

**Developmental Fisheries Program
Annual Review of Activities**

**Prepared for Oregon Fish and Wildlife Commission
December 11, 2009 Salem, Oregon**

Introduction

This report constitutes the 2009 annual review of the Developmental Fisheries (Devo) Program. The Developmental Fisheries Program and Developmental Fisheries Board were created by the 1993 Legislature to make recommendations to the Fish and Wildlife Commission on developmental fisheries. State policy requires the Commission to institute a management system for developmental fishery resources that addresses both long term commercial and biological values and that protects the long term sustainability of those resources through planned commercial development when appropriate (ORS 506.455).

List of Species and Current Landings

Table 1 and 2 identify the categories of developmental species and indicate pounds landed and value by developmental fisheries species in 2008 and 2009. Those species requiring permits for harvest are listed in Category A within both tables. From species in Category A, the hagfish fishery in 2009 through September has landed only a quarter of the pounds landed in 2008. From discussions with both fishermen and processors this decrease can be contributed to instability of the hagfish markets overseas as well as the economic downturn in our own economy.

Many list changes were implemented through the 2008 annual review process, effectively making many of those species permitted in 2008 open access in 2009. None of the species that were removed from Category A and placed onto the Category B or C list have landed.

Landings of a few species, both in Category B and C, are worth mentioning here. Humboldt squid is included under the general grouping of 'other squid' listed as a Category B species. During October of 2008, as the whiting fishery was winding down, a few vessels participating in the whiting fishery encountered Humboldt squid. The whiting fishery is a full retention fishery mandating the vessels to land the large loads of squid, which was mostly sold at low prices for bait or ground up and dumped back out at sea. In 2009 the whiting fishery occurred much earlier in the year and no large Humboldt squid tows were recorded. The second Category C listed species of potential interest, also caught in the groundfish trawl fishery is Pacific cod. Landings of Pacific cod in 2009 increased ten-fold from 2008 pounds landed. This species is managed by the Pacific Fishery Management Council (PFMC) and conservation measures are addressed through the federal process as appropriate.

Permits

Each year the department issues permits for the harvest of developmental fisheries Category A species. Currently a total of 35 developmental fisheries permits are considered active. Five additional hagfish permits were issued through 2009, but were not fished and subsequently expired. Table 2 lists the number of permits issued and available through September of 2009. Of the permits issued in 2008, eleven permits achieved the landings requirements which allowed automatic renewal for 2009. Nine out of the eleven permits were re-issuance of hagfish permits. In 2009, there were no lotteries for any developmental fisheries permits and only the spot prawn fishery was fully prescribed with all ten permits issued since the end of February.

Budget

Funds generated from developmental fishery landing tax revenues were dramatically reduced in 2006 due to the removal of Pacific sardines and bay clams. In the past, these fisheries contributed approximately 30 percent of all funds to the budget. The landing fees for species in all categories have generated approximately \$8,170 into the developmental fisheries fund for 2009 (through September).

Advisory Board Update

During 2009 staff hosted three Developmental Fisheries Advisory Board meetings and one public meeting. For full manuscripts of each of the meetings that occurred during the re-evaluation of the program see Appendix A of this attachment. See below for brief summaries of each of the 2009 meetings.

February 18, 2009 – (Three board members and two ex-officio members participated) Staff presented a recap of the December 2008 Commission meeting and the changes that were made to Developmental Fisheries. The meeting was then turned over to Dalton Hobbs, Oregon Department of Agriculture (ODA) representative who led discussions regarding marketing opportunities, commodity commissions and the processes and integration of these for developing fisheries. Staff concluded the meeting with an informational presentation to the Board about the upcoming hagfish research project in its development stages.

July 14, 2009 – (Two board members participated) This meeting began discussions regarding the temporary suspension of the Developmental Fisheries Program due to funding shortfalls in the 2009-2011 biennium. Staff presented options for each fishery that was permitted in during 2009. Of the five permitted fisheries, most discussions focused on the hagfish and spot prawn fisheries which have been the most viable fisheries in most recent years. Options for both of these fisheries included creating limited entry programs, creating two-year permits and transferring the species to the non-permitted Category B list of developmental fisheries. The two board members present both strongly supported creating limited entry programs for both the spot prawn and hagfish fisheries. Due to the magnitude of the changes discussed, staff wanted to obtain representative feedback from the Board and hosted two additional conference calls to discuss options for each of the permitted fisheries (conference calls occurred on July 21, 2009 and July 22, 2009; two additional board members and one ex-officio member participated).

August 4, 2009 – Staff hosted a public meeting to discuss with current and past permit holders the options for each of the permitted developmental fisheries. Five hagfish permit holders; four spot prawn permit holders and one anchovy permit holder participated in the meeting. All of the hagfish permit holders present supported creating a limited entry program for the hagfish fishery. Three of the spot prawn permit holders supported creating a limited entry program for spot prawns. The one spot prawn permit holder that did not want limited entry, supported keeping the fishery as close to status quo with a two year permit. The anchovy permit holder present supported a two year permit and suggested decreasing the number of permits available each year from 15 to closer to five.

August 12, 2009 – (Three board members and one ex-officio member participated) This meeting was held in order to receive final recommendations from the Board for each of the permitted fisheries. In summary the majority of the Board was not in support of moving forward with any limited entry programs, instead they support moving each of the species onto the appropriate Category B or C list.

Program Re-Evaluation

In 2007, the department received authorization from the Legislature for a one-time funding distribution from the developmental fisheries dedicated account to evaluate the program and to fund specific research on one or more of the remaining developmental species fisheries. In this evaluation, staff, with guidance from the Devo Board, examined how the program and the board operate, where to improve efficiencies, and how to manage the program on an extremely limited budget. The

Devo program began the fully staffed (one NRS-2 and two EBA positions) re-evaluation in February of 2008. At-sea observing and market sampling for the hagfish (Part 1) and spot prawn (Part 2) fisheries began in March, 2008 and continued the duration of the biennium, through June of 2009.

Re-evaluation Summary Report (Appendix A)

Hagfish Assessment (Part 1)

Staff collected market and discard samples of hagfish, conducted ride-along trips on a fraction of the 2008 hagfish fleet to observe fishing activities, collected logbooks, began analysis for size, sex, and maturity, and have started development of fishery independent research projects. *Please see Appendix A for further information.*

Spot Prawn Assessment (Part 2)

Staff sampled market and discard sized spot prawns, the entire haul on two ride along trips, collected logbooks, began analysis for size, sex, and maturity, and have started development of fishery independent research projects. *Please see Appendix B for further information.*

Hagfish Research Project (Part 3)

Staff implemented a fishery independent research project on population structure, discard survival and gear fishing behavior of Pacific hagfish. Not complete at this time, scheduled for completion by December, 2009.

Table 1. Total pounds landed into Oregon of developmental fisheries species through September, 2009. Gray shading indicates data cannot be displayed due to confidentiality requirements. The rockfish, except shortbelly, are landed as species complexes so ticket data is not reflective of actual landings.

Category A	Pounds	Category B	Pounds	Category C	Pounds
Pacific hagfish	417,142	salmon shark	0	spiny dogfish	58,384
northern anchovy	***	carp	0	soupin shark	172
Pacific herring	15,441	black hagfish	0	skate	1,967,6621
swordfish	0	yellow perch	0	American shad	9,403
box crab	0	eelpouts	0	Pacific cod	110,929
spot shrimp	***	brown bullhead	0	Pacific flatnose	0
		skiffish	***	Pacific grenadier	85,973
		northern squawfish	0	jack mackerel	***
		Pacific saury	0	Pacific mackerel	115,567
		Pacific sandfish	0	greenstriped rockfish	0
		eulachon	4,349	redstripe rockfish	0
		whitebait smelt	0	shortbelly rockfish	0
		surf smelt	0	sharpchin rockfish	0
		longfin smelt	0	splitnose rockfish	0
		night smelt	0	Pacific sanddab	381,146
		Pacific pomfret	0	butter sole	280
		slender sole	1,015	English sole	341,896
		pacific sand crab	0	rex sole	677,899
		freshwater mussels	0	rock sole	2057
		Oc. cockle clams	0	sand sole	89,428
		market squid	***	curffin sole	361
		other squid	40,884	spotted rattfish	***
		fragile urchin	0	wolf-eel	181
		sea cucumber	0	walleye pollock	0
		giant octopus	5,210	blue shark	***
		coonstripe shrimp	0	red rock crab	2,308
		sidestripe shrimp	0	purple sea urchins	0

	grooved tanner crab	0	crayfish	57,469
	Oregon hair crab	0		
	scarlet king crab	0		

Table 2. Total pounds landed into Oregon of developmental fisheries species during 2008. Gray shading indicates data cannot be displayed due to confidentiality requirements. The rockfish, except shortbelly, are landed as species complexes so ticket data is not reflective of actual landings.

Category A	Pounds	Category B	Pounds	Category C	Pounds
Pacific hagfish	1,590,673	salmon shark	0	spiny dogfish	91,546
blue shark	396	carp	0	soupin shark	142
swordfish		black hagfish	0	skate	2,210,548
northern anchovy	572,201	yellow perch	0	American shad	37,602
Pacific herring	132,712	eelpouts	0	Pacific cod	14,916
box crab	0	brown bullhead	0	Pacific flatnose	0
tanner crab	0	skilfish	0	Pacific grenadier	72,390
Oregon hair crab	0	northern squawfish	0	jack mackerel	100,621
scarlet king crab	0	Pacific saury	0	Pacific mackerel	126,958
spot shrimp	***	Pacific sandfish	0	greenstriped rockfish	0
coonstriped shrimp	***	smelt	0	redstripe rockfish	0
sidestripe shrimp	0	Pacific pomfret	***	shortbelly rockfish	***
octopus	3,039	slender sole	***	sharpchin rockfish	0
snails	0	pacific sand crab	0	splitnose rockfish	0
flat abalone	1,691	freshwater mussels	0	Pacific sanddab	148,898
		Oc. cockle clams	0	butler sole	***
		squid (market and other)	773,994	English sole	341,438
		fragile urchin	0	rex sole	741,878
		sea cucumber	0	rock sole	458
				sand sole	36,192
				curlfin sole	49
				spotted ratfish	0
				wolf-eel	363
				walleye pollock	0
				red rock crab	363
				purple sea urchins	0
				crayfish	66,861

Table 3. Developmental fisheries permits issued in 2009 (as of October 6, 2009).

