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An Update for the British Columbia Experimental Fishery for Pacific Hagfish (*Eptatretus stoutii*)

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ABSTRACT

A review of a recent experimental fishery for Pacific hagfish (*Eptatretus stoutii*) in British Columbia is presented. The fishery took place between May 2000 and June 2001 (the experimental fishery license was issued for May 2000-April 2002), and was restricted to Pacific Fishery Management Areas 23 and 123, inside and outside waters of Barkley Sound. Fisheries and biological data are described and historical records are updated. The available information is limited, but indicates that the current level of exploitation is not negatively impacting the stock. Because hagfish are slow growing and mature relatively late in life (8-10) years, caution in managing the fishery is advised. Continued restriction of the fishery to areas 23 and 123, and improved data collection is recommended.

RÉSUMÉ

Nous faisons un bilan de la récente pêche expérimentale de la myxine brune (*Eptatretus stoutii*) en Colombie-Britannique. La pêche, qui s'est déroulée de mai 2000 à juin 2001 (le permis de pêche expérimentale émis couvrait la période mai 2000-avril 2002), n'a été effectuée que dans les secteurs d'exploitation des pêcheries du Pacifique 23 et 123, soit dans les eaux intérieures et extérieures de la baie Barkley. Nous présentons les données recueillies sur la pêche et la biologie de l'espèce, ainsi qu'un bilan des données historiques. Les données disponibles, quoique limitées, indiquent que le niveau actuel d'exploitation n'a pas d'incidences néfastes sur le stock. Étant donné que la myxine est une espèce à croissance lente, n'atteignant la maturité que relativement tard (entre 8 à 10 ans), nous préconisons la prudence dans la gestion de la pêche. Nous recommandons en outre que la pêche continue d'être limitée aux secteurs 23 et 123 et que de plus amples données soient recueillies.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

1.0 INTRODUCTION

An experimental fishery for Pacific hagfish (*Eptatretus stoutii*) and black hagfish (*E. deani*) was conducted in British Columbia (B.C.) between 1988 and 1992. Interest in this fishery developed in response to increased demand for hagfish skins in Asia, which were tanned and marketed as 'eels skins'. Biological, catch, and effort data were collected and subsequently summarized (Neville and Beamish, 1992; Beamish and Neville, 1993). During these years, hagfish were fished throughout Pacific Fisheries Management Areas (PFMA) 3-4, 23-27, and 123-124, however, effort was concentrated in areas 23 and 123, Barkley Sound inside and outside waters, respectively. The fishery was managed by limiting effort in terms of the number of traps used and the number of vessels permitted to participate in the fishery. Traps were limited to 2000 per vessel in area 23 and 3500 per vessel in area 123. Korean traps were the primary gear type used, with the exception of a trial in 1992 using 5 gallon traps. The bulk of the traps were set between 70 and 120m. The majority of catches consisted of Pacific hagfish; the less desirable black hagfish were avoided by setting the traps in shallower waters. Managers did not set a minimum size limit, but a market limit of 30cm was in place during the fishery. A requirement of participation in the fishery was to participate in a monthly biological sampling program. Two sampling sites were selected: Kirby Point (PFMA 23-7), and Amphitrite Point. (PFMA 123-5). The biological data included length measurements from a large random sample of 1000 individuals, and a subsample of 200 fish was measured, sexed and examined for eggs. Catch and effort were recorded for each set. The experimental fishery terminated in 1992 due to a lack of markets.

In 1999 there was renewed interest in the hagfish fishery because of increased market demand as a food fish in Asia. It was recognised that some form of assessment was required before the fishery could be reinstated. Fisheries and Oceans Canada (DFO) applies a phased assessment approach to new and developing fisheries that is based on the precautionary principle. There are three steps in the process, designated as Phases 0, 1 and 2. A Phase 0 summary and analysis of the available fishery and biological information was undertaken (Leask and Beamish, 1999). One of the findings of the Phase 0 report was that there were insufficient data for adequate assessment of the stock(s). Therefore, it was recommended that the appropriate data be collected via a closely monitored, exploratory fishery. A license to fish hagfish in two management (areas 23 and 123) between April 2000 and March 2002 was granted to a single vessel. The objective of the experimental fishery was to collect data on the biology and population structure of Pacific hagfish in order to assess the viability of a hagfish fishery. Managers requested an assessment of the program in its second year and raised the following questions:

1. What is known about the biology and productivity of hagfish?
2. What is known about the biomass and stock size structure of hagfish and how does it relate to historical stock conditions?
3. Given the biological and fishery data collected, what can be determined about the biological sustainability of a hagfish fishery?

4. Is the current exploratory management regime collecting the appropriate information for the proper assessment of hagfish?

The objective of this paper is to provide an update of the current (2000-2002) experimental fishery, including catch and biological information and recommendations for continuing a Phase 1 experimental fishery.

2.0 ECOLOGY OF HAGFISH

The class Agnatha, or jawless fishes, includes the most primitive fish: hagfish (Order Myxiniformes) and lampreys (Order Petromyzoniformes) (Hart, 1973). Hagfish in general are not well studied fishes, in part because their deep water, bottom dwelling habitat poses logistical problems for researchers. However, where they are located, they are among the most abundant demersal fish species in terms of both numbers and biomass (Martini, 1998). There are close to 60 species of hagfish worldwide, but only black and Pacific hagfish are known to occur along the west coast of North America between California and Alaska (Hart,1973).

