

Commercial catch sampling

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Abstract

This paper describes the 2000 commercial catch sampling program for halibut in Alaska, British Columbia, Washington, Oregon and California. Commercial catch sampling involves collecting otoliths, halibut lengths, logbook information and final ticket weights. All of the collected data are used in stock assessment. Otoliths collected provide age composition. Lengths of sampled halibut provide growth and mean weight. Mean weights are combined with ticket weights to estimate catch in numbers. Copied logbook information provides catch per unit effort (CPUE) data and fishing location for the landed weight. Finally, tags are collected to provide information on migration and mortality.

Fishery background

Individual Quota (IQ) systems remained in place in Alaska and British Columbia, while Washington, Oregon and California, or Area 2A, remained an open access fishery for commercial halibut fishing. Further, the Area 2A commercial fishery was restricted to the waters south of Point Chehalis, Washington. Commercial halibut fishing in northern Washington, or Area 2A-1, continued to be open only to treaty Indian tribes.

Sampling objectives

The primary objective in sampling landings of commercially caught halibut is to have halibut samples represent the total commercial halibut removals. To accomplish this, random sampling techniques are followed and an equal proportion of the catch is sampled over the entire landing period, or season, using prescribed sampling rates.

Other related objectives include copying fishing logs and their respective ticket weights for as many halibut trips as possible throughout the entire season, and collecting tags.

Inherent in the sampling program is the positioning of field sampling staff in ports where there is an opportunity to sample a majority of the catch by weight for each regulatory area. Therefore, landing patterns are reviewed annually. Another annual look includes a review to ensure proportional sampling occurs based on the weight landed by regulatory area per port. To accomplish proportionality in 2000, different days were assigned for sampling in each port. Also, in some cases, different sampling percentages were assigned for some ports for some regulatory areas. Finally, sampling priorities by regulatory area and port are assigned.

For Area 2B, samplers in Vancouver and Port Hardy sampled four days per week at one percent while the sampler in Prince Rupert sampled five days per week at one percent. Prince Rupert has a higher number of landings and more poundage so another day was sampled. More landings and a greater poundage can lead to more sampling conflicts.

For Area 2C, every sampler sampled five days per week at two percent except Sitka. The Sitka sampler sampled five days per week at three percent. This was due to the large number of landings in Sitka and the inherent conflict of not being able to be in two places at once. For Area 3A, samplers in Kodiak and Homer sampled five days a week at one percent while samplers in all other ports sampled at four days per week at one percent. Once again, this is due to conflicts arising in ports with more poundage and landings. For Area 3B, all samplers sampled five days per week at one percent. For the Areas 4A, 4B and 4C&D, all samplers sampled six days a week using three percent for Area 4A, five percent for Area 4B and three percent for Area 4C&D. The lone exception here was for sampling the Area 4C Community Development Quota (CDQ) fishery in St. Paul. The CDQ fishery is sampled from beginning to end and usually lasts about a month and a half. The St. Paul sampler sampled Area 4C CDQ at two percent four days a week.

Samplers use judgment when there are sampling conflicts. For example, it is common to have more than one boat at a time unloading from the same regulatory area. In these cases, the vessel with the larger poundage of halibut is usually sampled. In another instance, a sampler may be working at an unloading facility where there is a constant stream of halibut offloads. In this case, a sampler may opt to stay at one location. Finally, there are conflicts between regulatory areas. Here sampling priorities are assigned differently for these regulatory area conflicts. In Canada, when there is a choice of regulatory areas, Areas 2B and 2C are equal and are sampled before Areas 3A and 3B. In Alaskan ports, Area 4 is sampled first, followed sequentially by Area 2C, Area 3A, and Area 3B. Areas 3A and 3B are treated equally. Finally, there is a priority scheme for Area 4: Area 4B is sampled first, followed by Area 4C&D, then by Area 4A.