Species	Permits Allowed	Active Permits Issued	Renewals from 2008	Gear Used
Pacific hagfish	25	18	9	pot or longline
swordfish	10	0	0	drift gillnet
northern anchovy & Pacific herring	15	6	1	purse seine
box crab	25	1	0	pot
spot prawn-North-pot only	5	5	0	pot
spot prawn-South-pot only	5	5	1	pot

Appendix A
Part 1

**Oregon Pacific hagfish (*Eptatretus stouti*)
Fishery 2008-2009 Assessment Summary Report**

Oregon Hagfish Fishery

Pacific hagfish (*Eptatretus stouti*) was added to Oregon's Developmental Species List in 1995. Annually there are 25 fixed-gear permits for harvest. Through 2008, permits had annual renewal requirements of five landings of at least 1,000 pounds or more, or 25,000 or more cumulative pounds. Landings had to be made in at least three different months. New hagfish permits were valid for 90 days from date of issue, unless five landings of at least 1,000 pounds each or a total of 25,000 pounds were made within 90 days from date of issue, in which case the permit was validated for the remainder of the year. Several changes took effect at the beginning of 2009 simplifying the permitting and landing requirements for the hagfish fishery. Two requirements were completely removed including the "landings in three separate months" requirement and the annual renewal requirement of 5/1,000 pounds landings. Additionally the temporary permit time period was increased from 90 to 120 days, and initial landing requirements were reduced from 25,000 pounds to 5,000 pounds to validate temporary permits for the year.

The first directed landings in the Oregon hagfish fishery occurred in 1988 and totaled over 25,000 lbs (Figure 1). The first peak in landings occurred in 1992 when all Oregon hagfish was sold to Korean markets for non-consumptive use of the hagfish skins for production of leather. From 1994-1998, very little hagfish harvest took place in Oregon, most likely due to the high level of instability of the markets for hagfish leather.

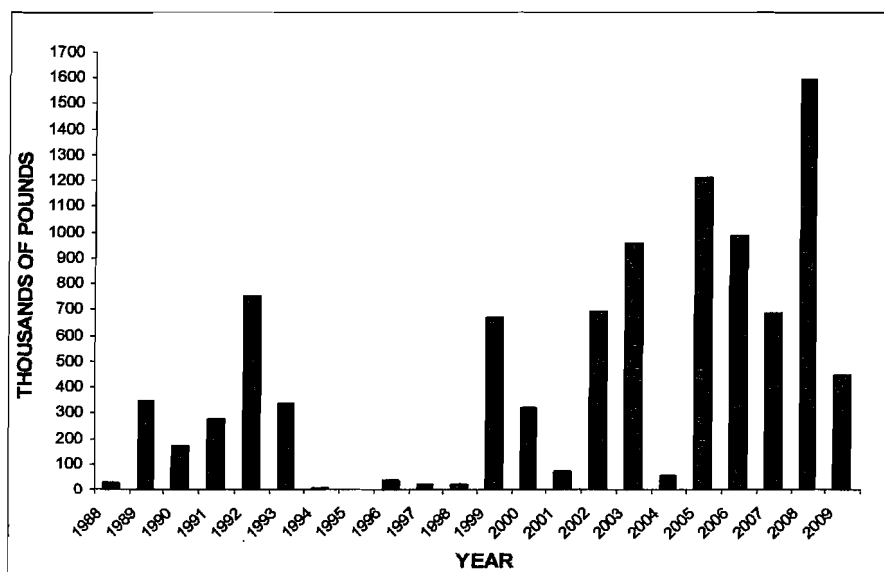


Figure 1. Oregon landings of Pacific hagfish: 1988-2009.

By 1999, Oregon hagfish fishermen began selling Oregon caught hagfish for consumption to the Korean food markets. Landings rise and fall through the years with the highest total landings of close to 1.6 million pounds occurring in 2008 (Figure 1). The majority of the fishing effort for hagfish has historically originated from the port of Charleston, with occasional effort out of Newport and Astoria. In contrast, 2008 total landings into north and south ports were relatively equal (Figure 2), however landings

shifted back to historical patterns in 2009 with over 70 percent of the total hagfish landed into southern ports.

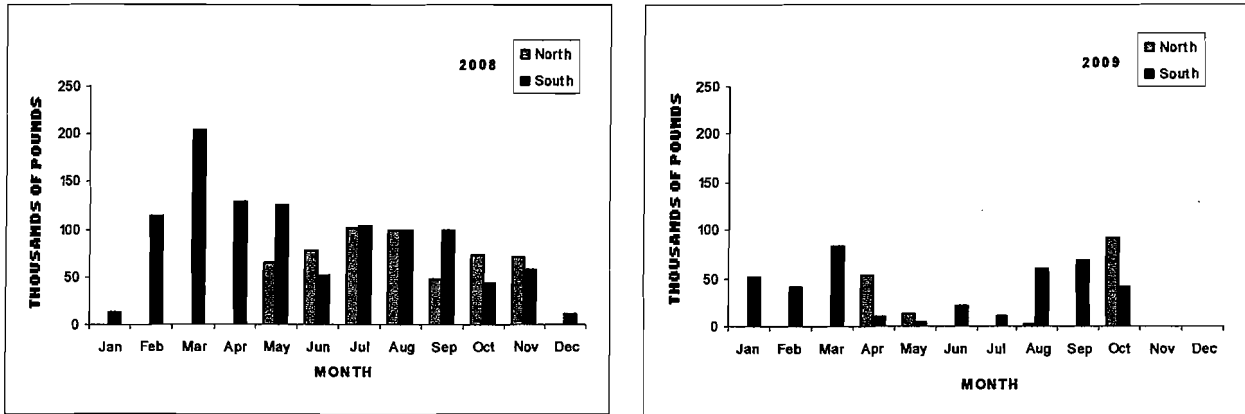


Figure 2. Pacific hagfish landings into Oregon ports in 2008 and 2009 by geographic area. Landings from ports from Astoria to Newport are combined and represented by the northern labeled bars and all landings into ports south of Newport are combined and represented by the southern labeled bars.

Landing data from the five-year average indicate the least amount of hagfish is landed in December and January, most likely due to unfavorable weather conditions and the start of the Dungeness crab fishery (Figure 3). In 2008 and 2009, the hagfish fleet ranged in boat size from 39 to 83 feet with an average vessel length of 53 feet. Many of the vessels participate in other fisheries such as albacore tuna, Dungeness crab, sablefish (black cod), spot prawn, and Pacific halibut. Most hagfish fishermen harvest hagfish in between fishing for other species, using the fishery to fill in times of the year with less productive fishing for other species.

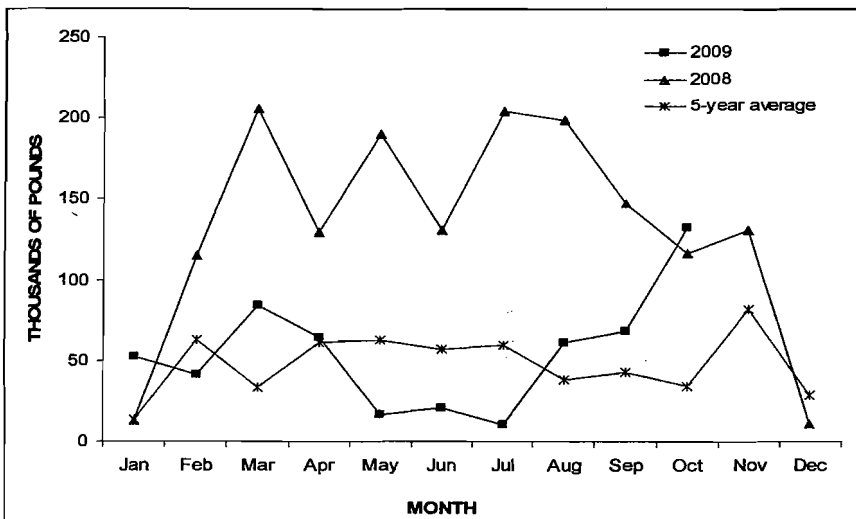


Figure 3. Oregon Pacific hagfish landings by month in 2008, 2009 and the 5-year average.

Each year, as mentioned above, 25 hagfish permits are available for issuance. In 2008, all 25 hagfish permits were issued, which was only the second time all of the permits had been subscribed since the fishery was added to the Developmental Fisheries list. Although each year a certain number of permits are issued, a better accounting of fishery participants over time is the actual number of vessels landing hagfish in a given year (Figure 4). In 2008, more vessels actively participated in the fishery than in any other year.

