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Halibut by-catch in the British Columbia Shrimp Trawl Fishery

J.A. Boutillier, J.A. Bond, and H. Nguyen

Fisheries and Oceans Canada
Pacific Biological Station
3190 Hammond Bay Road
Nanaimo, BC, V9R 5K6

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Abstract

In recent years, the number of vessels participating in the shrimp trawl fisheries in British Columbia has increased. In addition, the number of vessels exclusively fishing shrimp has also increased. With this increase in fishing effort, identifying the species and amounts of fish caught as bycatch in the fishery has become a concern. This paper focusses on the bycatch of halibut in the shrimp trawl fishery.

Since 1996, at-sea observers have collected information on the bycatch of halibut (and other species) in the shrimp trawl fisheries in British Columbia. This paper describes the bycatch observer program and summarises the observer sampling that has been carried out off the West Coast of Vancouver Island, in Queen Charlotte Sound, and in Chatham Sound. The data collected on halibut bycatch in these fisheries since 1996 are summarised, and estimates of the amount of halibut caught as bycatch in the shrimp trawl fisheries of British Columbia is estimated. In addition, the condition of the halibut caught and the fish exclusion devices that some vessels are now using to attempt to reduce the bycatch are discussed.

Résumé

Ces dernières années, il y a eu en Colombie-Britannique une hausse du nombre de bateaux utilisés pour la pêche au chalut de la crevette. Parallèlement, le nombre de bateaux employés exclusivement pour cette pêche a aussi augmenté. Une telle intensification de l'effort de pêche a suscité des préoccupations quant aux volumes des prises accessoires et à l'identification des espèces capturées. Le présent document est axé sur la prise accessoire du flétan imputable à la pêche au chalut de la crevette.

Des observateurs en mer ont accumulé depuis 1996 des données sur la capture accidentelle du flétan (et d'autres espèces) lors de la pêche au chalut de la crevette en Colombie-Britannique. Ce document donne un compte rendu du programme d'observation des prises accessoires et des échantillonnages effectués par les observateurs au large de la côte ouest de l'île de Vancouver, de même que dans les détroits de la Reine-Charlotte et de Chatham. Une synthèse des données amassées depuis 1996 est présentée ainsi qu'une estimation du volume de flétan capturé accidentellement dans les chaluts à crevette en Colombie-Britannique. De plus, la condition des flétans capturés et les dispositifs de pêche sélective maintenant utilisés sur certains bateaux pour réduire les captures accessoires font l'objet d'une discussion.

Introduction

The British Columbia shrimp trawl fishery has targeted primarily on three species of shrimp : *Pandalus jordani* (smooth pink), *P. borealis eous* (Northern pink), and *Pandalopsis dispar* (sidestripe). Species such as *Pandalus hypsinotus* (humpback), *P. danae* (coonstripe or dock), *P. goniurus* (flexed pink), and *P. platyceros* (prawn) have been caught incidentally or in small quantities. Only these seven species of shrimp are permitted to be retained in the shrimp by trawl fishery, and there are limits on retention of prawns. However, a large variety of other species (both fish and invertebrates) are caught as by-catch and then discarded. Octopus and squid may be retained, but there are limits on the amount of squid that may be kept. No other species may be retained. Two species caught as by-catch that are of particular concern are eulachon and halibut.

In 1995 discussions were initiated in the Shrimp Trawl Sectoral to meet obligations for documentation in all trawl fisheries of halibut by-catch. As a result of these initiatives, a Shrimp Sectoral By-catch Sub-committee was formed to address by-catch issues. The sub-committee met in December of 1995 to develop a co-ordinated approach to address this and other by-catch problems in the shrimp trawl fishery. One of the key areas that was identified for action by the sub-committee was development of a sampling program to document the spatial and temporal nature of by-catch associated with this fishery. In April of 1996, the Department of Fisheries and Oceans, DFO, and Ministry of Agriculture, Fisheries and Food, MAFF, developed a collaborative agreement to train a student and initiate a by-catch sampling program over the summer of 1996. In 1997 and 1998, more concerted efforts were made at addressing this issue with funding being jointly provided by both DFO and industry.

This report was prepared as part of the department's obligation to account for all halibut catches to the International Pacific Halibut Commission. This report summarises the halibut catches from the by-catch sampling programs and extrapolates the total halibut catches in the shrimp trawl fishery where appropriate.

