

SPOT PRAWN (*PANDALUS PLATYCEROS*) AND RIDGEBACK PRAWN (*SICYONIA INGENTIS*) FISHERIES IN THE SANTA BARBARA CHANNEL

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ABSTRACT

The Santa Barbara Channel prawn fishery, consisting of spot prawn (*Pandalus platyceros*) and ridgeback prawn (*Sicyonia ingentis*), has developed into a major fishery during the late 1970s. Increasing fishing pressure, along with oil drilling and seismic activities, warrants management of the resource.

The spot prawn fishery developed from a minor fishery in 1970, totaling 4,533 kg, to over 116,954 kg by 1981. Catch per unit of effort (CPUE) declined from 40 kg/hr in 1974 to 12.7 kg/hr by 1982.

The ridgeback prawn fishery rose dramatically from 1,813 kg in 1974 to 161,378 kg by 1979, but declined to 63,916 kg by 1982. CPUE declined from 59 kg/hr in 1979 to 19 kg/hr by 1982.

Age composition of spot prawn based on modal distribution revealed that two major age groups, 3 and 4, dominated the catch. Prawn were not recruited until the fall as age group 2.

Ridgeback prawn became recruitable at age group 1, but the adult population comprised age groups 2 and 3.

Management recommendations proposed a winter closure (November 1 through January 31) for spot prawns and a summer closure (June 1 through September 30) for ridgeback prawns.

RESUMEN

La pesca de los langostinos *Pandalus platyceros* y *Sicyonia ingentis* en el Canal de Santa Bárbara se ha convertido hacia finales de la década de 1970-1980 en una gran pesquería. El crecimiento de esta pesquería, junto con las perforaciones petrolíferas y las actividades sísmicas de la región, justifican que se establezcan regulaciones.

La pesca de *P. platyceros* evolucionó de una pesquería de poca importancia en 1970 con capturas de 4,533 Kg hasta alcanzar los 116,954 Kg en 1981. La captura por unidad de esfuerzo (CPUE) declinó de 40 Kg por hora en 1974 hasta 12.7 Kg por hora en 1982.

La pesca de *S. ingentis* incrementó dramáticamente de 1,813 Kg en 1974 hasta 161,378 Kg en 1979, mientras que en 1982 solamente se capturaron 63,916 Kg,

pasando la CPUE de 59 Kg por hora en 1979 a 19 Kg por hora en 1982.

La composición de edades de *P. platyceros* basada en la distribución modal revela que en la captura dominan dos grupos de edad, individuos de 3 y 4 años. El reclutamiento se produce en el otoño, incluyendo la generación de dos años.

El reclutamiento de *S. ingentis* es al año de edad, pero la población adulta incluye grupos de 2 y 3 años de edad.

Para regular la pesquería se recomienda establecer una veda durante el invierno (del 1° de Noviembre al 31 de Enero) para *P. platyceros*, y una veda durante el verano (del 1° de Junio al 30 de Septiembre) para *S. ingentis*.

INTRODUCTION

Since 1974, the Santa Barbara Channel spot prawn and ridgeback prawn fisheries have developed into a substantial industry. In 1981 they yielded 200,721 kg (441,587 lb) and contributed nearly \$750,000 to the local economy. Increasing fishing pressure, along with oil drilling and seismic activities, warrants management of the resource.

The spot prawn, actually a shrimp in the pandalid family, is larger and commands a higher price than does the smaller ridgeback prawn, a penaeid.

Spot prawns are commonly found from Unalaska, Alaska, to San Diego, California. They inhabit rocky and adjacent areas at depths ranging from 45 to 484 m, but generally are found between 198 and 234 m (Frey 1971). Juvenile spot prawns occur in shallow inshore areas (90 m or less), migrating to deeper offshore areas as they mature (Figure 1). These prawns are protandric hermaphrodites, with females spawning from September through November; they have an ovigerous stage lasting from October through April. They live an estimated 6 years; the maximum length recorded is 63 mm carapace length (CL).