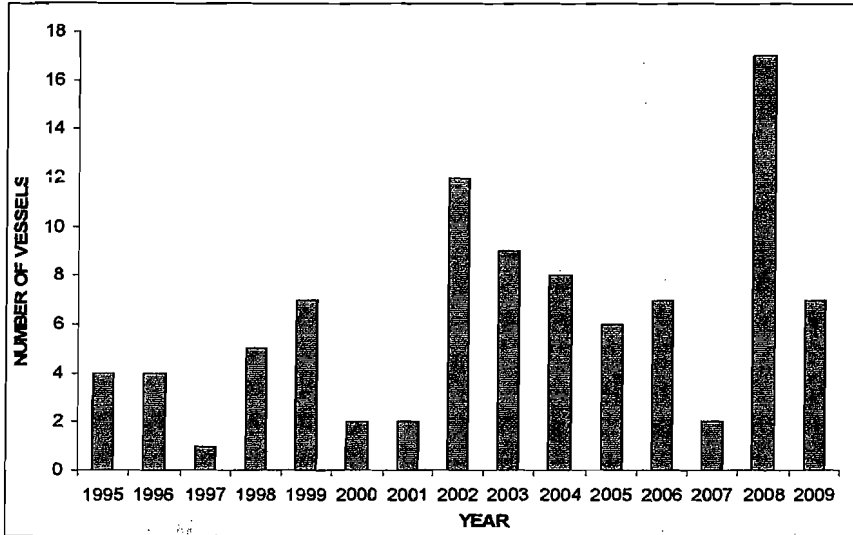


Figure 4. Annual number of vessels landing hagfish into Oregon while managed in the Developmental Fisheries Program: 1995-2009.

Another telling indicator of changes in a fishery is the number of landings made annually. Since hagfish has been managed in the Developmental Fisheries Program there have been three years of relatively dramatic increases in landings made: 1999, 2002 and 2008 (Figure 5). The first two spikes in number of landings occur only two years apart and can be characterized as the developmental stage of the frozen-at-sea harvest of hagfish for consumption. Beginning in 1999, the fishermen entering the fishery were new and had to learn how the fishery and markets worked. A few fishermen stayed with the fishery through this stage, which was followed by another increase in interest in the fishery in 2002. As fishermen became familiar with the fishery, efficiency increased and total poundage stayed relatively constant.

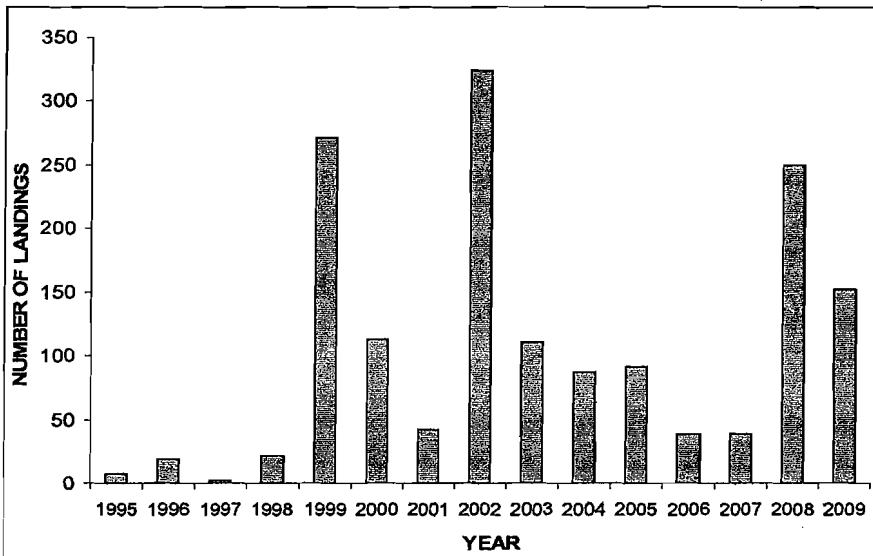


Figure 5. Annual number of hagfish landings made into Oregon while managed in the Developmental Fisheries Program: 1995-2009.

The third peak in landings occurred in 2008 as interest in the frozen-at-sea fishery increased somewhat, and a new market for live hagfish also gained momentum. The reduction in size of landings and increase in number of landings can be directly correlated to an increase in processors attempting to enter the live hagfish market, where the size of landings must be substantially reduced to maintain a healthy live product. A total of 250 individual hagfish landings were made throughout 2008, totaling 1,590,673

pounds. Individual landings ranged from 100-48,000 pounds and averaged around 6,000 pounds. In 2009, the total individual number of landings, average size of landings and total pounds landed were noticeably less than what was recorded in 2008. A total of 101 individual landings averaged around 4,100 pounds, indicating the continued development of the live markets into 2009.

Market Conditions

Hagfish are primarily exported to Korean markets for human consumption. Hagfish have been sold to processors in three different conditions during 2008-2009, frozen, live or iced. Historically, the majority of Oregon hagfish were plate frozen at sea in 25-35 pound blocks, landed and sold to shore-based fish processors between 0.35 and 0.80 cents per pound. In recent years, some processors have attempted to develop a live hagfish product for Korean markets, where the fishermen can receive up to \$1.00 per pound. This market requires the hagfish to remain alive when landed and while shipped to Korean buyers. Due to shipping logistics and high expenses, the development of the live market has been slow and difficult. However, by mid-2009, a few processors had developed shipping methodologies and controlled expenses to a degree making bi-weekly shipments overseas feasible. One concern heard from many permit holders pertains to the ratio of product arriving to the buyer in the live condition desired, versus the amount wasted in transit. At this time, staff has been unable to obtain accurate poundage estimates of product that is sold to consumers upon arrival overseas.

Beginning at the end of 2009, a few boats out of Newport began selling hagfish on ice, a condition called 'green', for \$0.35 per pound. Upon purchase, processors would separate out the hagfish from the ice, bag in 10kg blocks, freeze, and ship once a full container of hagfish was obtained. Feedback on the quality of the product from the end user has not been received, but some concern from permit holders who only plate freeze has been expressed. Many hagfish fishermen continued to voice concern over flooded and increasingly unstable overseas markets throughout most of the year.

WA and CA Hagfish Fisheries

The State of Washington requires a valid Emerging Commercial Fisheries License, as well as a Hagfish Pot Trial Fishery Permit (HPTFP) for each vessel. The Washington season is open year round, and permitted at 50 fathoms or deeper. Each HPTFP limits the vessel to 100 traps or pots fished individually or on a common groundline. Each trap has a tunnel entrance with a maximum size of 11 square inches, and an escape exit at least 9.5 square inches tied closed with 120 thread or smaller cotton twine. Logbooks are required and must be filed each quarter of the year fished.

In Washington, from 2005 to 2007 permits issued increased from two to 13. The number of individual landings and total poundage also increased substantially in this same three year time period, from 148,400 pounds of hagfish landed in 2005 to 304,600 pounds hagfish landed in 2007. Through mid-June 2008, 16 hagfish permits have been issued and 395,400 pounds landed.

The State of California requires a commercial fishing license and each person on board must possess a valid General Trap Permit. The permit stipulates no popup devices can be used, and limits the number of traps to 500 Korean style or 200 bucket style traps. The trap permit also requires that only hagfish can be kept and sold when Korean or bucket traps are on board.

The California hagfish fishery has had two periods of intense effort and harvest, much like Oregon's fishery. The California fishery landings increased from 18 between 1980 and 1987 to 461 in 1988. From 1988 through 1992, 4,718 landings occurred with slightly less than 9 million pounds of hagfish landed. This period represents fishing for the Korean hagfish leather industry. After 2003, the fishery continued but was greatly diminished with significant poundage being landed in only two years, 1996 (182,000 pounds) and 2001 (44,000 pounds). The present human consumption market for hagfish started in 2004.

From 2004 through 2007, 1,686 landings have been made, totaling slightly less than two million pounds. The effort is growing each year as seen by the increase in the number of landings being made. In 2007, California landings occurred in five ports. Eureka had the most landings with 62 percent of the catch. Monterey and Los Angeles were similar with 16 percent and 14 percent of total landings respectively. Santa Barbara (6.6 percent) and San Diego (1.4 percent) have the least number of landings.

Logbook Analysis

In past years, with very little staff time devoted to monitoring developmental fisheries, logbook compliance rates have been very low in many developmental fisheries, including hagfish. The importance of logbook data is recognized by the department, and as part of the re-evaluation of the program, logbook monitoring and enforcement were made high priorities. Through one-on-one communication and persistence with the hagfish fleet, logbook compliance rates rose and were maintained between 90-95 percent in 2008 and 2009. Historical hagfish fishing grounds appear to be contiguous along much of the coast, but with a clear break in the vicinity of Heceta Banks (Figure 6). It is necessary to note prior to 2008, logbook compliance varies greatly and the harvest areas depicted may not fully identify all areas where hagfish fishing took place. The map is divided between the north and south coast and also specifies where hagfish fishermen have focused fishing efforts in the two most recent years when logbook compliance is largely representative of harvest.