Hagfish are exclusively marine fishes that are associated with the bottom and are found as deep as 5000m. There is no minimum depth limit (Fernholm, 1998). Individual hagfish species have characteristic depth ranges. Off the west coast of North America, Pacific hagfish are most common at shallow depths (100-500m) while black hagfish are mainly associated with the shelf slope between 750 and 1000m (Martini, 1998). There are indications of habitat partitioning by age and sex. Johnson (1994) found that large male Pacific hagfish are located at the shallow depths (100m), the females are common at the deeper depths, and small individuals are found in intermediate (250m) depths. Smaller black hagfish predominate at depths close to 750m while the larger individuals are found deeper. All hagfish are slow swimmers and it is hypothesized that they form relatively isolated populations with small home ranges (Martini, 1998). Seasonal migrations are documented for only one species, however, there are indications that many species exhibit seasonal changes in their depth distribution (Wakefield, 1990). During December through March off California, the entire California population of Pacific hagfish migrates inshore to spawn, and this is exhibited in increased inshore abundance of the smaller individuals (females and juveniles) that generally occupy the deeper depths. A return migration of the smaller hagfish (females and juveniles) to deeper waters occurs in April through November and leaves only the larger males in the inshore waters (Stevens, 1995).

Hagfish are considered a nuisance species for commercial fishing operations (Hart, 1973), because feeding aggregations are attracted to dead or dying fishes captured in fishing gear. They are most often considered to be scavengers, but it is possible that hagfish are also predatory, as several species have been shown to be predators on a variety of invertebrates in addition to scavenging vertebrate remains (Martini, 1998). Little is known of hagfish reproduction and growth. A review of the available information may be found in Leask and Beamish (1999). In brief, it is believed that hagfish are slow growing (ca. 4cm per year) and of low fecundity, with 1 to 30 eggs per

female. Most species have been shown to spawn annually, and the age of maturity of females may be around 9 or 10 years.

3.0 EXPERIMENTAL DESIGN

Managers instituted a small scale, experimental fishery for hagfish in two areas (23 and 123) using one vessel. The objective of this fishery was to collect biological data to determine whether changes in CPUE (catch (kg) of hagfish per trap) were related to fishing effort or could be attributed to seasonal migration. Monthly samples from both areas 23 and 123 were required in order to examine seasonal trends in catch rates, and to explore the possibility of seasonal migration. Five-gallon traps were used for all commercial sets. These traps were 5-gallon pails modified with entrance tunnels. Korean traps were used to collect biological samples in order to maintain consistency between the biological samples collected in the 1988-1992 fishery. The Korean traps were cylindrical traps approximately 60cm long and 12cm in diameter. A single tunnel was located at the end of the trap. Catch and effort data were recorded for every set.

In order to generate information on the biology and population structure, and to determine whether the experimental fishery was affecting the population size structure, biological samples of Pacific hagfish were to be collected monthly at Kirby Point in Barkley Sound (area 23) using a minimum of 350 Korean traps. This sampling site was used in order to maintain consistency with the 1988-1992 sampling program. Monthly biological data from other sites in areas 23 and 123 were to be provided by sampling the commercial catch in these areas. The biological samples included a large random sample of approximately 1000 lengths and a sub-sample of approximately 200 fish that were individually sexed and measured.

4.0 RESULTS OF THE EXPERIMENTAL FISHERY

4.1 Commercial Data

A summary of the available hagfish data by area is presented in Table 1. The locations of commercial fishing operations during the May 2000 – June 2001 period are presented in Figure 1. Five-gallon traps were used for commercial sets in areas 23 and 123. Although it was a requirement of the fishing license, fishing did not occur monthly during the fishery. Logbook data are available for six trips spanning 7 of a possible 18 months.

4.1.1 Catch and Effort

Total hagfish catches from the B.C. commercial fishery are compared to total catches from California, Oregon and Washington States and from Nova Scotia, Maine, Massachusetts and New Hampshire on the east coast of Canada and the United States in Table 2. In B.C., catches ranged from 45 to 625 tonnes during the 1988-1992 period. No fishing took place between 1993 and 1999. Catches in 2000 (37t) and 2001 (57t) were of similar magnitude to those in the later years of the previous fishery (64t and 45t in 1991 and 1992 respectively) (Table 2). However, it is noteworthy that the current catch levels

are attained by a single vessel using the larger 5 gallon traps, while as many as 11 licenses were active on a monthly basis in the 1988-1992 fishery using Korean traps. In Oregon, hagfish catches ranged between 12 and 341t between 1988 and 1993. During the same time period, catches in California ranged between 136 and 2223t. In all areas, catches declined after 1993 due to a lack of markets. There was a small fishery in Oregon and California in 1996 in response to a small market, and the Oregon fishery increased again in 1999 after which interest in a B.C. fishery developed. On the east coast, there has been a small, steady fishery in Nova Scotia since 1989, and in Maine and Massachusetts since 1993.

The total catch over the period from 5-gallon traps was 9.28 t. No trend in CPUE is evident for either area (Table 3b, 4b; Figure 2). CPUE from the outside area (area 123) was higher than in the inside (area 23) in every month that fishing occurred in both regions. However, when the two areas were fished in the same month, the amount of effort and spatial coverage varied, and was generally concentrated in area 123. Area 23 was intensively fished using 5 gallon traps only in March and April of 2001 (Figure 1). Although direct comparisons between areas could not be made due to a lack of fishing in the outside area, the CPUE in area 23 (2.4 kg/trap in both months) is similar to the area 123 average CPUE of 2.3kg/trap.

4.2 Biological Data

To ensure continuity with the 1988-1992 fishery, biological data were collected in area 23 (Kirby Point) using Korean traps. Catch and effort were recorded for each set and biological samples were taken. Biological data are available for 10 of a possible 18 months from Kirby Point (Table 1). The biological samples conform to the required size of close to 1000 fish randomly selected for length frequency and close to 200 selected for more detailed examination. The length frequencies and sample sizes are shown in Figures 3 and 4.