Ridgeback prawns occur from Monterey, California, to Cedros Island, Baja California, at depths ranging from 45 to 162 m. The major concentration is in the Ventura-Santa Barbara Channel area. Their life span is probably 4 years, and sexes are separate in this species. Females reach a maximum length of 45 mm

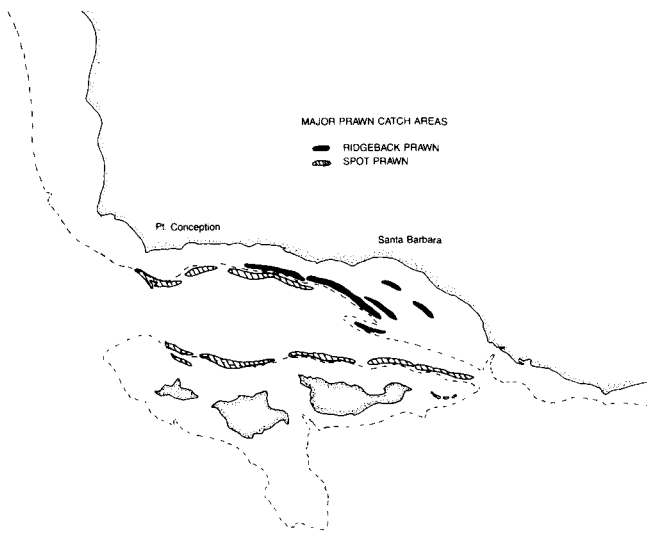


Figure 1. Trawling grounds for spot prawns and ridgeback prawns in the Santa Barbara Channel, California.

CL; males, 37 mm CL. Peak spawning occurs from June through September (Susan Anderson, pers. comm.).

METHODS

The catch per unit of effort for this trawl fishery is measured in kg/hr. When comparing single rig (use of one net) to double rig (use of two nets), I used the conversion factor of 1.6 to convert double-rig to single-rig effort. The 1.6 value was derived by comparing the catch rates of single-rig and double-rig trawlers fishing in the same area at the same time (Walter Dahlstrom, pers. comm.).

Since both species were fished by the same fleet, there was a problem deciding which species was the target. I decided to use the percent composition of the catch as determined by fish receipts, and used only log data from landings that contained 80% of one species to determine fishing effort for a given species. Logs were selected from boats known to submit accurate

information and that were representative in size and gear of boats involved in the fishery.

I determined ages of spot prawns and ridgeback prawns by differentiating size modes of the sampled catch using techniques described by Harding (1949) and Cassie (1954).

THE FISHERY

Fleet Description

The prawn trawl fleet comprises 12–16 vessels in Santa Barbara, 1–2 in Oxnard, and 7 in Ventura. These trawlers range from 10 to 22 m in length, the average being 14.5 m. Net tonnage is 7 to 55 tons, with an average of 18 tons. The fleet remained fairly constant (12 boats) during the past decade, with seasonal fluctuations. Standard gear is a single-rig shrimp trawl, either semiballoon or Gulf shrimp trawl. Beginning in late 1981, as many as 7 Pacific Northwest shrimp trawlers entered the fishery, all based in Ventura. These boats are larger, averaging 20.3 m and 58 tons. All these draggers are equipped with a double-rig shrimp trawl.

Spot Prawn

Landings. Spot prawns have been fished intermittently for years, but not until 1970 were landings significant. By 1974, nearly 82,955 kg (183,000 lb) were taken (Table 1). Catches in following years declined, reaching a low of 13,357 kg in 1977. Landings improved slightly in 1978 to 24,912 kg, but in 1979 many of the trawlers diverted their efforts towards fishing ridgeback prawn; thus catches diminished slightly to 21,668 kg. In 1980, the ridgeback prawn fishery began to wane, resulting in increased landings of spot prawns to 64,271 kg. The following year, a record catch of 117,093 kg was landed, much of it taken in the second half of 1981. The significant increase in landings was due to the entry into the fishery of up to seven Pacific Northwest trawlers. Because these boats

TABLE 1
 Spot and Ridgeback Prawn Landings (Kilograms) in Santa Barbara Area 1970-82

Year	Spot prawn	Percent	Ridgeback prawn	Percent	Total
1970	4,795	100.0	0	0	4,795
1971	12	100.0	0	0	12
1972	0	0	0	0	0
1973	4,232	100.0	0	0	4,232
1974	82,834	97.8	1,820	2.2	84,654
1975	61,681	83.1	12,520	16.9	74,201
1976	23,459	94.3	1,419	5.7	24,879
1977	13,357	89.5	1,561	10.5	14,918
1978	24,912	57.2	18,663	42.8	43,575
1979	21,668	11.8	161,640	88.2	183,308
1980	64,271	33.9	125,216	66.1	189,487
1981	117,093	58.4	83,172	41.6	200,265
1982	105,632	62.2	64,158	37.8	169,790