The Fishery

The shrimp trawl fishery has 249 licensed vessels, under an "S" tab, targeting five species of shrimp with incidental catches on an additional two species of shrimp. The number of vessels active in the fishery has varied considerably over time although it has been increasing in recent years (Boutillier et al. 1996). From 1987 to 1994, an average of 172 (ranging from 149 to 182) vessels have participated annually. Since 1995, the average number of vessels has increased to 202 vessels. In addition to the number of vessels participating, more vessels are using the shrimp trawl fishery as their sole source of income. In the past, shrimp trawling was mainly a secondary fishery to salmon, however, with the implementation of the Mifflin plan, a large number of salmon licenses have been retired and these same fishers are now targeting exclusively on shrimp. From 1995 to 1997, the number of single "S" tab vessels increased from 6 to 67.

The fisheries vary considerably from large single species, high volume, low-unit-value, offshore fisheries; to multiple-species, low volume, high-unit-value, isolated, inshore fisheries. There are two distinctive types of gear used by the shrimp trawl fleet: otter trawls and beam trawls. Between 1987 and 1998, otter trawls were utilised on average by 20% of the fleet. They accounted for about 25% of the fishing time and 60% of the total catch by weight. The larger vessels in the fleet mainly use otter trawls. These vessels fish the large offshore regions of the coast and target on high-volume, low-unit-price species of pink shrimp. The smaller vessels in the fleet use beam trawls. These vessels, which make up the majority of the fleet, concentrate their efforts on inshore and nearshore areas of the coast. They target mainly on a mixed species assemblages of shrimp.

There has been a change in the gear used by the fleet over the last few years. In 1995, some of the otter trawlers were starting to use Nordmore Grates to reduce the by-catch of fish. Use of these and other fish exclusion devices began to expand into the beam trawlers in more recent years. These devices encourage fish to leave the net while retaining most of the shrimp. They cannot, of course, produce a catch that is entirely shrimp, but it is believed that they do reduce the by-catch (Hannah et al. 1996).

Retention of finfish, including halibut, is not permitted in the shrimp trawl fishery. The capture of halibut and other fish increases the time that must be spent sorting shrimp from the by-catch. Many fishers are interested in reducing this sorting time. While it is believed that exclusion devices reduce the catch of shrimp slightly, they are thought to result in a significant reduction in the amount of by-catch. In the interests of limiting sorting time, some fishers are now using exclusion devices, but at this time, such devices are purely voluntary.

Methods and Materials

Observers were hired and trained to identify and biologically sample target and by-catch species in major areas of the coast. Sampling was carried out aboard commercial shrimp trawlers using standard observer procedures, with the objectives of identifying key species caught in the shrimp trawl fishery by time, area and gear type. The program was not designed to look at the selectivity of the by-catch by size and age of the animals.

Where possible, all tows on each trip were sampled. For each tow, the weight of each species captured (both those retained and released) was recorded, in addition to other information such as the vessel, type of gear, date, location (latitude and longitude co-ordinates), time, and duration. A total of 43 different observers have been involved in the program since 1996. A single observer collected samples taken in 1996, in 1997 by 21 different observers and in 1998 by 24 different observers. Most of these observers were environmental consultant employees, and students, contract observers, and DFO employees supplemented these. The intent was to collect by-catch information on a variety of areas, times, and gear types, according to the level of fishing intensity.

The observer program in 1996 and 1997 was totally on a voluntary basis. In 1998 in response to concerns about eulachon by-catches in Queen Charlotte Sound shrimp fishery, vessels were only allowed to fish under permit and observers were assigned as necessary at the time of licensing. In all other areas of the coast, observers where placed on a voluntary basis.

Most samples were taken from areas where there was a high level of fishing activity, and few samples were taken from marginal production areas. The majority of samples are thought to be representative of the fishing activity taking place at the same time in the same area. Efforts were made to distribute sampling effort throughout the year in an attempt to ensure that samples were representative of the commercial fleet activity.

The observer sampling in 1998 is not yet complete and this report only details the information that was available to the end of October 1998. Only areas in which the halibut by-catch was observed in the commercial catch or in surveys were considered for this analysis.

Total catch of halibut is estimated by multiplying the catch rate (kg per hour) of halibut in observer sample tows by the total effort expended (trawl hours) as recorded in logbook records. 1998 logbook effort values were adjusted upward to account for logbooks that have not been received. To accomplish this, effort was divided by the proportion of AMR validated catches recorded in logbooks to date.