The last objective involves otolith targets by regulatory areas. Otolith targets are established to optimize work effort and sample size. A target of 2,000 otoliths and halibut lengths (plus or minus 500) was set for Regulatory Areas 2B, 2C, 3A, 3B, 4A, 4B and combined 4C and 4D in 2000. In Area 2A, the target was 1,000 otoliths and halibut lengths. The Area 2A target was further subdivided to obtain a proportional number based on the treaty Indian and commercial catch limits. This resulted in a target of 650 otoliths/lengths for the treaty Indian fishery and 350 otoliths/lengths for the non-treaty commercial fishery.

To meet sampling targets and to obtain an equal proportion of the catch, the sampling rates detailed above are calculated.

Sampling rate calculations

Sampling rate calculations for each regulatory area are shown in Tables 1 and 2. The rates were calculated by determining the average halibut weight for an area using Forsberg (1999) and multiplying the weight by the otolith target for each respective area to obtain a sample size. This sample size was divided by the available catch limit set by IPHC to obtain the overall sampling ratio. This sampling ratio was divided by the proportion of the catch expected to be landed in ports with samplers in place to obtain a sampling ratio for sampled ports. This resultant ratio was then divided by an estimate of landings that will actually be sampled to obtain the sampling rate for each area rounded to the nearest 0.5% with 1% as a minimum rate.

As a comparison to the estimates, the actual average halibut weight and the actual ratio landing in sampled ports is included.

Alaskan IFQ

To meet Alaskan sampling objectives, the ports of Dutch Harbor, Homer, Kodiak, Seward, Hoonah, Juneau, Sitka, Petersburg and Bellingham were staffed. Juneau was added in 2000. Also, St. Paul was staffed during the Area 4C CDQ fishery from June 15 through August 5. Furthermore, halibut landings from Alaska unloaded in Prince Rupert were sampled. A sampling summary is presented in Table 3. Otolith/length samples for each Alaskan regulatory area fell within an acceptable range although Area 4B was short by just over 100 otoliths. In 2000, a high volume of halibut was landed in Dutch Harbor leading to more sampling conflicts. In other words, offloads occurred simultaneously. Further, one buyer location could not be sampled. Adjustments will be made in 2001.

The goal of having proportional sampled weight to landed weight in each sampled port was acceptably met (Table 4). However, the variation between ports was greater in 2000 than it was in 1999. The reason for this appears to be related to not having the regulatory area on the Pending Landing List. Knowing the regulatory area helps samplers with sampling priorities. The Pending Landing List is comprised of vessels notifying NMFS Enforcement of their intention to land. It includes poundage of halibut and sablefish, the unloading port, the buyer, and the unloading date and time. The Regulatory Area was omitted from the Pending Landing List in 2000 due to a regulatory omission and will be corrected in 2001.

IPHC samplers copied about 5,100 Alaskan logs from ports where we have a presence and another 1,600 logs for Alaskan landings from other ports. Samplers have an opportunity to collect logs from other locations when they encounter halibut vessels in their own ports. Samplers also collected 89 tags. Table 5 illustrates fishing logs collected in key ports.

Canadian IVQ

IPHC samplers were in place in Prince Rupert, Port Hardy and Vancouver, where about 89% of the Area 2B catch was landed. About 47% of the coast-wide Area 2B poundage was sampled for 2,427 otoliths. Canadian samplers collected a little over 1,000 Canadian logs in their ports. A total of 110 U.S. logs were also obtained in Bellingham and Prince Rupert by the local samplers (Table 5). Data from tagged halibut were also collected. There were only 3 halibut tags redeemed in 2000.

Washington, Oregon and California

Commercial halibut fishing in Area 2A-1 continued to be restricted to treaty Indian tribes. Treaty Indian managers worked cooperatively with IPHC and sampled Area 2A-1 catch but the sampling objective of 650 otoliths was not met. There were 533 otoliths collected in the tribal fishery. During sablefish openings, up to 500 pounds of halibut could also be retained. It appears halibut sampling during the sablefish fishery was under sampled. Adjustments will be made in 2001.

The Area 2A non-treaty commercial fishery was restricted to waters south of Point Chehalis, Washington. Sampling was conducted only in Newport, Oregon where sampling objectives were not met. The Area 2A otolith objective is difficult to meet. From a budget and efficiency standpoint, Newport is the only reasonable port to sample. Further, only the first fishing period was a

good candidate for sampling. There were 173 otoliths collected versus the target of 350 otoliths. Options for improving the Area 2A non-treaty commercial fishery sampling will be re-evaluated before 2001.