4.2.1 Catch and Effort

The total catch using Korean traps during May 2000-June 2001 was 1577kg. No trend is evident in the CPUE (Table 3a, 4a, Figure 2). Because the gear type and area are the same, monthly CPUE in area 23 can be compared between 1988-1992 and 2000-2001 (Figure 5). CPUE in the first four months of the 1988-1992 fishery was high, between 0.8 and 1.1 kg/trap, and declined to an average of 0.44 kg/trap for the remainder of the fishery. Monthly CPUE varied without trend and averaged 0.47 kg/trap during the 2000-2001 fishery. When the CPUE is examined quarterly (Jan-Mar, Apr-Jun, Jul-Sep, Oct-Dec) an increase in the CPUE in the inshore waters (Area 23) is observed during the fall and winter months. During the same time period a decrease in CPUE is observed in Area 123 offshore waters (Talbe 3a, 4a). This may support the observations of Stevens (1995) that more females move to inshore waters in the winter. It is important to note that the spatial distribution of effort using Korean traps in the present fishery was lower than in the 1988-1992 fishery as fishing using the Korean traps in 2000-2001 was limited to the biological sample from Kirby Point.

4.2.2 Length

The range of sizes and average length of hagfish sampled at Kirby Point did not change during the May 2000 – June 2001 fishing period (Figures 3 and 4; Table 5). The average size was close to 40cm, and the minimum and maximum sizes captured in the fishery were 18.6 cm and 63.1 cm respectively. There was no length data available for hagfish from Amphitrite Pt. during the 2000-2001 fishing period, however mean lengths were similar between the two areas in the earlier fishery (Table 6). No direct estimates of growth and age are available for Pacific hagfish, however the results of a study on hagfish growth off California suggest that an 18 cm long hagfish is 4-8 years old, and a 45 cm long hagfish is 15-25 years old (Nakamura, 1994). The size and age of maturity for female Pacific hagfish has been estimated to be 35.4 cm and 8-12 years of age (Nakamura, 1994). If these results apply to the B.C. stock, then the majority of hagfish caught in Barkley Sound would range from 12 to >25 years old, and most females in Barkley Sound are mature.

In contrast to spawning related seasonal changes in size composition observed off California (Stevens, 1995), no change in length frequency distributions was observed in either the 1988-1992 or the 2000-2001 biological samples. It may be that the B.C. fishery did not sample the population adequately, or that the population dynamics differ between stocks. Additionally, there was no difference in size distributions of males and females captured in the B.C. fishery during 2000-2001 and 1988-1992 (Figure 3 and 4).

The proportion of females in the biological samples in area 23 from 1989-1992 and 2000-2001 is presented in Table 7. The results from the early fishery were consistent with the results of Stevens (1995), in that more females were present in the inshore waters in the winter. The proportion of females in the samples shifted from 40% in the summer months to 74% and 70% in the January 1990 and 1991 samples. Leask and Beamish (1999) noted that these high percentages of females were associated with high percentages of unidentified (unsexed) fish. These unidentified fish were smaller and presumably juveniles. Gorbman (1990) considered the sexual determination of hagfish to be “juvenile progynous hermaphroditism” as a single long gonadal fold develops ovarian tissue in the anterior portion of post-larval hagfish and may start developing testicular tissue in the posterior portion of larger individuals. Although the occurrence of fully developed hermaphrodites is rare, early stage hermaphroditism is more frequently observed in juveniles making sex determination difficult (Leask and Beamish 1999). The increased percentage of females and juveniles appears to support Stevens (1995) results, and indicates that an inshore spawning migration may occur in the B.C. stock. However, the results obtained from the 2000-2001 samples do not support this possibility, as the highest proportion of females in these samples (70% and 71%) occurred during the summer in June and July 2001. However, as noted previously, the effort used to collect the biological data in recent years is much lower than in the earlier fishery (350 traps per month compared to between 300 - 104522 traps per month).

The average size of hagfish at Kirby Point declined slightly from an average of 41.5cm during the 1988-1992 fishery to 40.0cm during 2000-2001, although this decline is not significant. Because no samples were collected in area 123, no comparison can be

made of the size of hagfish between areas, however, the length frequency data collected during 1988-1992 showed no difference in the average size in the two areas (41.4 and 41.5cm, for areas 123 and 23 respectively)(Table 5,6).

5.0 STATUS OF THE STOCK

Catches and Korean trap CPUE varied without trend in 2000 and 2001, and were of similar magnitude to catches in the final years (1991 and 1992) of the previous fishery. Based on the results of studies off California, the majority of hagfish in Barkley Sound range in age from 12 to >25 years and the fishery is targeting mature fish. This is an indication that the present level of exploitation may not be negatively impacting the stock. There is insufficient information to develop abundance estimates for the B.C. population(s). Nakamura (1991) suggests that they grow slower (between 1-2cm/year) than was previously thought (4cm/year), and mature at ages of 8 to 12 years. Although these data are preliminary, this information indicates that managers should take a cautious approach in the development of a hagfish fishery.

6.0 RECOMMENDATIONS

Limited information was collected during the recent experimental fishery. If managers intend to continue or expand the current fishery, the following recommendations are made:

1) Managers should continue to limit the fishery to areas 23 and 123 until sufficient information on the abundance, distribution, reproduction and age structure is obtained to assess the impacts of the current levels of fishing.
2) Fishing must be conducted year round in both areas 23 and 123 in order to examine seasonal movements and changes in density. Managers should consider closing the experimental fishery if the license requirements are not met.
3) Monthly biological sampling using Korean traps should continue at Kirby Point, and biological samples should be taken from commercial sets using 5 gallon traps in both areas 23 and 123 on a monthly basis. The samples should include a random sample of 1000 lengths and a sample of 200 fish stratified by length for which individual length, weight and sex are taken.

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Table 1. Commercial fishery and biological data available on Pacific hagfish in Pacific Fisheries Management Areas 23 and 123 (L=logbook, B=biological sample).