Results

Three shrimp trawling areas on the coast were identified for analysis of halibut by-catch because they were identified as having halibut being caught in either the commercial catch or in assessment surveys. These areas include the offshore fisheries off the West Coast of Vancouver Island (WCVI) and in Queen Charlotte Sound (QCS) and the nearshore fishery in Chatham Sound. For the purposes of this report, the WCVI includes Shrimp Management Areas (SMA) 23IN, 23OFF, 124OFF, and 125OFF, QCS includes SMA QCSND, and Chatham Sound includes SMA PRD. Shrimp Management Areas are described in Southey et al. (1998), and Figure 1 shows the SMA of British Columbia, with primary areas of shrimp trawl activity in WCVI, QCS, and Chatham Sound indicated.

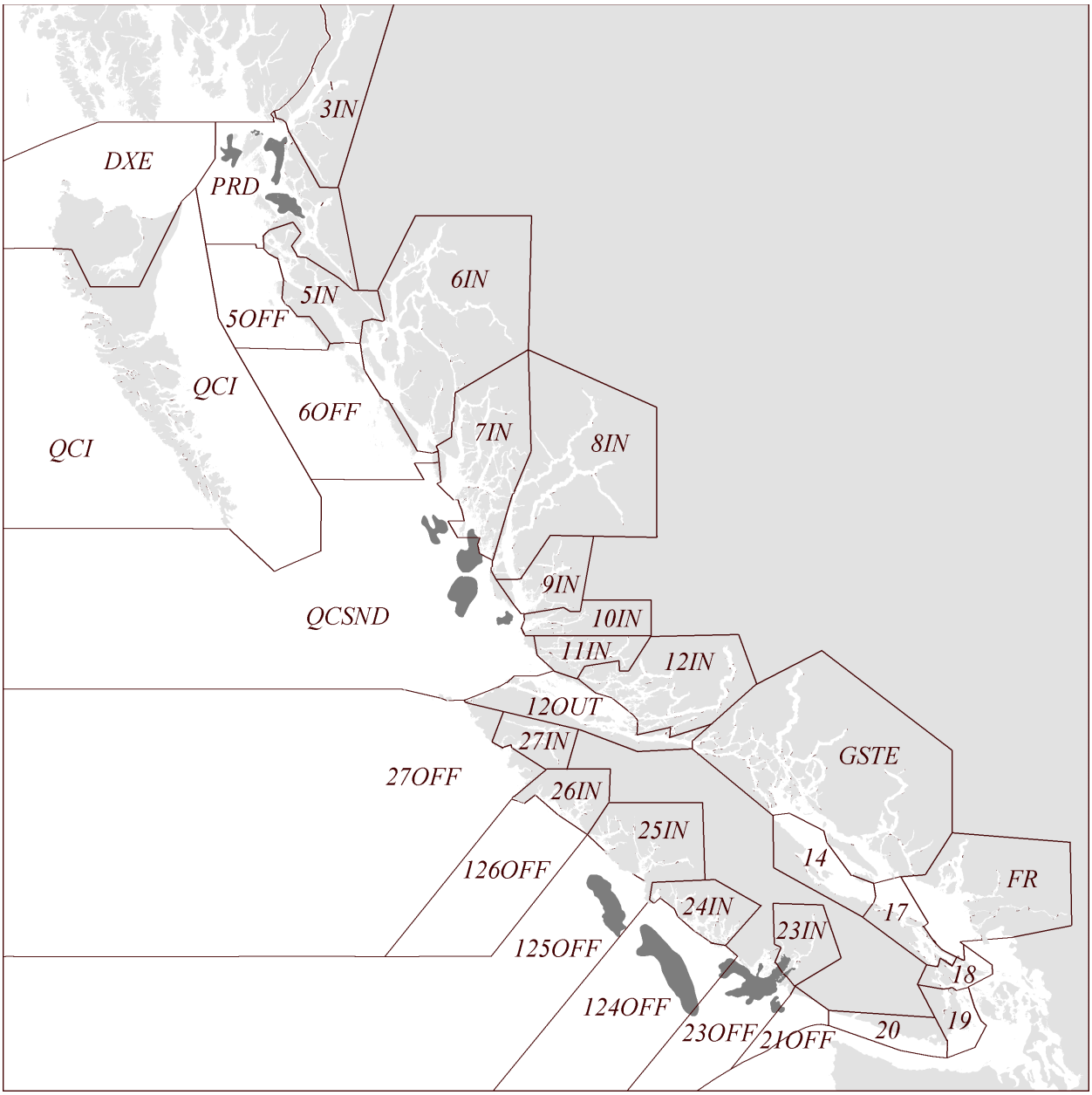

Figure 1: Shrimp Management Areas (SMA) of British Columbia. Main areas of shrimp trawl activity in WCVI, QCS, and Chatham Sound are shaded.