TABLE 2
Monthly Landings and Catch Per Unit of Effort of Spot Prawn

Month	1981		1982	
	Catch (kg)	CPUE (kg/hr)	Catch (kg)	CPUE (kg/hr)
January	2,515	17.7	12,016	13.0
February	1,869	19.5	9,300	12.6
March	3,695	22.8	14,483	16.8
April	7,680	30.0	7,690	12.9
May	4,308	30.1	18,776	15.7
June	5,696	20.9	11,201	9.4
July	10,913	22.2	9,173	9.2
August	16,295	25.9	6,804	9.5
September	15,698	31.3	3,153	13.6
October	14,001	27.5	2,635	13.1
November	12,703	20.4	4,040	10.6
December	21,738	15.4	6,013	10.2

were equipped with double-rig nets, fishing effort was increased by a factor of 1.6. Landings declined in 1982 to 105,621 kg, although most catches occurred during the first half of the year (Table 2). The reduced landings in the latter half partly resulted from the departure of Northwest trawlers from the area. These boats returned late in 1982, contributing significantly to the landings.

Catch effort and total effort. Catch per unit of effort was collated both on an annual and monthly basis. CPUE for the sampled fleet was 39.8 kg/hr (86 lb/hr) in 1974 and 1975, but declined sharply to a low of 16.5 kg/hr in 1977 (Figure 2). During 1978 and 1979, significant effort was diverted to the ridgeback prawn fishery, although CPUE increased to 23.6 kg/hr during this period. The following year, CPUE remained near 25.5 kg/hr. CPUE in 1981 declined slightly to 23.6 kg/hr, but dropped sharply to 12.7 kg/hr by 1982.

Monthly CPUE and landings have fluctuated widely, with a high of 31.3 kg/hr in September 1981; but since then, CPUE displayed a gradual decline through 1982 (Table 2). Total effort (hours trawled) declined from 2,000 hours in 1974 to 818 hours in 1977, but began to double each year beginning in 1979, reaching over 8,000 hours by 1982 (Figure 2).

Declining catches and CPUE, coupled with increasing total effort portend a resource in distress.

Ridgeback Prawn

Landings. The ridgeback prawn resource off Santa Barbara has been known for years, but a lack of demand instilled little interest. Trawl fisherman finally did develop a small fishery in 1966, when 13,600 kg (30,000 lb) were landed. But the fishery quickly faded as a result of poor marketability. Annual landings were below 2,266 kg from 1974 to 1977, except in 1975 when landings reached 12,520 kg (Table 1). The