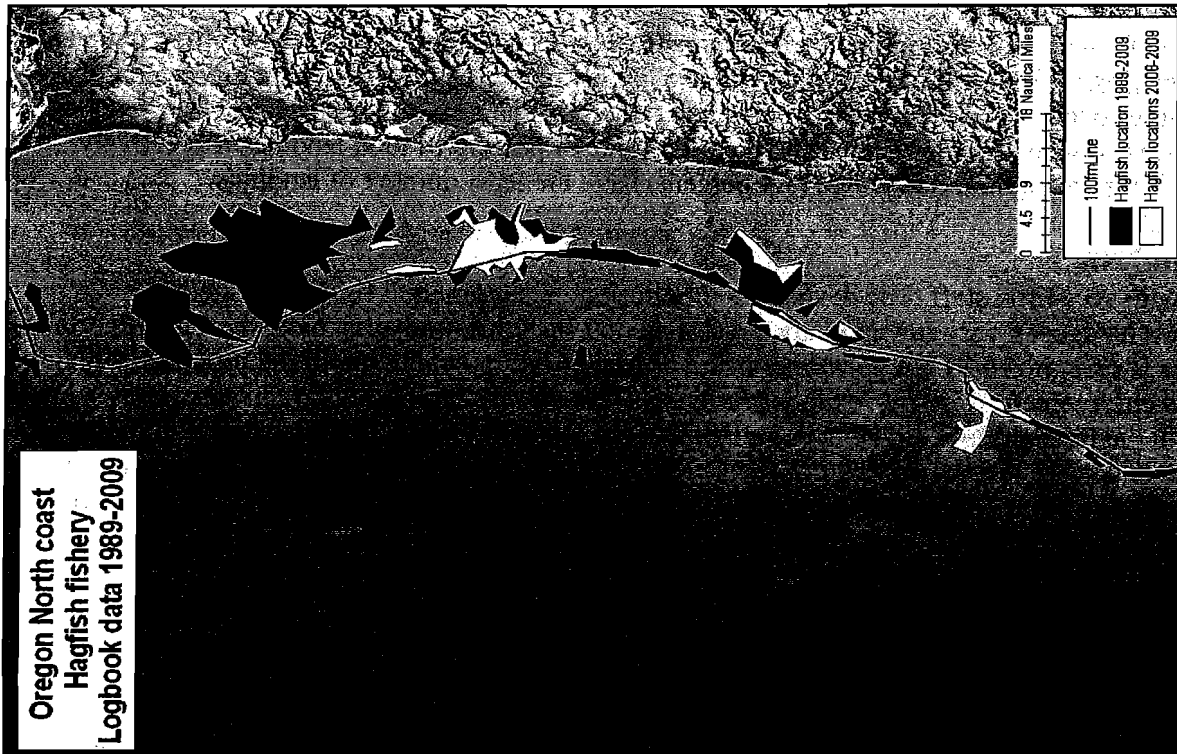


Figure 6. A map of the Oregon coast overlaid with areas of historical hagfish fishing grounds (dark purple) from 1989-2009 obtained from hagfish logbooks. The light purple areas indicate areas fished in most recent years 2008 and 2009.

Hagfish Life History

There are six genera of Hagfish (Nelson, 1994), all strictly marine, occurring from Baja California to southern Alaska. Hagfish are benthic dwellers, occurring from a few meters (m) to over 2,400m deep (Leask and Beamish, 1999). Hagfish are found on mud/silt bottoms where they burrow into the substrate, often leaving a circular depression. Pacific hagfish, *Eptatretus stoutii*, is the primary target species in the Oregon hagfish fishery. Barss (1993), found that fisherman in Oregon typically target hagfish between 100-219m. Black hagfish, *Eptatretus deani*, are occasionally caught in the fishery. Black hagfish can be distinguished from Pacific hagfish by a shorter distance from the snout to the first gill pore, darker coloration (black or dark prune verse gray to pink), and the lack of a visible ventral line in the background coloration (Leask and Beamish, 1999). Black hagfish tend to reside at greater depths of 156 to 1,070m (Hart, 1973).

Hagfish, in general, are the most primitive class of extant fishes (Nelson, 1994). Hagfish have been widely studied regarding their physiology and biochemistry but little is known about their reproductive biology and ecology. Hagfish are jawless, having a round sucking mouth which is a unique feature to this class of fishes. The body is an elongated cylinder, having an eel-like shape, with a single nostril, a pair of eye spots, 4 pairs of barbells, and no paired fins. The skeleton is cartilaginous, lacking ribs, girdles or jaws. The mouth contains two plates of keratinous teeth which are extruded during feeding.

Hagfish have low fecundity only producing 1-25 mature eggs. Mature eggs can be 32mm long, 8mm wide and have tufted hooks at their ends. Eggs are extruded through the vent, attach to substrate and are externally fertilized. Patzner (1978) calculated the growth rate for *E. burgeri* (Japanese Hagfish) using a correlation between ovarian development and annual increase in body length; a growth rate of 4-5cm per year was calculated. According to Leash and Beamish (1999), a female hagfish that releases her first clutch of eggs (42-46cm) would be between 9-10 years old.

ODFW Sampling Efforts

Beginning in March 2008, dockside and at-sea observer sampling efforts for the Oregon hagfish fishery were initiated. From each sampled landing, staff collected a “market sample”, generally a frozen block of hagfish between 25-35 pounds or 50-80 live hagfish. Each hagfish was weighed, measured and dissected to determine its sex and stage of maturity. Maturity stage determination followed Barss’ (1991) hagfish maturity scale.

Staff also began observing the hagfish fleet on multi-day observer trips in 2008. On these trips, discard samples were collected during sorting of the catch for each set of gear. All discarded individuals were collected, counted, weighed in total and 50-80 randomly sampled individuals were kept for laboratory processing. Measurements of the fishing gear were also collected each trip, including the total number of buckets/barrels per string, and the number and diameter of tunnel and escape holes from five randomly selected buckets/barrels per string.

Sampling rates

In March, 2008 staff began collecting market and discard samples from the hagfish fleet. In both 2008 and 2009, staff averaged over 50 percent market sampling coverage of total pounds landed each month (Table 1).

Table 1. Developmental Fisheries Program hagfish sampling coverage during 2008 and 2009. The months highlighted indicate that no sampling took place during these months.

	# Landings	Lbs	# boats fishing	# boats sampled	Market Samples	% lbs sampled	% landings sampled	Discard Samples	Observer Trips
Jan-08	2	12,831	1	0	0	0	0	0	0
Feb-08	17	114,923	3	0	0	0	0	0	0
Mar-08	33	205,754	7	4	5	26	15	1	0
Apr-08	26	128,978	8	3	4	28	15	1	1
May-08	31	189,956	12	11	14	43	45	1	1
Jun-08	17	130,147	9	7	13	85	76	3	2
Jul-08	14	204,438	5	4	7	53	50	2	1
Aug-08	14	198,254	5	5	10	69	71	1	2
Sep-08	13	147,026	6	5	10	72	77	3	2
Oct-08	9	116,672	4	3	6	71	67	0	1
Nov-08	11	130,516	4	4	7	77	64	1	0
Dec-08	2	11,178	1	0	0	0	0	0	0
Jan-09	11	51,876	2	2	4	44	36	0	0
Feb-09	10	41,131	3	1	1	39	10	0	0
Mar-09	11	84,117	4	4	8	86	73	0	0
Apr-09	6	64,364	3	3	4	81	67	0	0
May-09	3	16,746	2	3	2	68	67	2	1
Jun-09	9	20,460	4	2	3	38	33	0	0
Jul-09	8	10,016	2	0	0	0	0	0	0
Aug-09	18	60,779	6	0	0	0	0	0	0
Sep-09	19	67,683	4	0	0	0	0	0	0
Oct-09	2	131,849	2	0	0	0	0	0	0
Total 08	189	1,590,673	5	4.6	76	56	51	13	10
Total 09	83	549,021	3	2.5	22	59	48	2	1

Coordinating discard sampling observer trips with the hagfish fleet proved difficult and challenging. The program was only able to observe on nine separate trips in 2008 and a single trip in 2009 (Table 1). The

newness of the program, small boat size, age/condition of boats, scheduling, staff flexibility, and staff turnover all contributed to relatively low observer coverage throughout the re-evaluation of the program. Additionally, markedly less observer trips were obtained in 2009 due to the much reduced activity of the fleet throughout the months samplers were available for observer trips (June, 2009).

Observer Trip Data

Bycatch in the hagfish fishery consists of mostly (>99.99 percent) of small (<16 inches) hagfish. The only other bycatch confirmed was a single sea mouse (*Aphrodita negligens*) found in one market sample from a hagfish landing made into Charleston. Discard rates of small hagfish from the ten trips observed in 2008/2009 ranged from 1-19 percent (Table 2). The high variance in discard rates can be contributed to high levels of variability in gear configurations (Table 2), including both escape-hole size and number of escape holes per gear, as well as a large degree of variability in soak times, and spatial and temporal set locations.

Table 2. Summary of the Developmental Fisheries Program 2008/2009 hagfish fishery observer data.

Port	Trip Date	Trip Length (days)	Strings	Qty. Gear Used	Individual hagfish discard	Discard Weight (lbs)	Target Species Weight (lbs)	% Discard	Num Holes	Size Holes (mm)
Charleston	4/9/2008	2	7	161	no count	466	7,045	6.6	60.6	16.3
Charleston	5/18/2008	3	39	217	3,651	970	8,730	11.1	63	15.88
Newport	6/3/2008	1	4	44	no count	128	2,450	5.2	31.5	13.73
Newport	6/13/2008	2	9	125	no count	747	3,850	19.4	35.2	14.3
Newport	7/23/2008	7	37	238	3,250	335	19,272	1.6	31.5	13.73
Charleston	8/5/2008	1	1	420	216	76	8,000	1.0	30.8	13.8
Charleston	8/23/2008	1	1	420	no count	243	5,000	5.0	30.8	13.8
Charleston	9/26/2008	2	12	276	5,169	1128	7,200	16.0	21.4	13.85
Newport	9/18/2008	2	6	70	793	55	7,600	1.0	60.6	16.3
Charleston	5/15/2009	1	4	37	3375	660	9,000	7.3	88.5	13.9

Species Composition

Two species of hagfish, Pacific hagfish (*Eptatretus stouti*) and black hagfish (*Eptatretus deanii*) were found in both market and discard samples collected. Less than 1 percent of the total hagfish sampled were black hagfish (0.07 percent market samples and 0.02 percent discard samples were made up of black hagfish).

Sex ratios

The percentage of females was markedly higher in both the market and discard samples compared to the percentage of males (Figure 6). However, due to the sex determination methods, it was considerably harder to identify sex in the smaller individuals, which were more prevalent in the discard samples. Furthermore, detecting female gonads, due to the more distinguishable egg structures, was less difficult in smaller animals than distinguishing male gonads in the same sized animals. As a result, the discard samples contained a much higher rate of undetermined sex animals; however these are likely undeveloped male hagfish. Making this assumption and combining the male and unknown percentages in the discard samples, the ratio of males to females is very similar in both sets of samples.