References

Forsberg, J. E. 1999. Age composition of the commercial halibut catch for 1999. Int. Pac. Halibut Comm. Report of Assessment and Research Activities 1999: 77-80.

Table 1. 2000 otolith targets and sampling rates for Areas 2B, 2C, 3A and 3B.

	Regulatory Areas			
	2B	2C	3A	3B
Otolith target (no)	2,000	2,000	2,000	2,000
1999 Average halibut weight (lbs)	22.2	25.2	22.7	25
Sample size (000 lbs)	44.4	50.4	45.4	50
Catch limit (000 lbs)	10,600	8,400	18,310	15,030
Overall sampling ratio	0.004	0.006	0.002	0.003
Estimated ratio landing in sampled ports	0.89	0.71	0.83	0.85
Ratio for sampled ports	0.005	0.008	0.003	0.004
Estimated ratio that will be sampled	0.54	0.50	0.50	0.50
Final sampling rates (%)	1.0	2.0	1.0	1.0
Actual average halibut weight (lbs)	23.3	28.9	26.7	24.9
Actual ratio landing in sampled ports	0.89	0.69	0.84	0.82

Table 2. 2000 otolith targets and sampling rates for Areas 2A-1, 2A, 4A, 4B and 4C&D.

	Regulatory Areas				
	2A-1	2A	4A	4B	4C&D*
Otolith target (no.)	650	350	2,000	2,000	2,000
1999 Average halibut weight (lbs)	19	19	26.5	29.9	21.9
Sample size (000 lbs)	12.35	6.65	53	59.8	43.8
Catch limit (000 lbs)	305	139	4,970	3,928	3,951
Overall sampling ratio	0.040	0.048	0.011	0.015	0.011
Estimated ratio landing in sampled ports	0.85	0.32	0.94	0.57	0.80
Ratio for sampled ports	0.048	0.15	0.011	0.027	0.014
Estimated ratio that will be sampled	0.9	0.45	0.39	0.57	0.50
Final sampling rates (%)	5.0	33.0	3.0	5.0	3.0
Actual average halibut weight (lbs)	21.3	21.3	30.0	34.8	32.1
Actual ratio landing in sampled ports	0.91	0.35	0.96	0.60	0.93

*4C&D includes CDQ

Table 3. A summary of 2000 otolith targets, collected otoliths, vessels sampled and the percentage of the catch sampled.

Regulatory Area	Otolith Target	Collected Otoliths	No. Landings Sampled	% of Catch Sampled-lbs
2A-1	650	533	28	16
2A	350	173	8	43
2B	2,000	2,427	293	47
2C	2,000	2,101	193	32
3A	2,000	2,462	224	32
3B	2,000	2,077	136	33
4A	2,000	1,589	60	35
4B	2,000	1,398	27	31
4C&D	2,000	1,543	59	54
Totals	15,000	14,303	1028	36

Table 4. Proportion of halibut sampled by weight, separated by IPHC regulatory area and listed by key ports.

Port	2A	2B	2C	3A	3B	4A	4B	4C&D
Newport	0.44							
Taholah	0.41							
La Push	0.52							
Neah Bay	0.50							
Vanc/Bell		0.64		0.63	0.87			
Port Hardy		0.42						
Prince Rupert		0.55						
Petersburg			0.51					
Sitka			0.36	0.40				
Juneau			0.45	0.48				
Hoonah			0.53					
Seward				0.37	0.38			
Homer				0.27	0.37	0.49		
Kodiak				0.40	0.39			
Dutch Harbor						0.32	0.52	0.53
St. Paul								0.67

Table 5. The number of halibut fishing logs collected in the key ports.

Port	Washington/ Oregon	B. C.	Alaska
Newport	12		
Taholah	6		
Neah Bay	18		
Bellingham			106
Port Hardy		331	
Prince Rupert		537	4
Vancouver		168	
Petersburg			599
Sitka			494
Juneau			496
Hoonah			328
Seward			499
Homer			680
Kodiak			835
Dutch Harbor			483
St. Paul			537
Total key ports	36	1,036	5,061
Total all ports	39	1,220	6,677

Age distribution of the commercial halibut catch for 2000

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Abstract

The age distribution of halibut sampled from the 2000 commercial catch is summarized.