YEAR	MONTH	AREA 23	AREA 123	YEAR	MONTH	AREA 23	AREA 123
1988	October	L		1992	January		L
	November	L			February	L B	L B
	December	L B	L		March	L B	L B
1989	January	L	L		April	L	L
	February	L B	L		May	L B	L B
	March	L	L				
	April	L	L				
	May	L	L B	2000	May	L B	L
	June	B	L B		June	L B	L
	July	L B	L B		July	B	L
	August	B	L B		August		
	September		L		September	B	
	October	L B	L B		October	B	
	November	LB	L B		November		
	December	L B			December		
1990	January	L B	L B	2001	January	B	
	February	L B	L B		February		
	March	L B	L B		March	L B	
	April	L B	L B		April	L B	
	May	B	L B		May	L B	L
	June	B	L		June	B	L
	July	B	L B				
	August	B	L B				
	September						
	October	B					
	November						
	December						
1991	January	L B	L B				
	February		L B				
	March	B	L				
	April		L				
	May	B	L B				
	June						
	July	L B	L B				
	August	L B	L B				
	September						
	October						
	November						
	December	B	L				

Table 2 Landing statistics for hagfish (Pacific, Black, and Atlantic) in North America. Landings in metric tonnes. Values are taken from DFO and NMFS statistics.

YEAR	BC	WA	OR	CA	**Pacific & Black[b] Hagfish**	NS	ME	MA	NH	**Atlantic Hagfish**
1988	66		12	313.3	**391**					
1989	626		156	1198.6	**1980**	117				**117**
1990	167	36	76	2222.9	**2502**	88				**88**
1991	64		125	137.5	**326**	87				**87**
1992	45	19	341	183.9	**589**	205				**205**
1993			151	0.3	**151**	7	83	394		**484**
1994				0.6	**1**	108	29	1076		**1213**
1995			1	0.4	**1**	503		1421		**1925**
1996			17	82.7	**100**	269	410	1549		**2228**
1997				0.03	**0.03**	16	418		4	**438**
1998			9	0.2	**9**	56	876	572		**1503**
1999			303		**303**		1319	1063		**2382**
2000	37		145		**182**	484	544	2541		**3569**
2001[a]	57				**57**	126				**126**
TOTAL	**1062**	**55**	**1335**	**4140**	**6592**	**2064**	**3679**	**8617**	**4**	**14364**

[a]2001 includes January to June only.
[b]Black hagfish as by-catch only.

Table 3A Landing statistics for Pacific hagfish in PFMA 23, Barkley Sound Inside Waters using Korean traps. Average weight of individual hagfish in samples 0.1kg.

YEAR	MONTH	LANDINGS (kg)	EFFORT (# of traps)	CPUE (month) (kg/trap)	CPUE (quarter) (kg/trap)	TOTAL LANDINGS Annual	CPUE Average Annual
1988	October	3653	4200	0.9	1.0	66192	1.0
	November	32797	28647	1.1			
	December	29742	36275	0.8			
1989	January	86554	104522	0.8	0.7	226919	0.6
	February	57822	81175	0.7			
	March	12926	34000	0.4			
	April	9763	26478	0.4	0.4		
	May	4558	12896	0.4			
	June	a					
	July	12355	21504	0.6	0.6		
	August	a					
	September	a					
	October	15085	27900	0.5	0.6		
	November	6942	13850	0.5			
	December	20914	33077	0.6			
1990	January	25096	52542	0.5	0.4	62341	0.4
	February	17522	39940	0.4			
	March	18997	53422	0.4			
	April	725	2100	0.3	0.3		
	May	a					
	June	a					
	July	a			a		
	August	a					
	September	a					
	October	a			a		
	November	a					
	December	a					
1991	January	4550	10900	0.4	0.4	6879	0.3
	February	a					
	March	a					
	April	a			a		
	May	a					
	June	a					
	July	23	300	0.1	0.3		
	August	2306	7596	0.3			
	September	a					
	October	a			a		
	November	a					
	December	a					
1992	January	a			0.4	2610	0.5
	February	136	400	0.3			
	March	272	600	0.5			
	April	477	1450	0.3	0.6		
	May	1725	2099	0.8			
2000	May	148	350	0.4	0.5	743	0.5
	June	182	350	0.5			
	July	116	350	0.3	0.3		
	August	a					
	September	C					
	October	297	350	0.8	0.8		
	November	a					
	December	a					
2001	January	272	350	0.8	0.5	789	0.5
	February	a					
	March	93	350	0.3			
	April[b]	127	350	0.4	0.4		
	May	226	350	0.6			
	June	71	350	0.2			

a – No fishing occurred.
B – See table 4b
C – no weight data

Table 3B Landing statistics for Pacific hagfish in PFMA 23, Barkley Sound Inside Waters using 5 gallon traps.

YEAR	MONTH	LANDINGS (kg)	EFFORT (# of traps)	CPUE (month) (kg/trap)	TOTAL LANDINGS Annual	CPUE Average Annual
2000	May	2043	1215	1.7	4472	1.8
	June	2429	1307	1.9		
	July	a				
	August	a				
	September	a				
	October	a				
	November	a				
	December	a				
2001	January	a			37371	2.2
	February	a				
	March	15625	6566	2.4		
	April	10714	4470	2.4		
	May	11032	5900	1.9		
	June	a				

Table 4a Landing statistics for Pacific hagfish in PFMA 123, Barkley Sound Outside Waters using Korean traps. Average weight of individual hagfish in samples 0.1kg.

