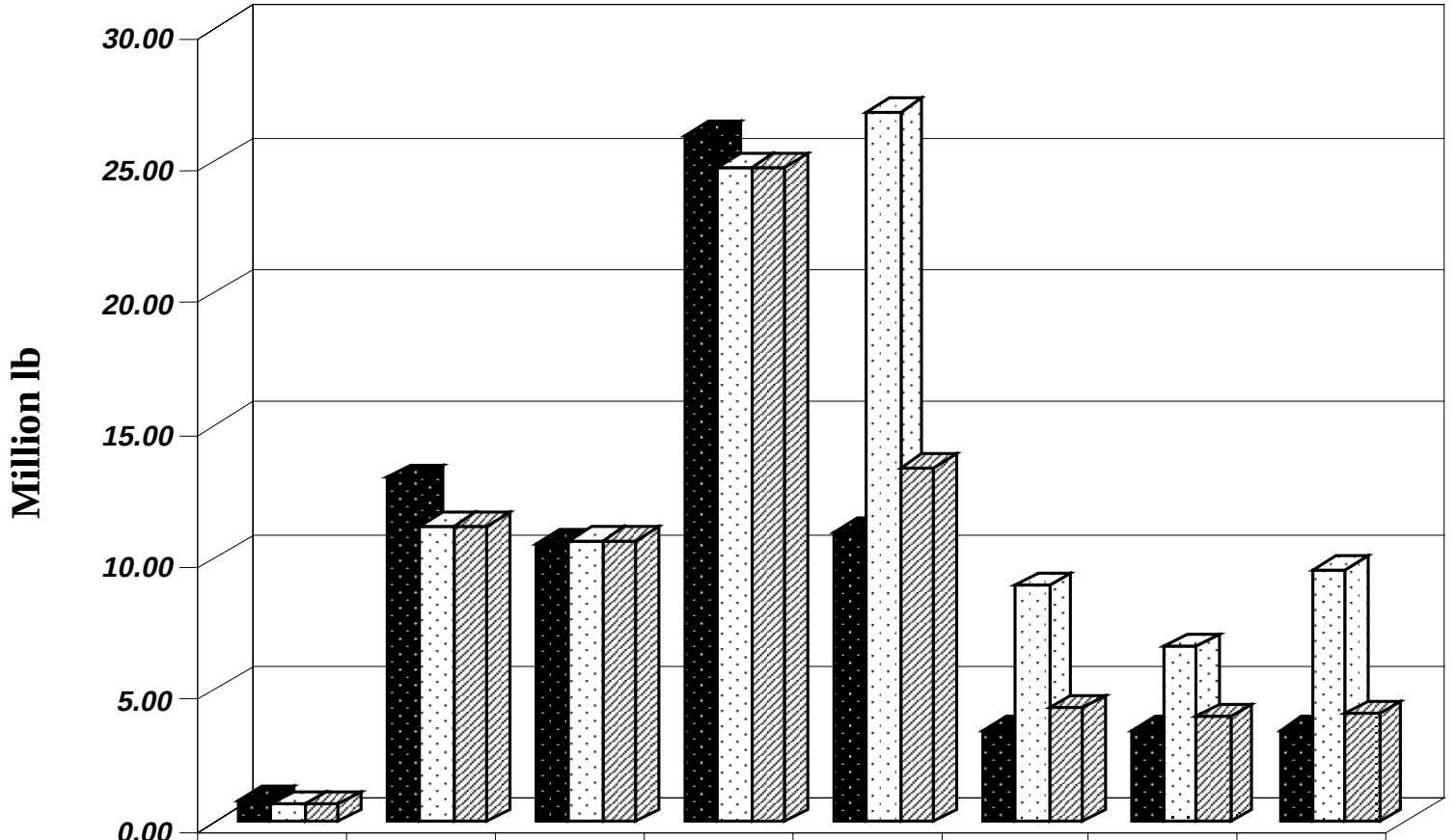
Lastly, we required a specific procedure to provide a recommendation for Area 4C/D/E. The fishery in this area is largely concentrated on the edge of the continental shelf, but the exploitable biomass is widely distributed at low density across the entire Bering Sea shelf. If this entire shelf area were to be fully included in catch limits, then the estimated setline CEY would be approximately 9.56 Mlb. We believe that some of this biomass eventually mixes across the 'edge' and is not separately vulnerable to a fishery on the shelf. However, a great deal of uncertainty about the spatial dynamics of halibut on the Bering Sea shelf and edge remains. We therefore consider that even greater caution should be applied to the Area 4C/D/E quota than for those in Areas 3B and 4A/B. Staff recognizes that yield should be increased over that which would be calculated solely from consideration of the 'edge' area but are adopting a more conservative policy for this area. We recommend adding only ten percent of the difference between the 1998 catch limit and the 1999 estimated age-specific CEY value to the previous quota of 3.5 Mlb, leading to our recommended catch limit of 4.1 Mlb.