Age distribution

The age distribution of the commercial catch of Pacific halibut is summarized in Table 1. Mean age of halibut by regulatory area for the years 1991-2000 is presented in Table 2. Average age of samples from all areas except Area 2B increased from 1999. The average age from all areas combined increased by 0.4 years in 2000. Overall average age in 2000 is 1.8 years higher than it was in 1991.

Average size (measured fork length) of sampled halibut increased in Areas 2, 3A, 4A, 4B and 4D in 2000 but decreased in Areas 3B and 4C. Average fork length for all areas combined increased slightly from that of 1999.

As it has for the last four years, the 1987 year-class (13-year-olds) accounted for the largest proportion (in numbers) of the overall commercial catch (24%) in 2000. The next most abundant year-classes were 1988 and 1989, (12- and 11-year olds), accounting for 15% and 10% of the catch respectively. Thirteen year-olds were also the most abundant year-class in all areas when broken down by regulatory area. Area 4C had the highest percentage (46%) of 13-year-olds in the 2000 commercial catch. The 1988 year-class (12-year-olds) was the second most abundant in every regulatory area. The 1986 year-class (14-year-olds) was the third most abundant in Areas 3, 4B and 4D, while the 1989 year-class was the third most abundant in Areas 2, 4A and 4C.

The oldest and youngest halibut in the 2000 market samples were determined to be 45 and 4 years old, respectively. The 45-year-old came from Area 4B, and had a fork length of 180 cm. There were three 4-year-olds, all from Area 2B and measuring between 80 and 93 cm. The largest halibut in the 2000 commercial samples was a 213-cm fish from Area 4B, which was determined to be 23 years old.

Only about 75% of the market samples collected in 2000 had been aged at the time of writing (November 27, 2000). Last year, the stock assessment model was modified to incorporate current year survey ages. For this reason, there was a shift in sample priorities and deadlines for age determination; survey otoliths from Areas 2B, 2C and 3A were read first, with a deadline of October 15. Market sample otoliths from the same areas were given second priority. Prior to 1999, market sample otoliths from all areas were aged first, with as many as possible aged before the end of October. Survey otoliths were aged after market sample ages were complete; usually the following winter and spring. In 2000, Regulatory Area 3B was added to the priority list for both market sample and survey ages. As a result, about a thousand fewer market sample otoliths were aged by the stock assessment deadline in 2000 than had been aged at the same time in 1999.

The 1999 Area 4 mean ages in Table 2 are slightly different from the figures reported in last year's RARA. Adjustments of 0.2 to 0.6 year resulted when the means were recalculated using complete age data. Last year's Area 4 mean ages were based on the portion of Area 4 otoliths aged by mid-November 1999 (about 66%). This year, even fewer Area 4 otoliths have been aged (48%), therefore, mean lengths and ages as well as the age distribution for Area 4 reported in Tables 1 and 2 are very preliminary.

Table 1. Age distribution of commercial catch of Pacific halibut by regulatory area, 2000.