YEAR	MONTH	LANDINGS (kg)	EFFORT (# of traps)	CPUE (month) (kg/trap)	CPUE (quarter) (kg/trap)	TOTAL LANDINGS Annual	CPUE Average Annual
1988	October	a					
	November	a					
	December	a					
1989	January	2400	2505	1.0	0.8	322817	0.7
	February	12700	17368	0.7			
	March	4550	5490	0.8			
	April	27800	26740	1.0	0.8		
	May	48206	42232	1.1			
	June	42875	73725	0.6			
	July	35683	46786	0.8	0.7		
	August	57810	82651	0.7			
	September	54461	84574	0.6			
	October	26678	42872	0.6	0.6		
	November	9654	17544	0.6			
	December	a					
1990	January	4932	10633	0.5	0.4	82831	0.3
	February	21404	69735	0.3			
	March	19575	49134	0.4			
	April	10772	29518	0.4	.02		
	May	12442	59325	0.2			
	June	5482	29362	0.2			
	July	745	7453	0.1	.03		
	August	7479	25278	0.3			
	September	a					
	October	a			a		
	November	a					
	December	a					
1991	January	14009	21857	0.7	0.7	51283	0.6
	February	682	1197	0.6			
	March	15727	22463	0.7			
	April	10247	10992	0.9	0.9		
	May	3205	3839	0.8			
	June	a					
	July	4971	29561	0.2	0.2		
	August	2261	6580	0.3			
	September	a					
	October	a			0.2		
	November	a					
	December	181	800	0.2			
1992	January	1232	3000	0.4	0.4	3037	0.5
	February	114	200	0.6			
	March	1328	4295	0.3			
	April	136	350	0.4	0.5		
	May	227	350	0.6			
2000	May	45.4	230	0.2	0.2	45.4	0.2

a – No fishing occurred.

Table 4b. Landing statistics for Pacific hagfish in PFMA 123, Barkley Sound Outside Waters using 5 gallon traps.

YEAR	MONTH	LANDINGS (kg)	EFFORT (# of traps)	CPUE (month) (kg/trap)	TOTAL LANDINGS Annual	CPUE Average Annual
2000	May	12056	5044	2.4	32225	1.9
	June	10760	5446	2.0		
	July	9409	6133	1.5		
	August	a				
	September	a				
	October	a				
	November	a				
	December	a				
2001	January	a				
	February	a				
	March	a				
	April	a				
	May	3450	1250	2.8	18716	2.8
	June	15266	5468	2.8		

Table 5 Summary of Pacific hagfish length data from PFMA 23-7, Barkley Sound Inside Waters. Sample station Kirby Point.

Year	Date	Mean Length (cm)	Min. Length (cm)	Max. Length (cm)
1989	June	36.6	19.0	62.0
	July	48.3	32.0	63.0
	October	44.1	29.0	61.0
	November	45.6	26.0	68.0
	December	45.8	27.0	69.0
1990	January	38.9	27.0	63.0
	February	44.3	29.0	64.0
	March	40.5	30.0	58.0
	April	41.4	20.0	64.0
	May	46.2	24.0	64.0
	June	38.1	18.0	59.0
	July	33.5	16.0	57.0
	August	45.6	23.0	72.0
	October	44.0	27.0	66.0
1991	January	45.6	26.0	65.0
	March	46.3	23.0	72.0
	May	43.7	24.0	65.0
	July	41.1	26.7	62.1
	August	30.4	21.2	63.3
	December	37.8	20.4	56.2
1992	February	41.2	21.2	60.2
	March	34.9	23.1	60.4
2000	May	40.9	23.0	59.1
	June	40.6	22.8	60.0
	July	40.1	21.0	59.2
	September	38.4	23.5	57.7
	October	40.5	23.6	59.1
2001	January	39.9	18.6	63.1
	March	40.5	23.0	59.0
	April	39.5	22.0	52.8
	May	40.1	21.3	60.5
	June	40.2	22.4	59.1

Table 6. Summary of Pacific hagfish length data from PFMA 123-5, Barkley Sound Outside Waters. Sample station Amphitrite Point.

Year	Month	Mean Length (cm)	Min. Length (cm)	Max. Length (cm)
1989	May	45.0	24.0	68.0
	June	42.1	22.0	61.0
	July	45.4	22.0	65.0
	August	47.8	24.0	67.0
	October	44.0	23.0	69.0
	November	41.7	22.0	61.0
1990	January	39.5	22.0	61.0
	February	42.4	19.0	68.0
	March	43.8	20.0	66.0
	April	38.7	17.0	60.0
	May	42.9	19.0	60.0
	July	43.9	23.0	67.0
	August	44.6	21.0	67.0
1991	January	42.5	24.0	61.0
	March	44.5	22.0	73.0
	May	45.8	25.0	72.0
	July	47.2	21.8?	61.2
	August	43.9	22.2	62.3
1992	March	46.3	20.4	64.9

Table 7. The proportion of females in biological samples in PFMA23-7, Barkley Sound Inside waters. 1989-2001.Sample station Kirby Point. Sample size = 200.

YEAR	MONTH	% female
1989	JUNE	69
	JULY	48
	AUGUST	41
	OCTOBER	42
	NOVEMBER	46
	DECEMBER	44
1990	JANUARY	74
	FEBRUARY	53
	MARCH	55
	APRIL	54
	MAY	35
	JUNE	36
	JULY	48
	AUGUST	56
	OCTOBER	57
1991	JANUARY	70
	MARCH	62
	MAY	63
	JULY	62
	AUGUST	58
	DECEMBER	66
1992	FEBRUARY	58
	MARCH	63
2000	MAY	53
	JUNE	71
	JULY	70
	SEPTEMBER	42
	OCTOBER	59
2001	JANUARY	58
	MARCH	55
	APRIL	67
	MAY	55
	JUNE	59