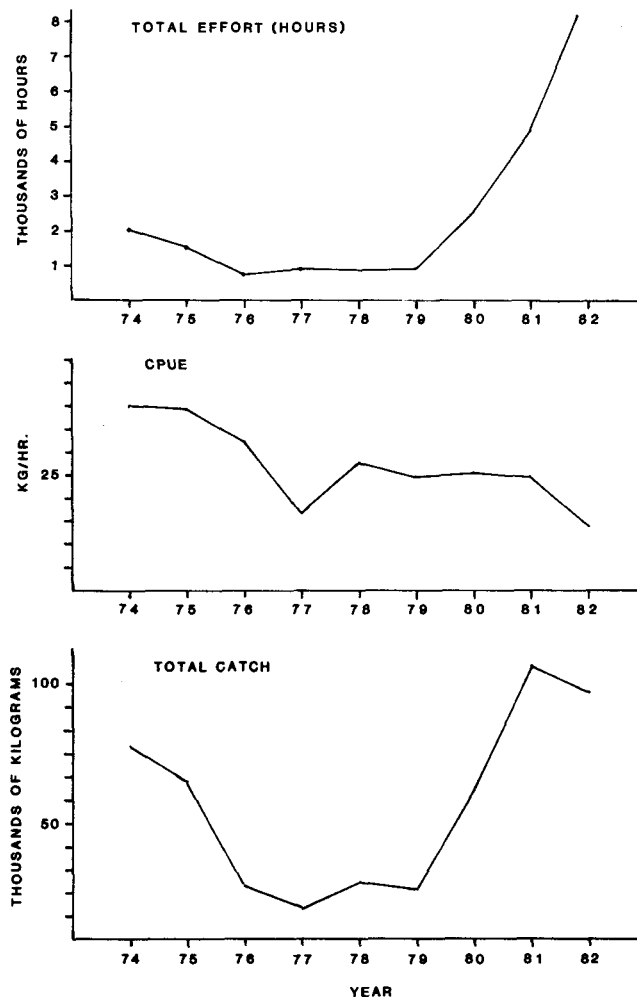


Figure 2. Annual total effort, catch per unit of effort, and annual total catch of spot prawns from 1974 to 1982.

fishery began to increase during 1978, when 18,663 kg were landed, and reached a record high of 161,640 kg in 1979. The dominant reason for such an increase was consumer acceptance coupled with reasonable retail prices. Landings declined to 125,216 kg the following year, and continued this trend in 1982 when 64,158 kg were landed (Table 1).

Most successful fishing occurred during fall, winter, and spring, with record monthly landings of 51,242 kg taken in May of 1979 (Table 3).

Catch effort and total effort. During the early years (1975 to 1977) CPUE was difficult to assess because of low landings and effort. Ridgeback prawn landings began to increase in 1978 and 1979, along with log information. Annual CPUE reached nearly 59 kg/hr (130 lb/hr) in 1979, but the CPUE declined to 49 kg/hr in 1980, reaching a low of 19 kg/hr in 1982 (Figure 3). Monthly CPUE analysis indicates highest CPUE during fall and winter. CPUE as high as 91.6 kg/hr was

TABLE 3
 Monthly Landings and Catch Per Unit of Effort of Ridgeback Prawns

Month	1979		1980		1981		1982	
	Catch (kg)	CPUE (kg/hr)	Catch (kg)	CPUE (kg/hr)	Catch (kg)	CPUE (kg/hr)	Catch (kg)	CPUE (kg/hr)
January	524	—	11,500	91.1	9,585	43.4	5,291	31.9
February	4,466	81.1	11,480	68.1	16,029	31.4	7,840	20.4
March	11,353	56.8	21,907	77.5	13,022	27.2	7,057	18.6
April	44,744	71.0	10,648	46.0	9,129	17.0	3,860	9.4
May	51,242	91.6	4,173	27.6	6,615	24.7	671	18.1
June	12,330	38.0	6,570	27.6	3,057	—	1,023	4.5
July	16,052	38.1	7,791	39.9	7,188	23.5	828	—
August	8,024	30.3	7,660	27.4	3,450	12.9	684	—
September	969	22.6	4,511	20.4	3,398	25.6	364	8.0
October	5,469	44.4	20,105	41.1	1,320	19.9	352	7.0
November	3,457	—	11,413	33.7	6,428	28.5	10,377	24.5
December	3,040	73.7	7,478	24.5	3,964	13.2	25,820	26.7

noted in May of 1979, declining to 22.6 kg/hr by September (Table 3). Catch rates of near 90 kg/hr were recorded from January to April 1980, with a gradual decline during spring and summer. The declining trend in CPUE continued into 1982, when the catch rates reached a low of 4.5 kg/hr in June. The fishery recovered slightly in November of 1982, when CPUE rose to 24.5 kg/hr.

Estimated total effort (in hours) increased dramatically from 823 hours in 1978 to 2,738 hours in 1979, although total effort dropped slightly in 1980 to 2,532 hours (Figure 3). Since 1980, total effort has been increasing annually, reaching 3,357 hours by 1982. CPUE data and annual landings indicate a possible decline in total population of ridgeback prawns during 1980 and 1981. But by late 1982, the fishing success and landings indicated a possible recovery of the resource.

LENGTH AND AGE COMPOSITION

Spot Prawn

Age determination was accomplished by discerning modes in the length distribution (Harding 1949; Cassie 1954). Analysis of modes indicated that age groups 3 and 4 were dominant during 1981-82. These age groups, representing the 1978 year class (group 3) and 1977 year class (group 4), ranged near 40 mm CL and 50 mm CL, respectively (Figure 4). During the 1982-83 period, three modes were located near 36 mm CL, 45 mm CL, and 50 mm CL, which represented the 1979, 1978, and 1977 year classes, respectively (Figure 4). Spot prawn became fully recruited during the fall and winter as age group 2 when they appeared in increasing numbers.