Table 1 summarises the observer coverage in WCVI, QCS, and Chatham Sound since 1996. In 1998, QCS was made a special management area under amended licence conditions and the requirement for observer coverage. This allowed for increased sampling in this area. In 1998 there was less fishing activity off the WCVI than in previous years, and there were difficulties in placing observers on vessels, and in Chatham Sound difficulties were

encountered in having trained observers in place to undertake sampling. This explains why sampling coverage declined in WCVI and Chatham Sound in 1998.

Table 1: The effort expended observing the offshore and nearshore regions of the coast as presented by the number of trawling hours observed, the total number of tows observed and the observation coverage as a percentage of total commercial fishing effort (tow time) in the area.

	WCVI			QCS			Chatham Sound		
	1996	**1997**	**1998**	**1996**	**1997**	**1998**	**1996**	**1997**	**1998**
Hours of Tow time Observed	53	353	140	0	262.9	589.4	12.7	109.4	28.6
Number of tows observed	27	203	64	0	137	297	6	90	15
% of Total effort (hours of tow time) observed	0.1%	2.1%	0.5%	0	7.5%	8.6%	0.2%	1.5%	0.7%

Segments of the industry have undertaken a number of initiatives to address some of the by-catch problems. In particular, there has been an increase in the use and acceptance of fish exclusion devices. This is particularly the case for otter trawlers where over 90% of the vessels sampled were using some form of fish exclusion device as seen in Table 2 below. The acceptance and use of these devices has been much slower in beam trawls where only about a quarter of the vessels sampled are using these devices. However, this use by beam trawlers is still a significant increase from 1996 when none of the 30 beam trawlers sampled were using fish exclusion devices.

Table 2: The percentage of vessels sampled by major gear type using fish exclusion devices from 1996 to 1998, and the percentage of all vessels using fish exclusion devices over the entire coast.

	1996		1997		1998	
	Otter	**Beam**	**Otter**	**Beam**	**Otter**	**Beam**
Vessels sampled	6	30	16	26	17	50
% of vessels sampled with fish exclusion devices	0%	0%	87.5%	11.5%	94%	24%
Total # of vessels	43	170	41	147	45	136
% of Vessels Reporting the Use of Exclusion Devices in Logbooks	N/A	N/A	70.7%	29.9%	91.1%	47.1%

By-catch of halibut was only observed in shrimp trawl catches in 1997. All recorded documented halibut by-catch was taken from vessels fishing otter trawls. All catches were taken from two of the three major offshore and nearshore shrimp areas, Chatham Sound and Queen Charlotte Sound. Six fish, with an average weight of 15.0 kg were caught in Chatham Sound from one vessel over four tows, and three fish with an average weight of 8.3 kg in Queen Charlotte Sound were taken from three separate vessels. The vessel that caught the fish in Chatham Sound was not using a fish exclusion device while the vessels in QCS were all using fish exclusion devices. Of the fish caught and released in Chatham Sound, one was dead, two were in poor shape, and three were in good shape. In Queen Charlotte Sound, the three fish caught were all released in good condition. Table 3 below shows the estimated catch by major area, but it does not reflect the actual mortality associated with the animals. The actual mortality may be much lower than this if the condition of the animals were to be incorporated into the equation. The condition of the released animals is however a very subjective measure (except for dead animals) and as such this estimate was not made.

Table 3: The observation effort, total effort, by-catch sampling catch and total estimated catch of halibut for otter trawls by area by year. NB: Logbook effort for 1998 has been adjusted to account for logbook records not yet received.

Area	Year	By-catch Effort (hrs)	Logbook Effort (hrs)	Obs. Catch (Kg)	% of Logbook Effort	Est. Total Catch(Kg)
Chatham Sound	1996	0.00	836.70		0.00%	N/A
	1997	106.40	2567.20	90.27	4.14%	2178
	1998	0.00	2154.66		0.00%	N/A
QCS	1996	0.00	3835.88		0.00%	N/A
	1997	262.92	3274.82	24.95	8.03%	310
	1998	529.22	6771.19	0.00	7.80%	0
WCVI	1996	9.75	13558.92	0.00	0.07%	0
	1997	172.68	6739.23	0.00	2.56%	0
	1998	8.00	5257.59	0.00	0.15%	0