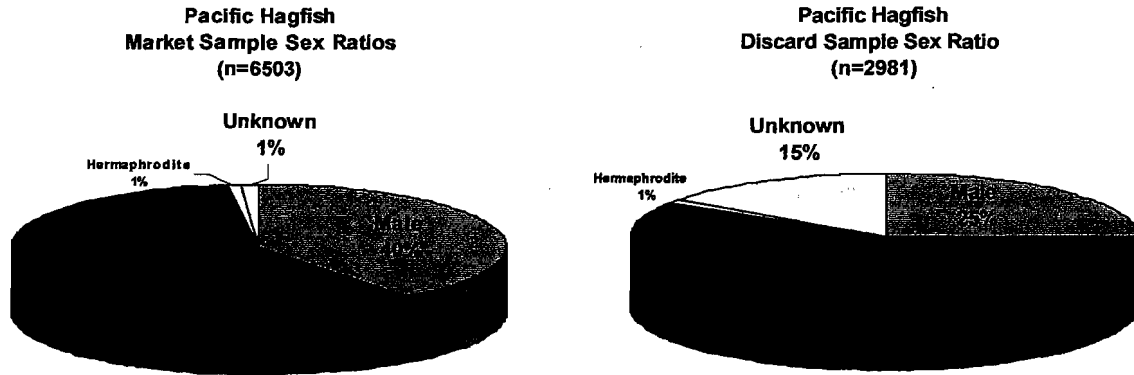


Figure 7. Percentage of males, females, hermaphrodites and unknown sex hagfish from market and discard samples collected by the Developmental Fisheries Program in 2008 and 2009.

Additionally, within each set of samples, roughly one percent of the hagfish were hermaphroditic. The majority of these individuals were very mature males and undeveloped females.

The small percentage of black hagfish (n=54) sampled had a slightly different sex ratio, with a higher percentage of male individuals (75 percent male and 25 percent female) and had no hermaphrodites recorded. Given the very low sample size of black hagfish caution is warranted prior to arriving at any conclusion or making any comparisons to Pacific hagfish using this data.

Length/Weight

The market enforced size limit of hagfish is around 35.5cm (14 inches) however, it appears additional factors may play a role in the decision to discard as fish of the same length were differentially discarded (Figure 8). Sorting methodologies, sorting experience, individual buyer preferences and/or weights of individual hagfish most likely all contribute to the large percentage of hagfish of market length being sorted out.

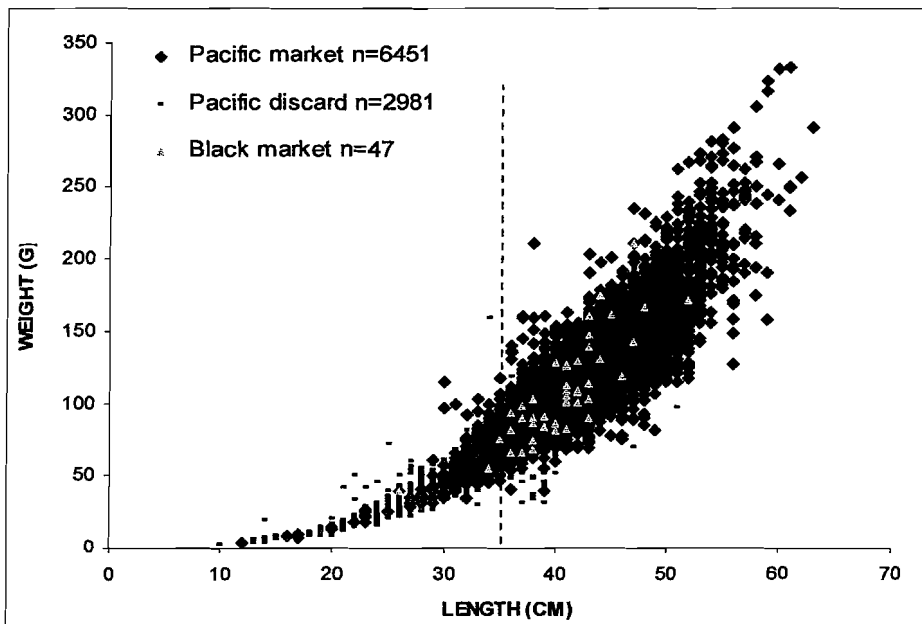


Figure 8. Length weight relationship curves of Pacific hagfish from market (blue diamonds) and discard samples (pink squares). The horizontal red dashed line indicates the 35.5 cm (14 in.) market enforced minimum size limit.

Seven percent of the market and 34 percent of the discard sampled hagfish were shorter than the 35.5cm market enforced size limit. These rates combined indicate vessels are over sorting to ensure individual hagfish are of or above market desired length.

Maturity

The Barss (1991) maturity scale was used for classifying stage of maturity of each hagfish processed. For gender comparative purposes female stages three to five were combined to form one ‘Mature’ stage. The number of mature males and females was highest in the market samples (Figure 9). The majority of retained hagfish are within either the developing or mature stages and a relatively small percentage of immature hagfish are harvested.

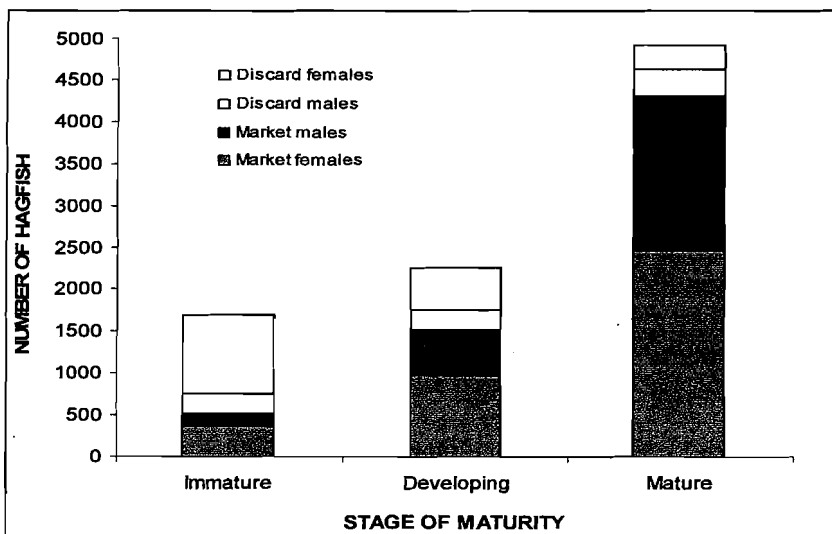


Figure 9. The number of individual hagfish of each sample category by sex and stage of maturity.

There is a clear relationship between the increase in body length to stage of maturity for both male and female hagfish (Figure 10). Furthermore, there is a slight increase in mean body length of male hagfish in each stage of maturity compared to female (Figure 10).

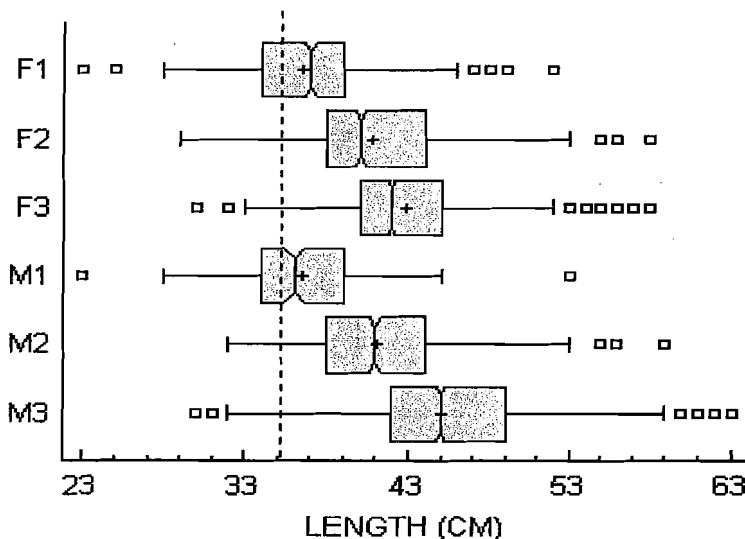


Figure 10. Length frequencies of male and female Pacific hagfish by maturity stage from market samples obtained during 2008 and 2009. The horizontal red dashed line indicates the 35.5 cm (14 in.) market enforced minimum size limit.

Discussion and Research

The department did not receive funding to continue the program during the 2009-2011 biennium. The program will be placed in a temporary suspension mode with no staff or funding to actively manage or assess any of the fisheries in the program including the hagfish fishery. During this period, the hagfish fishery will most likely (not officially decided until December 2009 by the OFWC) reside on the Developmental Species Category B list. This list change will effectively make the hagfish fishery open access with no permitting or landing requirement infrastructure.

During this time, given the increase in interest and effort that occurred in 2008, staff recommended both a harvest guideline and gear limitations effective at the beginning of 2010.

Staff proposed that upon attainment of the 1.6 million pound harvest guideline, a public meeting will be required to review the management of the fishery. This is a precautionary measure to account for the lack of an active developmental fisheries program that ensures the fishery is reviewed if landings increase to near 2008 record levels. Additionally, staff is proposed limiting the amount of gear to be fished at any one time by a single vessel to 200 buckets or barrels, fished individually or on a common groundline. This also is a precautionary measure to address potential gear conflicts and establish fishery sideboards in the absence of an active management program. Both California and Washington currently have gear limitations in place for their hagfish fisheries. California limits the number of traps to 500 Korean style (small cylindrical tube) or 200 bucket style traps and does not allow the use of the larger barrel gear. Washington limits each vessel to 100 traps total, but does not specify gear type. Through discard sampling of hagfish from both types of gear, staff concluded there was no significant difference in discard rates of smaller hagfish. Thus, staff is not recommending restricting the fleet to a certain gear type at this time. Limiting the number of traps to 200 will have no affect on the majority of the fleet that use the larger barrel gear in strings of five-15 barrels and with no more than eight strings.