	Area 2A	Area 2B	Area 2C	Area 3A	Area 3B	Area 4A	Area 4B	Area 4C	Area 4D	All Areas Combined
Age	% of catch	% of catch	% of catch	% of catch	% of catch	% of catch	% of catch	% of catch	% of catch	% of catch
4	0	0.2	0	0	0	0	0	0	0	<0.1
5	0	0.4	0	<0.1	0	0	0	0	0	0.1
6	0	1.3	0.7	0.3	0.1	0	0	0	0	0.4
7	0	1.9	1.7	0.4	0.4	0.1	0.2	0.3	0.3	0.8
8	2.2	3.8	4.3	1.7	1.5	0.5	0.8	1.1	0.3	2.3
9	9.0	6.0	4.7	2.9	2.6	1.6	1.3	1.9	0.3	3.8
10	14.2	11.3	8.0	4.8	5.3	3.6	5.0	4.1	2.9	7.1
11	14.9	13.1	12.7	7.0	7.0	7.8	7.8	11.1	6.3	9.8
12	19.7	17.4	17.6	12.8	14.4	13.9	11.8	12.7	16.0	15.3
13	26.7	20.7	20.3	17.7	22.6	36.4	23.6	45.8	40.4	23.7
14	5.5	7.3	7.9	10.6	9.9	7.7	9.8	6.8	8.9	8.6
15	1.9	3.6	5.4	7.8	6.8	5.0	4.2	2.7	6.0	5.4
16	1.0	3.3	5.0	7.4	5.8	2.4	4.0	3.3	2.3	4.7
17	0.7	2.3	3.0	7.7	6.3	2.0	3.8	0.8	4.3	4.2
18	1.3	1.5	1.9	5.3	4.0	1.7	2.8	1.4	1.4	2.8
19	0.7	1.3	1.4	4.2	3.1	2.0	4.0	0.5	1.7	2.4
20	0.7	1.5	1.4	3.1	3.3	3.2	3.8	1.1	2.6	2.3
21	0.3	1.2	1.3	2.2	1.9	4.1	3.3	3.5	2.3	2.0
22	0.4	0.4	0.3	1.2	2.0	2.8	2.5	1.4	1.4	1.2
23	0.1	0.4	0.6	1.0	1.6	2.5	2.7	0.5	1.1	1.1
24	0.3	0.4	0.6	0.7	0.6	1.4	2.0	0.5	0.3	0.7
25	0.3	0.2	0.2	0.5	0.3	0.3	1.0	0.3	0.6	0.4
26+	0.1	0.6	1.0	0.8	0.5	1.1	5.5	0.3	0.6	1.0

	Area 2A	Area 2B	Area 2C	Area 3A	Area 3B	Area 4A	Area 4B	Area 4C	Area 4D	All Areas
Average Length (cm)	99.4	100.2	106.8	104.8	102.8	110.2	112.2	112.1	106.4	104.8
Average Age (years)	12.1	12.5	12.9	14.5	14.3	14.5	15.6	13.4	14.0	13.7
Average Weight (lbs)*	21.3	23.3	28.9	26.7	24.9	30.0	34.8	33.8	30.8	27.7
Otoliths Collected**	706	2,427	2,101	2,462	2,077	1,589	1,398	682	861	14,303
Otos used in stats***	692	1,987	1,887	2,208	1,857	885	601	369	349	10,835

*Weights calculated from measured fork lengths

**Summarized from market sample forms entered by Nov.30, 2000. This number is higher than the number of otoliths that will be aged since the "Otos Collected" figure may incorporate counting errors and includes otoliths that are discarded and not aged

***Numbers of otoliths aged by November 27, 2000

Table 2. Mean age (in years) of Pacific halibut by regulatory area, 1991-2000.

<u>Area</u>	<u>1991</u>	<u>1992</u>	<u>1993</u>	<u>1994</u>	<u>1995</u>	<u>1996</u>	<u>1997</u>	<u>1998</u>	<u>1999</u>	<u>2000</u>
2A	10.9	10.7	10.8	11.4	10.5	9.6	10.3	10.6	11.3	12.1
2B	11.2	11.5	11.9	12.4	11.9	11.6	11.3	11.8	12.6	12.5
2C	12.6	12.7	13.3	13.1	12.8	12.2	12.1	12.3	12.8	12.9
3A	12.0	12.1	12.8	13.3	13.0	13.0	13.2	13.7	14.1	14.5
3B	11.9	12.1	12.6	12.4	12.4	12.9	12.8	13.5	14.2	14.3
4A	11.9	12.0	12.2	11.6	13.6	13.0	12.8	12.5	12.9	14.5
4B	13.3	13.8	14.5	13.8	14.6	14.0	14.7	14.2	15.1	15.6
4C	11.2	12.1	11.9	12.1	11.8	10.7	11.5	11.7	12.3	13.4
4D	12.1	12.4	12.6	13.8	12.9	13.4	12.1	12.7	12.5	14.0
All Areas	11.9	12.1	12.5	12.7	12.6	12.3	12.5	12.6	13.3	13.7

Revised estimates of Canadian sport catches

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Abstract

At the 2000 IPHC Annual Meeting, Canada presented an estimate of recent sport catch in British Columbia much lower than the mail survey estimate used by the staff in the stock assessment. It is very possible that the mail survey estimates are too high, and that the new estimate is too low. Clearly they do not have the same bias, but for assessment purposes it is necessary to equalize the biases by scaling either the historical mail survey estimates or the new estimate. Scaling down the historical mail survey estimates has the effect of increasing the staff catch limit recommendation for 2000 from 9.97 to 10.20 million pounds.