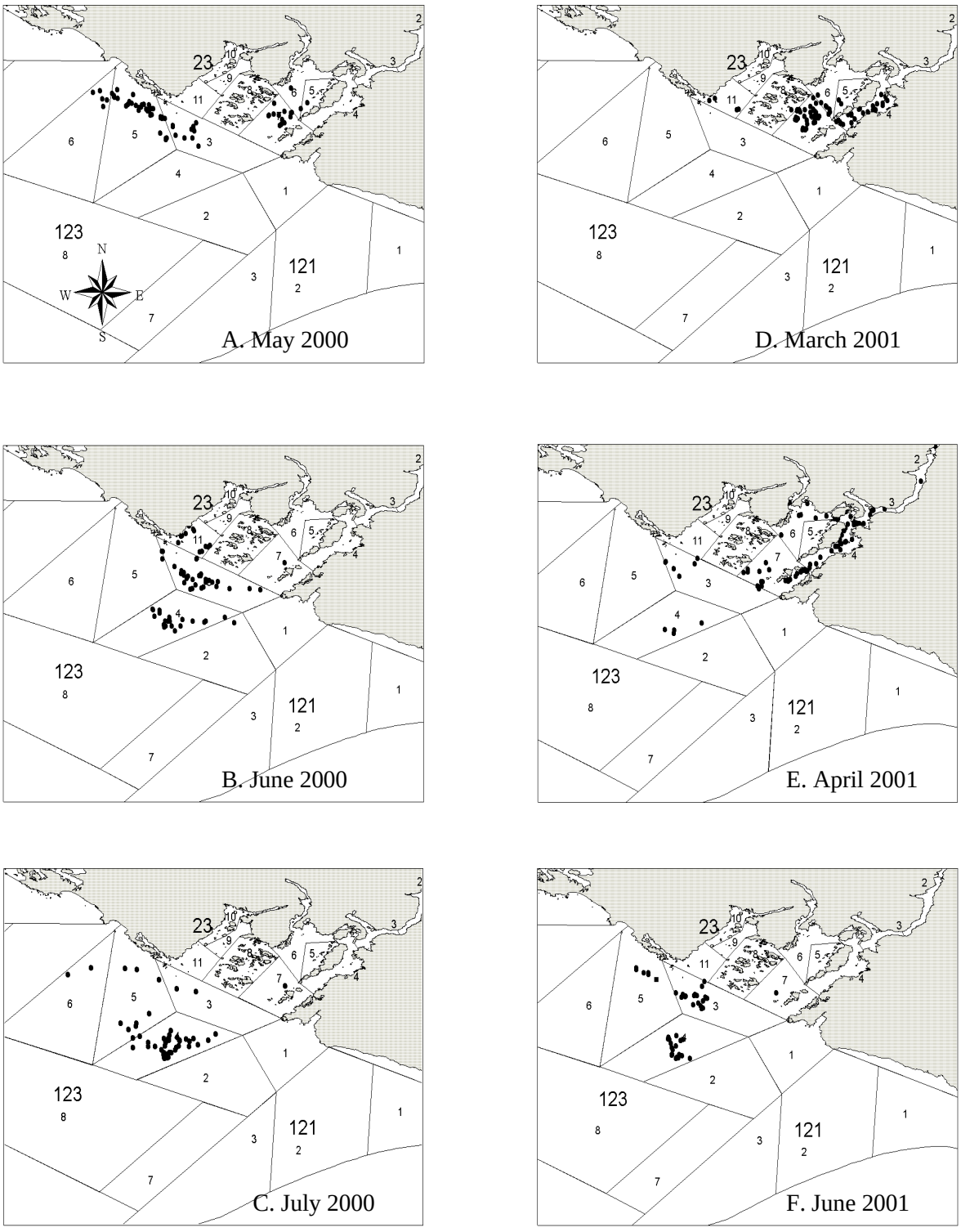

Figure 1 Fishing locations Area 23 and 123 for 2000 and 2001.
A. May 7-31, 2000. B. June 8-28, 2000. C. July 7-26, 2000
D. March 7- April 4, 2001. E. April 23- May 29, 2001.
F. June 7-22, 2001.

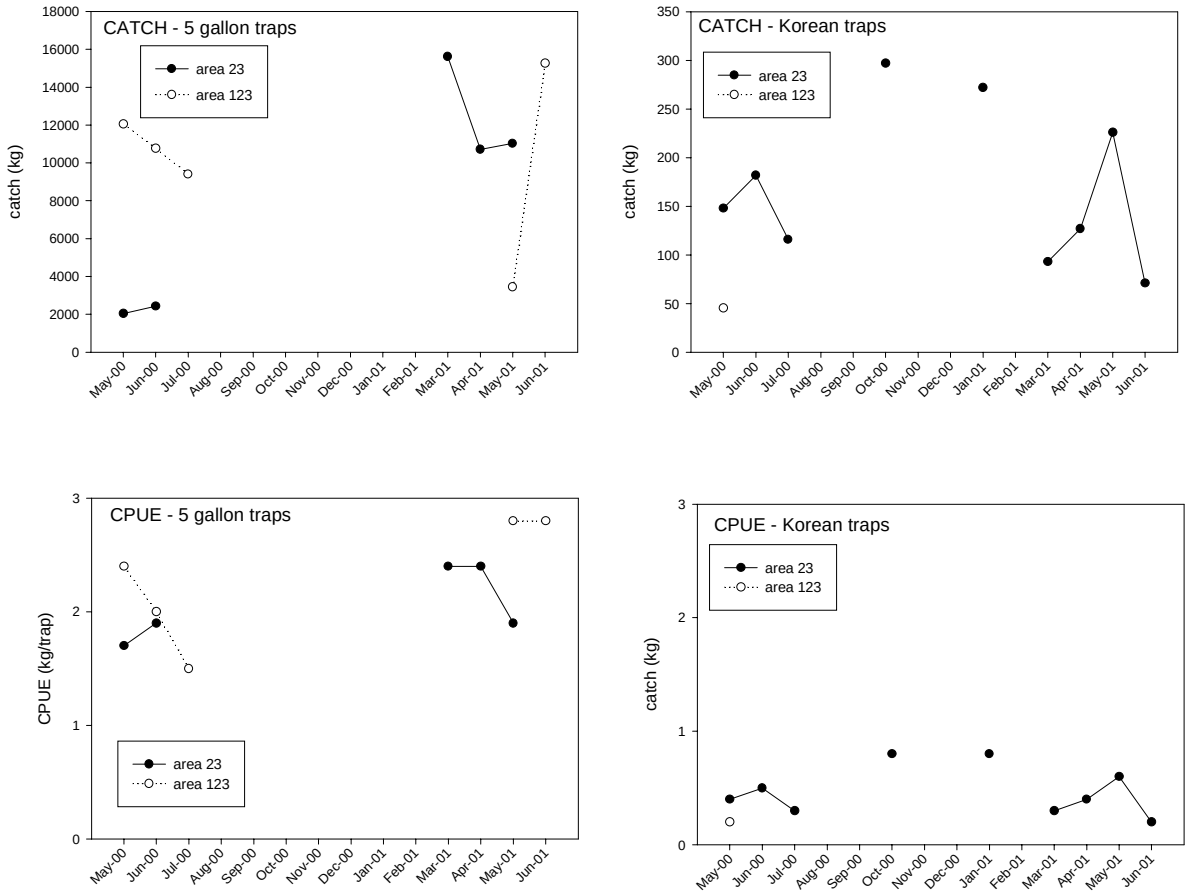

Figure 2 Catch (kg) and CPUE (kg/trap) during the 2000 and 2001 BC hagfish fishery.