Most of the 2008 to 2009 hagfish-devoted staff time was utilized to develop a market, discard, and observer sampling program to begin assessing and characterizing the hagfish fishery. As outlined throughout this report these efforts have included extensive literature reviews, developing sampling protocols, training and equipping staff, creation of a biological and logbook database, logbook compliance enforcement and field and lab market, discard and at-sea observer sampling. Dockside sampling rates and fleet logbook compliance continued to improve throughout the re-evaluation as sampling methodology became more streamlined and staff more familiar with the nature of the fishery.

The hagfish biological, fishery and logbook analysis provided in this report represent only a snap shot of the economic, social and biological parameters of the Oregon hagfish fishery. Recommendations for future sampling and data analysis include continued annual market and discard biological sampling and logbook spatial and temporal Catch Per Unit Effort (CPUE) analysis to investigate long term trends of the fishery and begin development of a management plan prior to the fishery transitioning into a limited entry fishery.

Hagfish research efforts conducted in 2009 focused investigations on population structure comparisons in fished and unfished areas, survival of discarded hagfish and behavior of hagfish around baited gear. A summary of this project is scheduled for completion and available in December 2009.

Acknowledgements

The Developmental Fisheries Staff would like to thank the 2008 and 2009 hagfish permit holders for their willingness to allow us to sample their catch, observe aboard their vessels and turn in their logbooks. We appreciate all of their efforts to accommodate us and share their knowledge and experiences of the hagfish fishery.

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Appendix A
Part 2

**Oregon Spot Prawn (*Pandalus platceros*)
Fishery 2006-2009 Assessment Summary Report**

Oregon Spot Prawn Fishery

Spot prawn fishing in Oregon does not have a long history, most likely due to the relatively low density of spot prawn populations off Oregon when compared to populations found off neighboring states and Canada. Throughout the fishery's history effort has been consistently low. From 1995 to 2003, spot prawns were harvested using high bottom impact trawl gear. Given the complexity of habitat which prawns live and other species found on those habitats, trawl gear was prohibited for spot prawns throughout the West coast by 2004. Since that time, landings have been exclusively made with pot gear. Similar to the trawl fishery, the pot fishery effort has been low.

Oregon spot prawn fishermen use pots of a few different varieties based on Canadian and Washington designs, fished on a common groundline. Habitats which produce commercially harvestable densities of spot prawns are confined to a small number of well-defined areas. These areas are located at depths of 80 to 140 fathoms on rocky substrate such as Rogue Canyon, off Cape Blanco, and off Nehalem Bay. Most commercial fishing has occurred in these areas, but many exploratory efforts indicate that prawns occur off the entire coast of Oregon in sparse numbers. From 2004 to present, some fishing effort has originated from Port Orford, Newport and Garibaldi, but the majority of consistent effort has been from Charleston.

The primary market for spot prawn is "live prawns" advertised as being six to eight prawns per pound. They are sold both direct to customers and as a specialty product for area restaurants. More recently they have also been exported to out of state markets and compete with product from British Columbia, Washington, and California. A self-imposed minimum size is used to assure desired count per pound; however this minimum varies from year to year. Smaller prawns are often sorted out and released alive at sea.

Spot prawns were added to the Developmental Species List in 1995. From 1995 to 2003 six trawl and ten pot gear permits were available annually for the harvest of spot prawns. During the first eight years of the fishery an average of seven vessels participated annually, one of which utilized pot gear (Figure 1). In 2004 the fishery was reduced to ten annually issued pot gear permits. Permits are initially issued geographically, half to ports north of Heceta Head and half to the south. The fishery has an annual permit renewal requirement of total landings of at least 500 pounds. Although each year all ten permits are subscribed, only one to three permit holders make spot prawn landings and an average of one vessel lands enough for permit renewal. The 2009 permitted spot prawn vessels ranged in size from 34 feet to 85 feet (average 51 feet) in length and participate in other fisheries including sablefish, crab, hagfish, halibut and tuna.

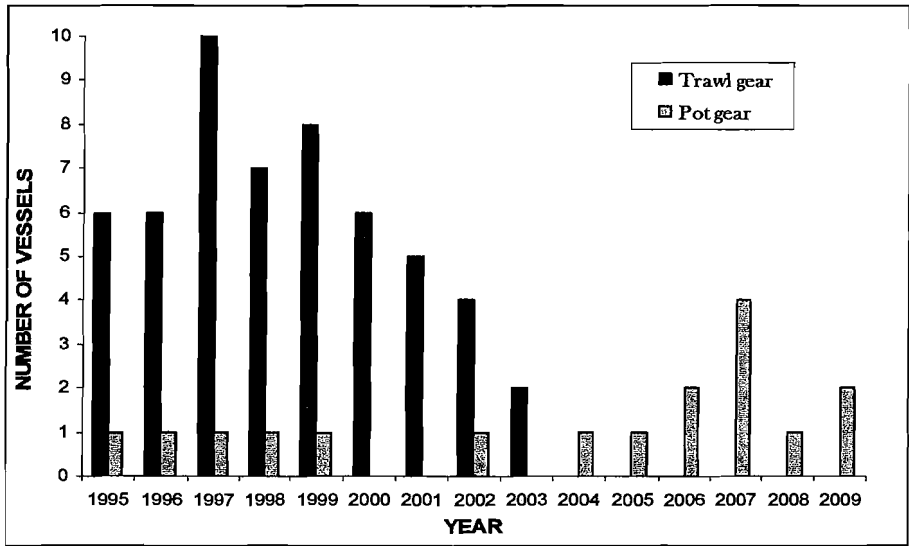


Figure 1. Annual number of vessels landing spot prawns into Oregon: 1995-2009.

In recent years (2004-2009), an average of 4,200 pounds of spot prawns has been landed annually, compared to an average of 55,000 pounds landed annually throughout the short trawl fishery from 1995 to 2003 (Figure 2). Given the low number of actual harvesters, for confidentiality purposes the most recent six pot gear only years are averaged for total pounds harvested. The number of individual landings made annually also decreased substantially as the fishery was restricted to the use of pot gear only. In combination, Figures 1 and 2 illustrate the consistent minimal effort and lower annual harvest rates beginning in 2004. The high cost of gear and low density of spot prawns in Oregon appear to be the most important limiting factors to further expansion of this fishery.

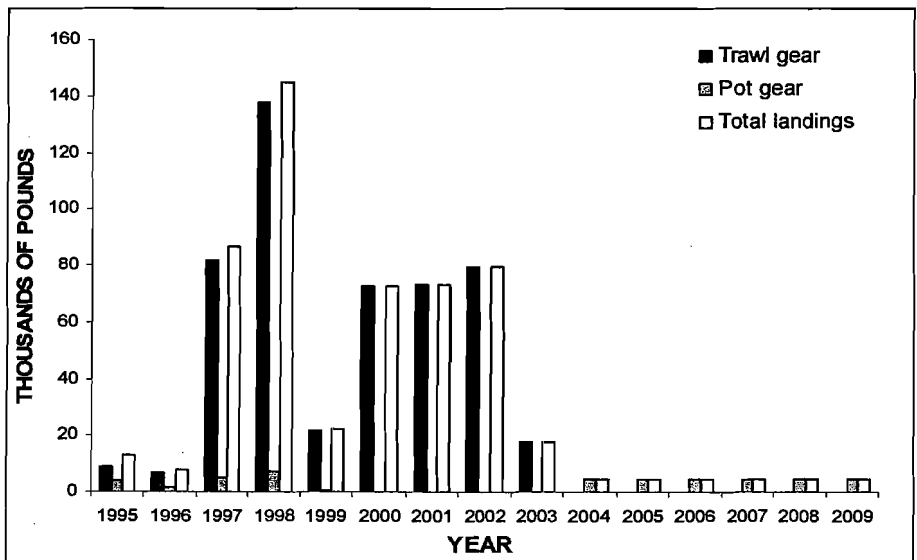


Figure 2. Oregon annual spot prawn landings by gear type: 1995-2009. Due to the low number of harvesters since 2004, annual landing made from 2004-2009 are shown as a combined average of the landings made in all of those years.

The majority of landings in Oregon occur in the summer and early fall from June through October due to the break in crab fishing, and timing of the best markets (Figure 3).

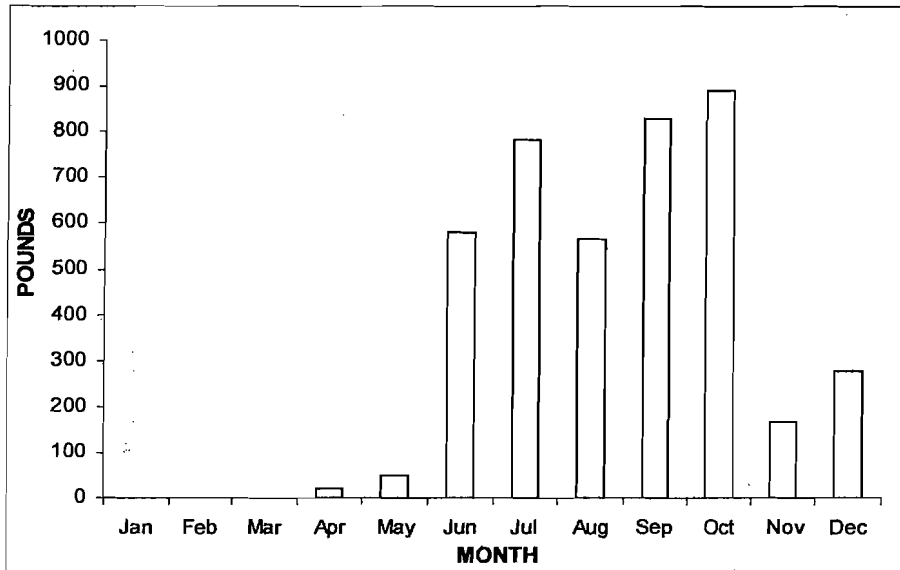


Figure 3. Average monthly spot prawn pot-gear only landings: 2004-2009.