Background

Through 1992 sport catches in British Columbia were estimated by the Tidal Diary Program (TDP), a mail survey of a sample of sport license holders conducted by the Pacific Region of the Department of Fisheries and Oceans (DFO). The TDP was discontinued after 1992, and for several years thereafter the IPHC staff used the average of the TDP estimates for 1988-1992 as its estimate of current catch (Trumble et al. 1995).

In 1990 and 1995 the Statistical Services Unit of DFO headquarters in Ottawa conducted the National Postal Survey of sport harvest throughout Canada, a survey similar to the TDP that produced a halibut sport catch estimate for 1990 very similar to the TDP estimate. When compiling catch estimates for the 1999 halibut stock assessment, the IPHC staff adopted the National Survey estimate from 1995 for all years 1995-1999. This estimate was 97,771 pieces, or 1.582 million net pounds at 16.2 net pounds/fish (Williams and Blood 2000).

During 1999 the Pacific Region of DFO produced another estimate of sport halibut catch in British Columbia in 1998 by combining the results of a number of creel survey and logbook programs, expanded in some cases to account for partial coverage. This estimate was 44,400 pieces, or 0.959 million *round* pounds at 21.6 round pounds/fish. It does not include 10,371 fish estimated and reported by the Washington Department of Fish and Wildlife to have been caught in Canadian waters on Swiftsure Bank and landed in Neah Bay, Washington (King and Gjernes 1999).

The Pacific Region's latest estimate is therefore about half of the National Survey estimate, and the paper argues that both the National Survey and the TDP overestimate sport catch by a wide margin because the mail survey estimates are not corrected for non-response bias—the tendency in mail surveys for a higher proportion of the more avid and successful anglers to return a questionnaire than of the less avid and successful.

The question for the IPHC staff is what estimate of Canadian sport catch to use in the stock assessment, not only for 1998 but for all years in the assessment data series back to 1974. It is certainly plausible that the mail surveys overestimate the sport catch, but it is also very possible that the Pacific Region's 1998 effort underestimates the sport catch because it is based on a number of partial estimates rather than on a comprehensive reporting or sampling program.

If all the sport catch estimates used in the assessment were biased in the same direction, it would not be a serious problem because the historical sport catch estimates add to the biomass estimates and the current sport catch estimates are subtracted from the total CEY (target catch level) to arrive at the setline CEY (commercial quota). For example, if estimated sport catches constituted 10% of the total catch throughout a long data series, the setline CEY would be 90% of the total CEY. If all the sport catch estimates were reduced by a half, the new CEY would be 95% of the old CEY and setline CEY would be 90% of the old CEY, just as before. The effect of a change in sport catch estimates in a particular case depends on the temporal pattern of sport catches, but at least to some extent, the effect of any bias on setline CEY will be canceled.

A problem arises if sport catch estimates with different biases are used together. In particular, using overestimates in the stock assessment to estimate total CEY, and then subtracting an underestimate from total CEY to arrive at setline CEY, would certainly produce an overestimate of setline CEY. In deciding on a full set of sport catch estimates to use in the assessment, therefore, the staff has to attempt to keep the bias consistent. It would of course be better to remove bias altogether, but the staff has no way of knowing what bias is present in either the mail survey estimates or the Pacific Region's 1998 estimate.

Adjustments applied to the Pacific Region's 1998 estimate

The estimate of poundage was based on round weights rather than net (headed and gutted) weight, which is how all other figures are stated. Net weight is 75% of round, so the average weight should be 75% of the 21.6 lb reported in the paper, or 16.2 lb, which is close to other estimates based on large samples from Alaska and Washington.