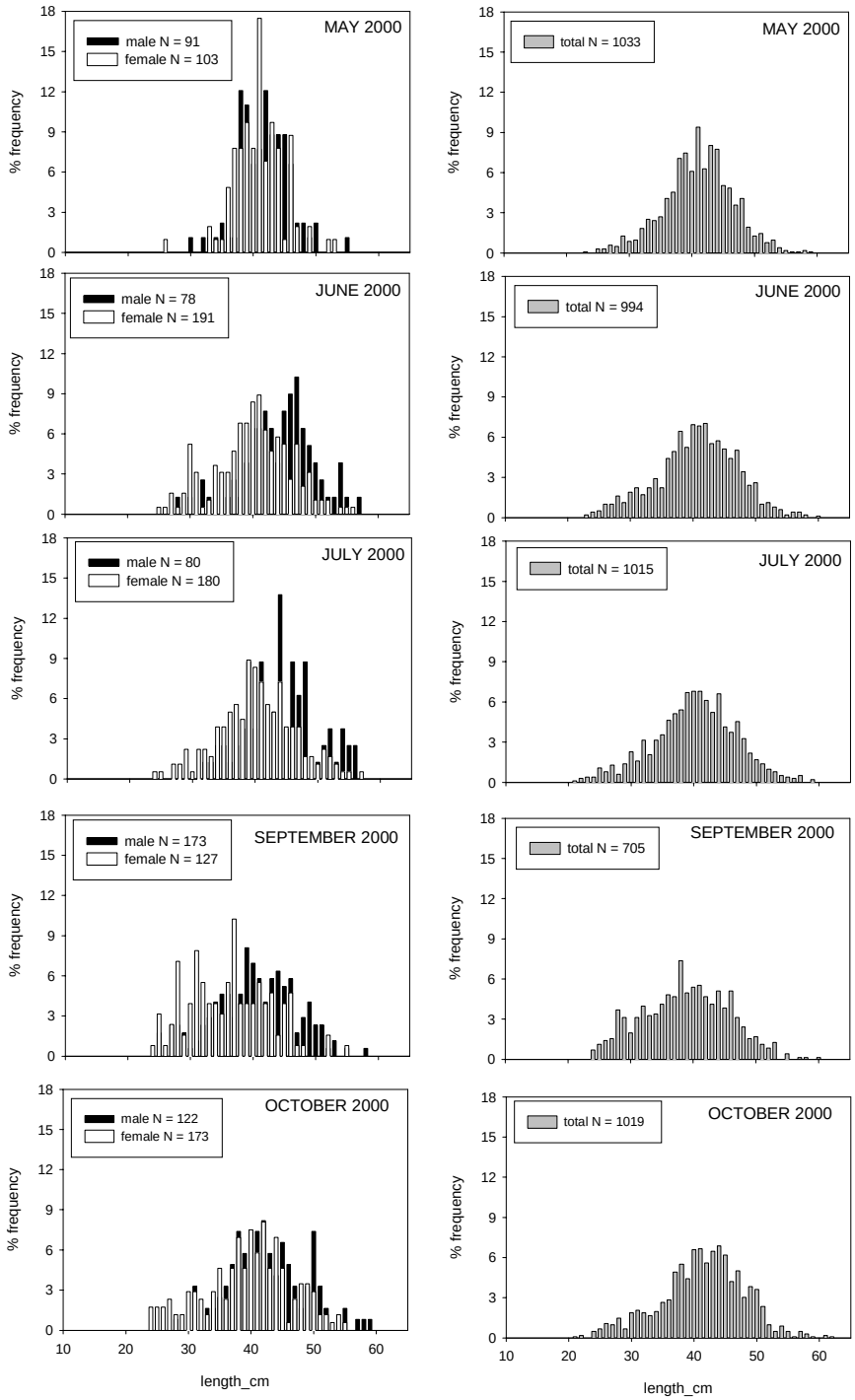

Figure 3 Kirby Point male (black), female (white) and total (grey) length frequencies May-October 2000.