In past years, with very little staff time devoted to monitor developmental fisheries, logbook compliance has been lacking in many developmental fisheries, including the spot prawn fishery. However, since the spot prawn fishery became a pot only fishery in 2004, effort has dropped considerably and logbook compliance from the few harvesters fishing has been extremely high.

Life History, Reproduction, and Habitats

Spot prawn life history is similar to many other pandalid shrimp which are protandrous hermaphrodites, meaning they mature as males first and then transition to female. Spot prawns mature as males in their second year and transition to females in their third year or fourth; they then remain females until they die. Spot prawns in Oregon become gravid (egg-bearing) in the fall months. They develop unfertilized eggs in their carapace (late summer), fertilize the eggs internally, and then extrude fertilized eggs (early fall) to their abdomen where they are carried until they hatch in the spring. Spot prawns hatch as planktonic organisms in the adult grounds where they become free swimming and are adrift. After a few months they settle to shallow areas (<45 meters) such as estuaries and nearshore areas. As spot prawns mature they migrate back to deep rocky habitats (120-300 meters).

Life history characteristics of spot prawns are variable by area. In Canada, spot prawns mature first as males at age 2 (27-35mm) and transition to females at age 3 (33-41mm), living a maximum of 5-6 years with a maximum size of 61mm (Butler, 1980). Oregon stocks appear to more closely resemble those of coastal Washington and California.

Sampling Efforts

Beginning in 2006, sampling efforts have consisted of sampling a single harvester's catch upon return to port, prior to grading by size for market. For most samples carapace length, body weight, and eggs presence/absence were recorded. From 2007 to 2009, large unsorted samples (>500 individuals) were collected to investigate each age class captured in the fishery. In 2008, three spot prawn fishing trips were observed to quantify and obtain species composition of bycatch. During one of these trips 100 percent of the bycatch caught in the spot prawn gear was sorted by species, quantified and weighed.

Cohort Strength

Analyzing unsorted samples of short lived and fast growing species such as spot prawns provides a practical method of ageing. Determining cohort size breaks in any given year is often clear with data from multiple years (Figures 4, 5, and 6). Coupling the relative proportion of cohorts in consecutive years, given continuous sampling, can then reveal the age at size and describe cohort strength.

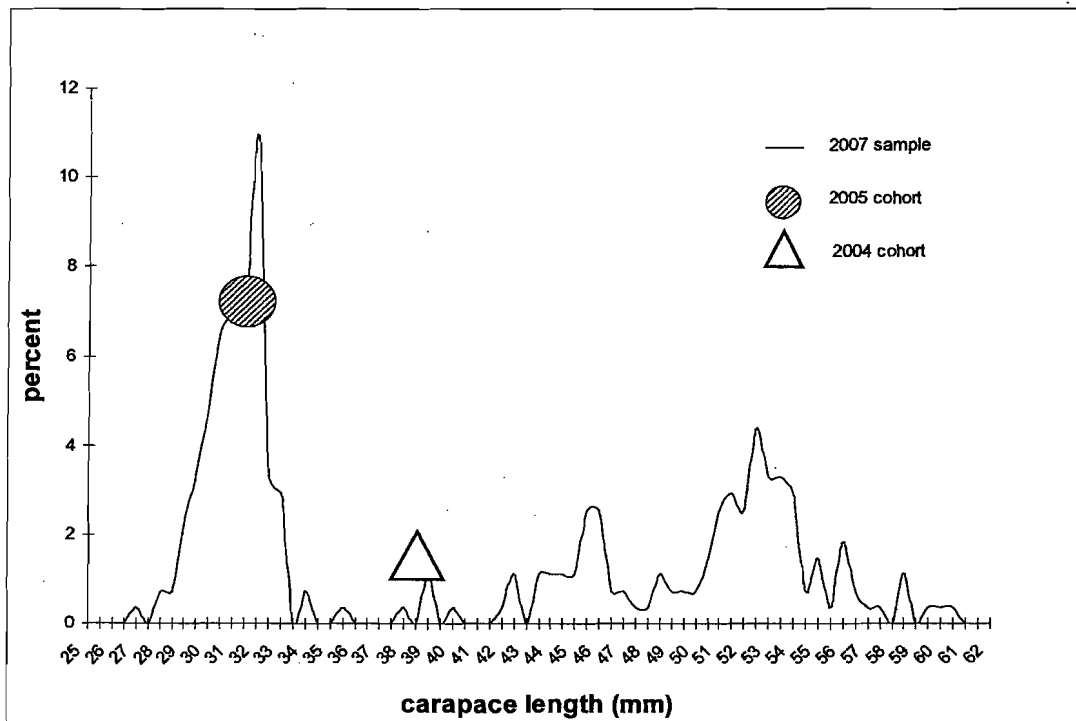


Figure 4. Unsorted sample from 2007 reveals a strong cohort of males entering the fishery (cross hatched circle) a much weaker cohort of 3 year old males (triangle).

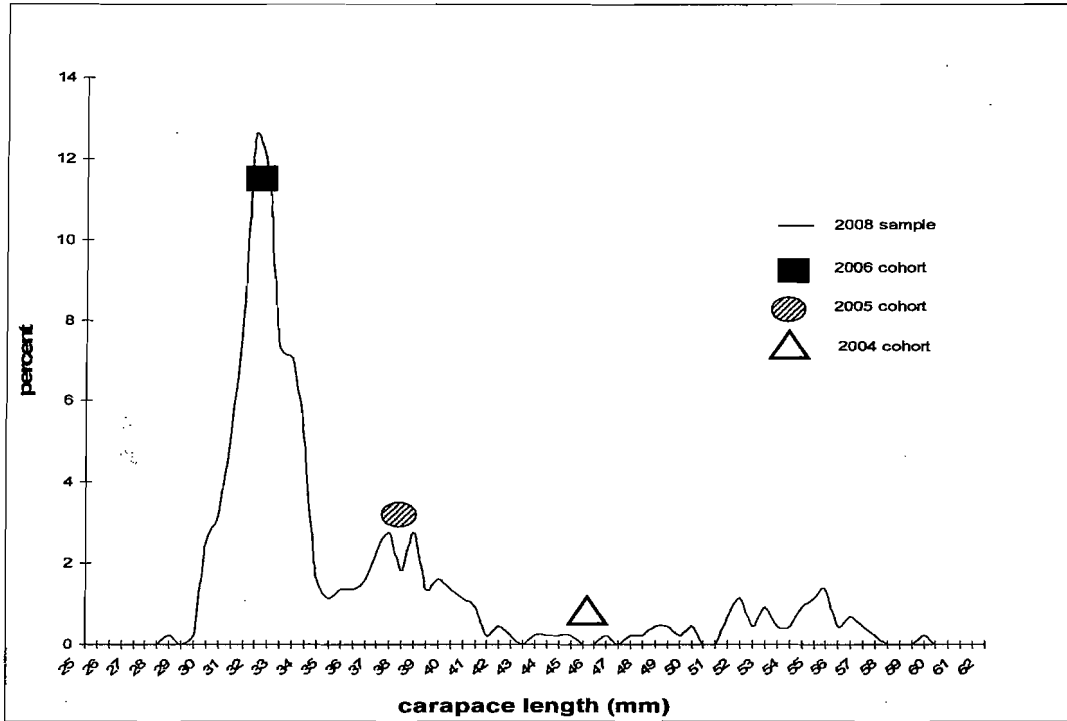


Figure 5. Unsorted sample from 2008 reveals arrival of a very strong 2006 cohort (solid square), a still strong 2005 cohort (cross hatched circle) and the continued weak 2004 cohort (triangle).

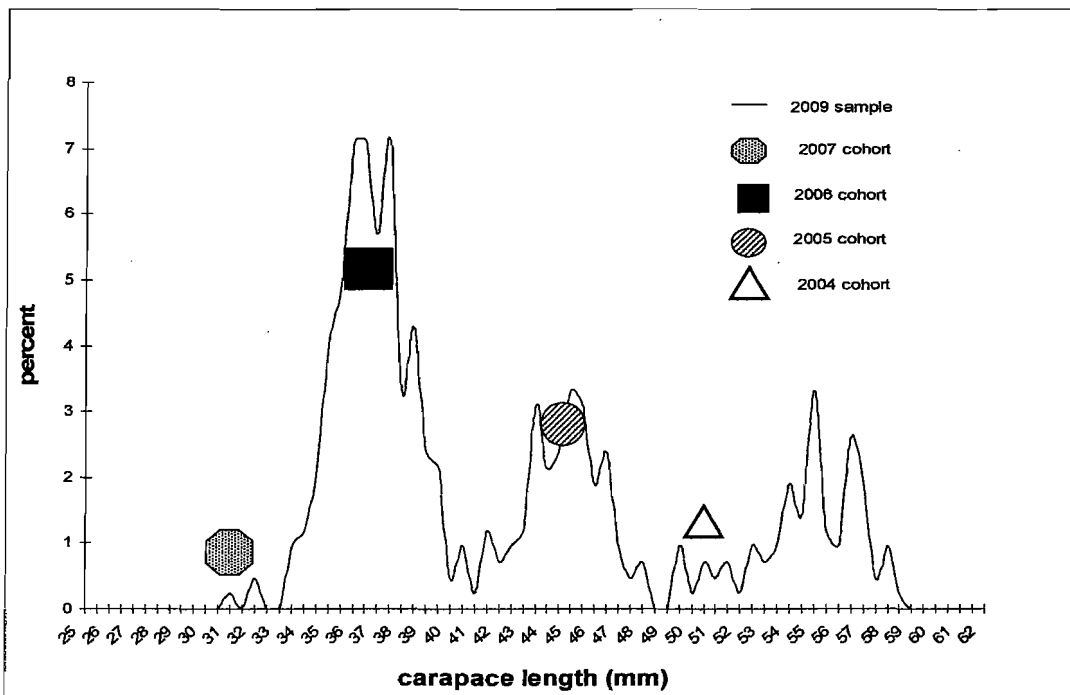


Figure 6. Unsorted sample from 2009 reveals a weak cohort of 2 year old males (dotted octagon) and a very strong cohort of 3 year old males (solid square). The relative proportion of cohorts tracked in previous years remains similar.