Although halibut was only observed in the commercial by-catch of shrimp trawlers on two of the three offshore and nearshore shrimp fisheries (QCS and Chatham Sound), we do know that halibut do occur on the WCVI shrimp grounds. Estimates of halibut on the WCVI shrimp grounds are obtained routinely through systematic area swept surveys of the shrimp grounds. Table 4 below shows the estimates obtained by Pacific Fisheries Management Area (PFMA) for shrimp grounds off WCVI. While these results to indicate that halibut are

present off WCVI, it should be noted that surveys encompass a far greater area than do commercial fishing operations, as it is necessary to completely delimit the stocks during a survey. Halibut may not be plentiful in the more productive shrimp areas, and therefore may not be regularly caught by the commercial fleet in this area.

Table 4: Halibut biomass estimates indices on shrimp grounds within major PFMA off the WCVI. Estimates are obtained through systematic area swept trawl surveys, which are then modelled over the area using a bicubic spline interpolator. Surveys took place in May of each year except where otherwise indicated.

Area 123		Area 124		Area 125	
Year	**Biomass (t)**	**Year**	**Biomass (t)**	**Year**	**Biomass (t)**
1996	154.778	1973	0.099	1973	0.178
1997	57.880	1975	56.761	1975	27.011
1998	56.690	1976	10.203	1976	10.273
		1977	0.073	1977	14.460
		1977 (July)	0.321	1977 (July)	17.220
		1977 (Sept.)	1.628	1978	3.709
		1978	10.690	1978 (Sept.)	6.922
		1978 (Sept.)	1.824	1979	53.239
		1979	6.737	1980	101.058
		1980	14.452	1981	41.746
		1981	43.699	1982	71.342
		1982	20.346	1983	151.131
		1983	13.030	1985	16.894
		1985	7.240	1987	0.463
		1987	2.356	1988	55.078
		1988	59.079	1990	47.435
		1989	53.735	1992	98.260
		1990	44.781	1993	79.578
		1991	37.295	1994	324.418
		1992	54.386	1995	41.036
		1993	49.965	1996	6.712
		1994	122.333	1997	51.752
		1995	198.638	1998	189.621
		1996	33.205		
		1997	64.464		
		1998	133.834		

Discussion

With the limited observations to date, halibut by-catch in the shrimp trawl fishery seems to be restricted to vessels using otter trawls. A majority of these otter trawl vessels are

trying to reduce the impact through the voluntary use of fish exclusion devices. The fish exclusion devices do not completely eliminate the halibut catch. However, there is preliminary but very limited information to suggest that they may reduce the problem by having the fish in better shape when they are released, as all of the observed halibut caught with gear using exclusion devices were released in good shape.

The observer coverage in QCS has been very good. This is in part due to improved logistics for observer deployment by requiring vessels to have a special permit issued monthly to fish the area. This allowed for constant contact with the vessels and made arranging observer coverage easier. Observer coverage in the other two areas relying on voluntary compliance is more hit and miss. It appears that until we get sampling coverage in the range of 5-10% of the total effort on the grounds, it will not be possible to get adequate estimates of halibut catches from these areas. Making Chatham Sound and WCVI permit areas which require monthly contact with the department could result in major improvements to the delivery of the program.

To date, observers have recorded the condition of halibut caught in the shrimp trawl fishery as good, poor, or dead. The International Pacific Halibut Commission (IPHC) has developed subjective criteria to describe halibut condition which are used in US and Canadian trawl fisheries. Shrimp trawl fishery observers could adopt these criteria to ensure conformity with other data sources.

It would be interesting to know if the shrimp survey indices of halibut abundance trends reflect the trends seen in other halibut abundance trends for these areas. Unfortunately, the data collected to date on surveys has been restricted to numbers and weight. Additional information could be collected if this information would be useful to the International Pacific Halibut Commission.

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References

Boutillier, J.A., M. Joyce, J. Bond and I. Winther. 1996. Assessing the Inshore Shrimp Fisheries: Data Status, Model Requirements, Problems. PSARC Working Paper I-96-11.

Hannah, R.W., S.A. Jones and V.J. Hoover. 1996. Evaluation of Fish Excluder Technology to Reduce Finfish Bycatch in The Ocean Shrimp Trawl Fishery. Oregon Department of Fish and Wildlife, Information Reports No. 96-4.

Southey, K., R. Harbo, and J. Boutillier. 1998. Shrimp Trawl Fishery – 1997/98. PSARC Fishery Update.