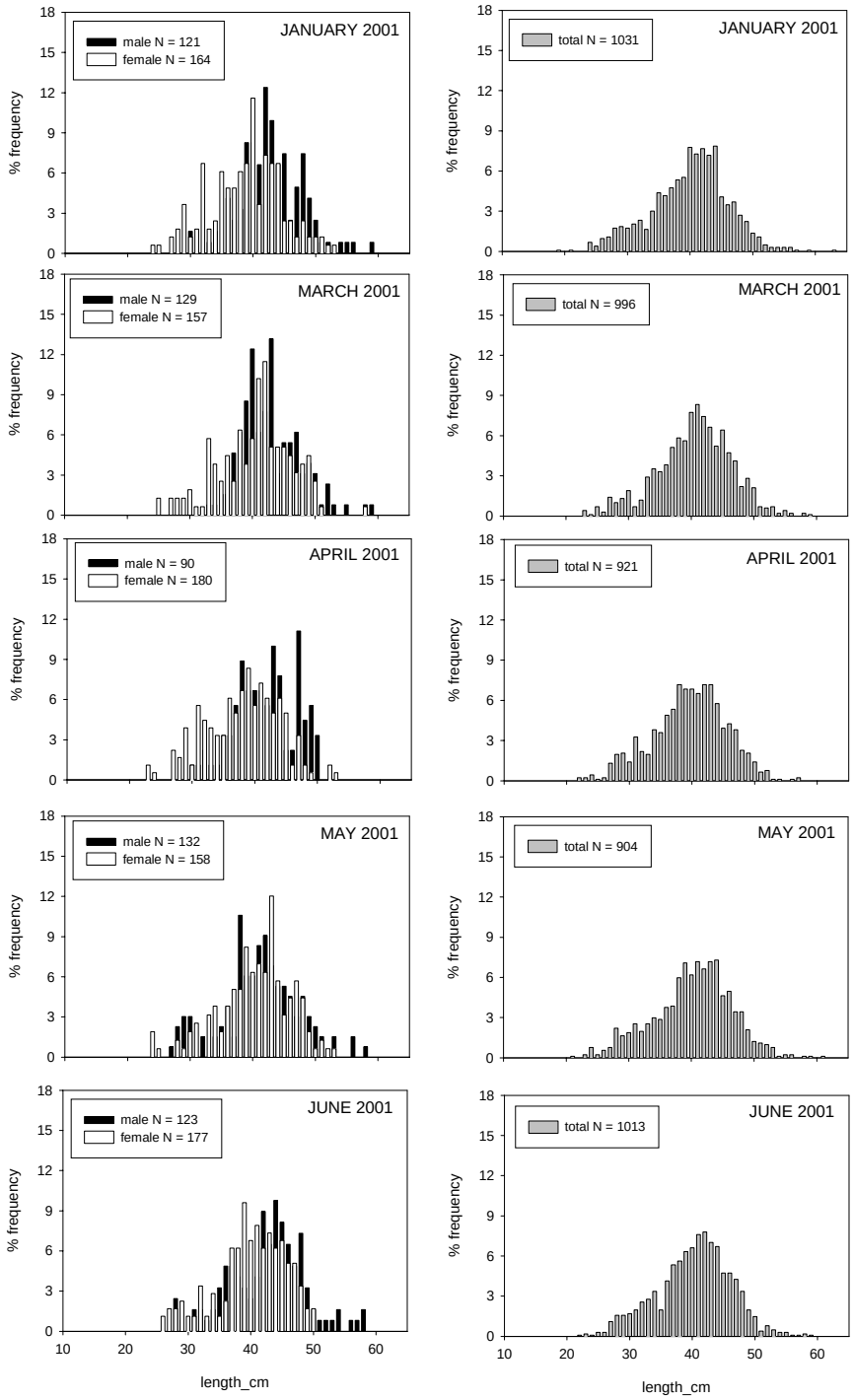

Figure 4 Kirby point male (black), female (white) and total (grey) length frequencies January-June 2001.

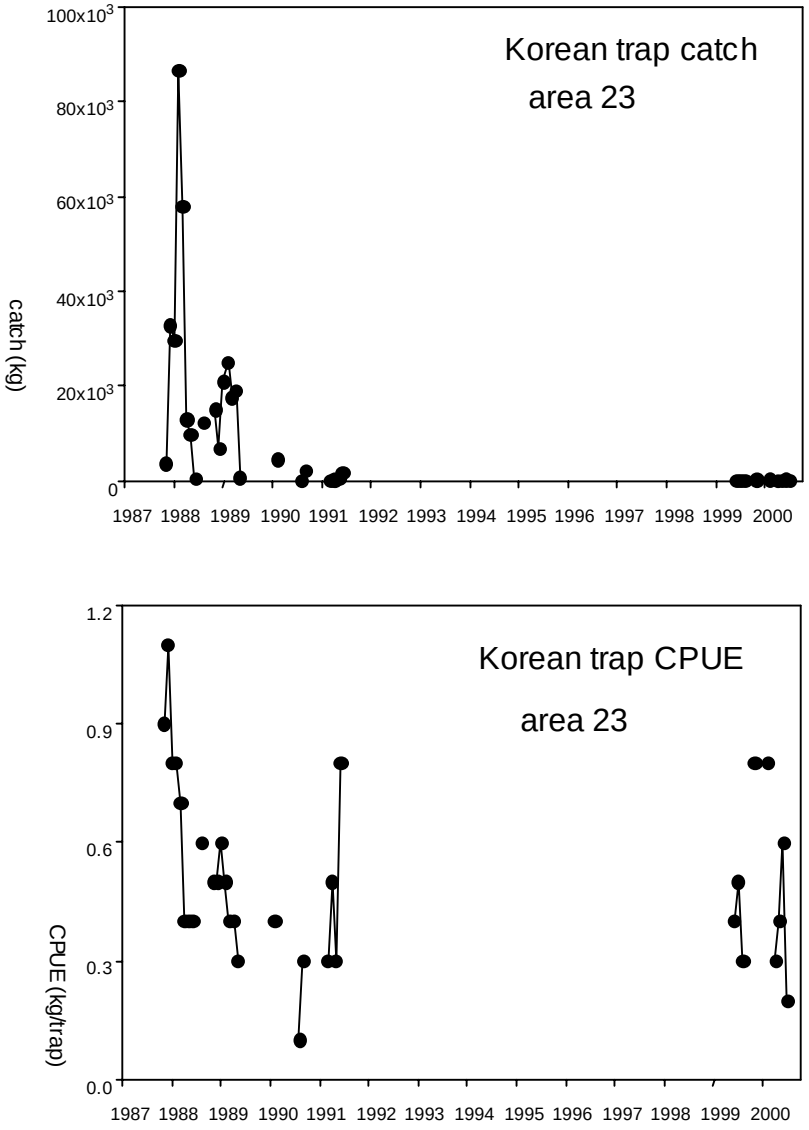

Figure 5 Hagfish catch (kg) and catch per unit effort (kg/trap) in the BC hagfish fishery 1988-2001. Catches shown for area 23.