Table 1.

Pacific Halibut 1999 Yield Estimation (M = 0.15)
Areas 3B and 4 Based on Survey Partitioning Relative to Area 3A

Area	2A+2B	2A	2B	2C	3A	3A Biomass	3B	4A	4B	4CDE Total	Grand Total
1998 quota		*0.82*	*13.00*	*10.50*	*26.00*		*11.00*	*3.50*	*3.50*	*3.50*	*71.82*
Age-specific estimates											
1999 exploitable biomass	67.00	5.36	61.64	64.00	159.00	159.00	138.33	46.11	34.98	58.83	568.25
Total CEY at 20%		1.07	12.33	12.80	31.80		27.67	9.22	7.00	11.77	113.65
Non-commercial removals		0.41	1.11	2.13	7.07		0.80	0.30	0.39	2.21	14.42
Age-Specific Setline CEY		**0.66**	**11.22**	**10.67**	**24.73**		**26.87**	**8.92**	**6.61**	**9.56**	**99.24**
Length-specific estimates											
1999 exploitable biomass	86.00	6.88	79.12	67.00	173.00	173.00	150.51	50.17	38.06	64.01	628.75
STAFF 1999 YIELD RECOMMENDATIONS		***0.66****	***11.22***	***10.67***	***24.73***		***13.38***	***4.31***	***3.97***	***4.10***	***73.04***

*** Area 2A recommendation includes all removals that would be included in a PFMC catch sharing plan.**



	2A	2B	2C	3A	3B	4A	4B	4CDE Total
1998 quota	0.82	13.00	10.50	26.00	11.00	3.50	3.50	3.50
1999 Age-Specific Setline CEY	0.66	11.22	10.67	24.73	26.87	8.92	6.61	9.56
STAFF RECOMMENDATION	0.66	11.22	10.67	24.73	13.38	4.31	3.97	4.10

Table 2. Halibut Setline Yield

	1998		1999	
Area	Age Selectivity	Adopted	Age Selectivity	Recommended
2A	1.05	0.82	0.66	0.66
2B	15.38	13.00	11.22	11.22
2C	15.48	10.50	10.67	10.67
3A	38.71	26.00	24.73	24.73
3B*	30.99	11.00	26.87	13.38
4A*	11.11	3.50	8.92	4.31
4B*	10.21	3.50	6.61	3.97
4CDE Total*	13.28	3.50	9.56	4.10
Stock Total	136.21	71.82	99.24	73.04

***** CEY scaled using survey estimates

- All closed area bycatch assumed to be in IPHC Reg. Areas 4C, 4D and 4E

Table 3. Exploitable biomass (millions of pounds) in Areas 3B and 4, relative to exploitable biomass in Area 3A.

		Biomass relative to 3A	
Area	% Std Biomass	Age Selectivity	Length Selectivity
3B	87	138.33	150.51
4A	29	46.11	50.17
4B	22	34.98	38.06
4CDE Total	37	58.83	64.01