The fish caught on Swiftsure Bank and landed in Neah Bay have to be accounted for somewhere. Area 2A and Area 2B are combined for estimating biomass and total CEY, so for that purpose it does not matter to which area the landings in question are assigned, so long as they are included in the total. But the area assignment will affect the setline CEY in each area.

These landings are included in the historical estimates of 2B sport catch, and the staff has no reason to question the recent estimates of landings from Canadian waters based on a comprehensive intercept survey in Neah Bay and reported by the Washington Department of Fish and Wildlife.

Adding the Neah Bay landings gives an adjusted total of 54,771 fish at an average weight of 16.2 pounds, or 0.887 million net pounds, as the Pacific Region estimate for 1998.

Alternative corrections to be applied to historical and recent estimates

It seems likely that the actual 1998 sport catch was somewhere in between the Pacific Region estimate and the National Survey estimate. If the Region's estimate is correct, then the National Survey estimate is high by 100% and all the historical estimates from mail surveys should be reduced by half. If the mail surveys are correct, then the Region's 1998 estimate is low by 50% and there is no need to scale any of the historical estimates.

Table 1 shows the two series of sport catch estimates corresponding to the different interpretation of the mail surveys.

Effect of alternative corrections on setline CEY and catch limit recommendations

The 1999 stock assessment used the postal survey estimates of Canadian sport catch throughout, both to estimate total CEY and to calculate setline CEY. The staff catch limit recommendation was the figure midway between the 1999 quota and the estimated setline CEY for 2000.

The other extreme would be to use the 1998 Pacific Region estimate for, say, 1997-1999, and half of the historical mail survey estimates for earlier years to estimate total CEY. Setline CEY for 2000 would be based on the lower recent estimate, and the staff catch limit recommendation calculated by the same rule.

These two procedures produce the following results:

	1999 assessment	Alternative procedure
Present sport catch estimate	1.58	0.89
Historical estimates	100% of survey values	50% of survey values
2A+2B exploitable biomass	55.5	54.1
2B total CEY in 2000	9.88	9.63
2B non-commercial removals	2.03	1.34
2B setline CEY	7.85	8.29
Staff catch limit recommendation	9.97	10.20

Discussion

In this case, reducing both the recent and historical estimates of sport catch does increase the setline CEY, because the sport catch increased as a percentage of the total over the course of the data series. The effect on the staff catch limit recommendation is only half of the increase in setline CEY.

In principle the bias in the mail survey estimates could be determined by comparing creel survey and postal survey estimates for the times and areas covered by the creel survey estimates. King and Gjernes (1999) report some comparisons of salmon catch estimates for Georgia Strait that indicate a high bias, but the only comparison available for halibut is the Neah Bay landings from Swiftsure. In that case the mail survey estimates agree very well with the intercept survey estimates (Trumble et al. 1995).

References

- King, J. R., and Gjernes, T. W. 1999. Estimate of 1998 recreational catch in British Columbia waters. Canadian Stock Assessment Secretariat Research Document 99/121.
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Table 1. Alternative series of British Columbia estimates. The high values are the postal survey estimates throughout, including the National Survey estimate from 1995 on. The low values are half the postal survey estimates through 1994, and the adjusted Pacific Region estimate for 1998 (0.887 million pounds) thereafter.

Year	Low values (M lb)	High values (M lb)
1974	0.000	0.000
1975	0.000	0.000
1976	0.000	0.000
1977	0.008	0.017
1978	0.004	0.009
1979	0.009	0.018
1980	0.006	0.011
1981	0.012	0.023
1982	0.033	0.066
1983	0.052	0.103
1984	0.062	0.124
1985	0.262	0.525
1986	0.186	0.372
1987	0.264	0.527
1988	0.252	0.504
1989	0.318	0.635
1990	0.381	0.762
1991	0.292	0.584
1992	0.290	0.580
1993	0.328	0.657
1994	0.328	0.657
1995	0.887	1.582
1996	0.887	1.582
1997	0.887	1.582
1998	0.887	1.582
1999	0.887	1.582
2000	0.887	1.582