With continuous annual data cohorts can be tracked through age break data, and then given their relative proportion to each other, ages can roughly be assigned (Figure 7). Cohort strength data can be used not only in determining life history information, but also in predicting relative CPUE in proceeding years. Continued monitoring of catch not only improves biological understanding of the species, but also provides insight into the sustainability of the fishery.

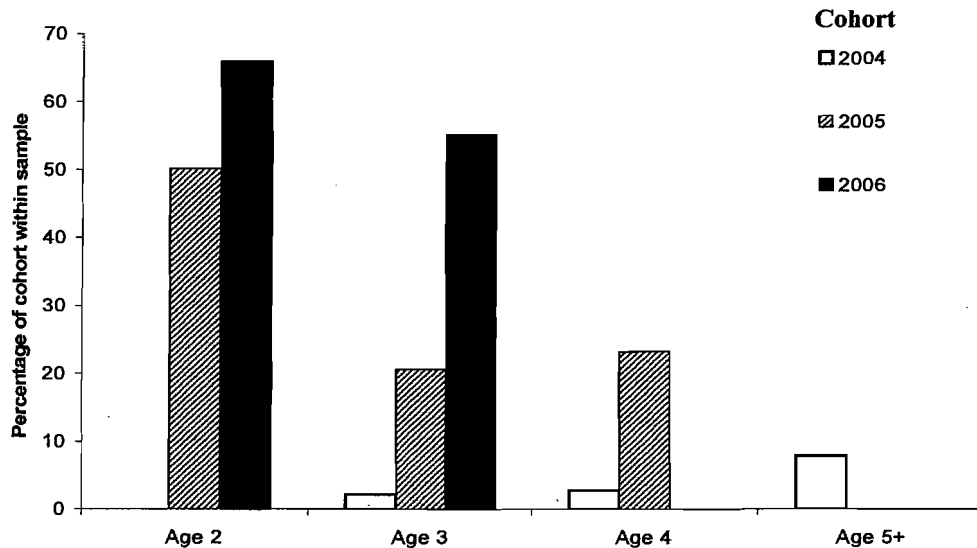


Figure 7. Relative strength of cohorts within unsorted market samples: 2004-2006.

Bycatch

Bycatch from five sets of pots was collected by staff to quantify the amount of discard and species composition of the bycatch (Table 1). An estimated 463 pounds of bycatch was harvested with an average of 92 pounds of bycatch per string. Over 60 percent of the bycatch consisted of invertebrates including seas stars, urchins, snails, crabs, octopus, and other shrimps (Table 2). The remainder was made up of fish species including sculpins, hagfish, cusk eels, and rockfish, most of which were juvenile. The CPUE for market sized spot prawns was 0.73 pounds spot prawn per pot and the bycatch CPUE was 1.37 pounds per pot.

Table 1. Number of pots, species diversity, individual animals and total weight per string of spot prawn gear observed in July 2008.

Set	Number of Pots	Num. Species of Bycatch	Individual Animals	Total Weight (lbs)
1	61	17	796	120
2	38	12	345	108
3	80	17	230	68
4	80	14	224	60
5	80	16	874	107
Total	339	26	2469	463

Table 2. Quantity and species composition of bycatch observed in five strings of gear harvesting spot prawns.

Species caught	Set 1	Set 2	Set 3	Set 4	Set 5	Total
box crab (<i>Lopholithodes forminatus</i>)	2.5	0	0	0	5.5	8
brittle star (<i>Ophiopteris papillosa</i>)	4	0	4.5	1	2	11.5
fish-eating star (<i>Stylasterias forreni</i>)	17.5	3.5	1	3.5	4.5	30
giant pacific octopus (<i>Enteroctopus doffeini</i>)	0	33.5	30.5	0	0	64
fragile sea urchin (<i>Allocentratus fragilis</i>)	34.5	32.5	9.5	23.5	25.5	125.5
hairy triton (<i>Fusitriton oregonensis</i>)	19.5	3.5	5.5	7.5	5	41
lithoid crab (<i>Acantholithodes hipsidus</i>)	3.5	8	4	4	0	19.5
Northern spearhead poacher (<i>Agonopsis vulsa</i>)	0	0	0.024	0	0.168	0.192
Pacific hagfish (<i>Eptatretus stoutii</i>)	7	4.5	0	1	6.5	19
pink shrimp (<i>Pandalus jordani</i>)	3	0	0	0	0	3
pygmy rockfish (<i>Sebastes wilsoni</i>)	0	0	0.084	0	0	0.084
red sea star (<i>Mediaster aequalis</i>)	0	0	1	2.5	0	3.5
redbanded rockfish (<i>Sebastes babcocki</i>)	0.385	0	0	0	0	0.385
rosethorn rockfish (<i>Sebastes helvomaculatus</i>)	0	0	0.122	0.08	0	0.202
sharpchin rockfish (<i>Sebastes zacentrus</i>)	1.13	0.366	0	0.082	0	1.578
shortspine thomyhead (<i>Sebastolobus alascanus</i>)	0.18	0	0	0	0	0.18
spot prawn large dead (<i>Pandalus platyceros</i>)	0	0	0.5	0	0	0.5
spot prawns small live (<i>Pandalus platyceros</i>)	3	15	5.5	6.5	50.5	80.5
spotted cusk eel (<i>Chilara taylori</i>)	0	0	0	0	0.16	0.16
squat lobster (<i>Munida quadrispina</i>)	6	1	0	0	1	8
sunflower star (<i>Pycnopodia helianthoides</i>)	1	0	0	0	2	3
threadfin sculpin (<i>Icelinus tenuis</i>)	7	4	2	4.5	0	17.5
unknown crab spp.	5	1	0	1	3.5	10.5
unknown hermit crab spp.	4.5	1	2.5	5	1	14
unknown sculpin	0	0	0.088	0.06	0.066	0.214
unknown sea star (class Asteroidea)	0	0	1	0	0	1
Total pound	120	108	68	60	107	463

Discussion and Research

The department did not receive funding to continue the program during the 2009-2011 biennium. The program will be placed in a temporary suspension mode with no staff or funding to actively manage or assess any of the fisheries in the program. The staff recommended option for the spot prawn fishery is to reside on the Developmental Species Category B list. This list change will effectively make the fishery open access with no permitting or landing requirement infrastructure.

In August 2009 staff hosted a public meeting with the program's fishery permit holders to discuss options for each of the permitted fisheries upon suspension of the program. Four current spot prawn permit holders attended the meeting and all were in support of keeping the fishery regulated to some degree through a permit system. The most discussed concern was that opening the fishery up to anyone might dramatically increase harvest activity and potentially lead to resource conservation and gear conflict issues. Three of the four permit holders were in favor of creating a limited entry spot prawn

fishery in order to add value to the fishery and promote development of a fishery with such high initial investment, a guarantee of a permit is essential.

One permit holder, who has been the primary spot prawn harvester since it has been a pot only fishery, conveyed that he was not in support of a limited entry spot prawn fishery due to the undeveloped nature of the fishery. He proposed retaining as much resemblance to the current program permitting infrastructure as possible. He supported creating a two-year spot prawn permit that kept the number of permits limited and retained landing requirements that are currently in place. He felt this option would allow development to continue slowly, protect pioneers of the fishery and allow new fishermen who are serious about the fishery a chance to participate and continue furthering its development.

Staff, along with the Board, assessed each of the options and concluded that due to a historically speculative nature, lack of consistent harvesters, and low landings in the fishery, it would be extremely difficult to develop a limited entry program for the fishery at this time. Additionally, parties agreed that in the absence of staff and funding for this program, creating a two-year permit is not feasible.

Although staff believes effort and harvest will remain relatively status quo, if changes occur due to the programmatic changes, there are minimal resources available for monitoring or sampling this fishery. The limited biological sampling that does occur will focus on annual unsorted sampling efforts. Continuous annual sampling combined with multivariate statistical analyses should provide useful conclusions on important aspects of stock such as predictive cohort strength, effect of fishery on stocks, and environmental drivers of recruitment.

Future recommendations for research and assessment of the spot prawn fishery include continued annual unsorted biological sampling, logbook spatial CPUE analysis, and a more rigorous fishery bycatch characterization.

Acknowledgements

The cooperation and assistance provided by the primary fisher (in recent years) of spot prawns in Oregon has greatly advanced the understanding of Oregon's spot prawn population. This collaboration in and contribution to science and consequently management of the spot prawn resource is greatly appreciated by staff.