Ridgeback Prawn

Age for ridgeback prawn was also determined by discriminating modes in the length distributions. Max-

imum age is estimated at 4 years, with females having a faster growth rate than males. Both male and female length distributions were analyzed separately. Length distributions of female ridgeback prawns during 1981

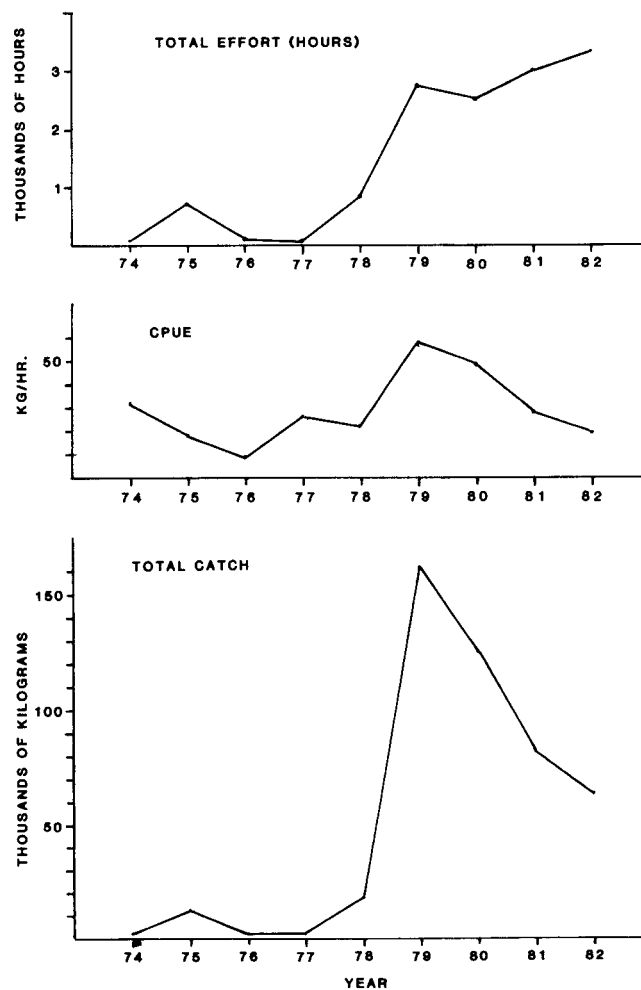


Figure 3. Annual total effort, catch per unit of effort, and annual total catch of ridgeback prawns from 1974 to 1982.

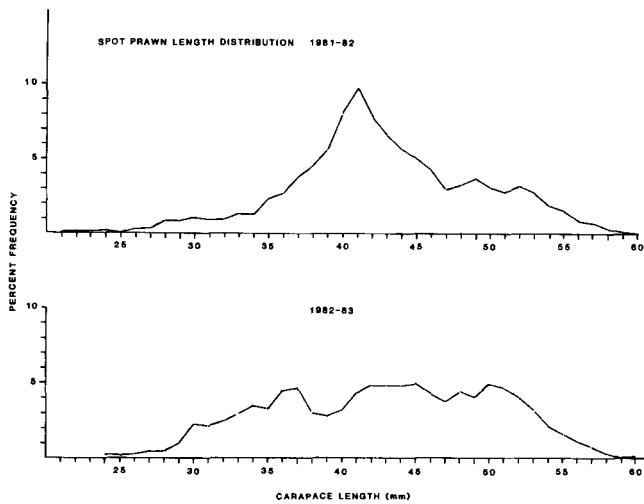


Figure 4. Spot prawn length distributions for 1981-82 and 1982-83.

indicated the dominance of older age groups, as indicated with modes near 36 mm CL and 40 mm CL (Figure 5). Poor recruitment of the 1979 year class (age group 2) became evident during the fall of 1981, when very few animals of the cohort were present in the catch. By August 1982, the fishery showed a marked decline. Then in October 1982, large numbers of prawns from the 1981 year class (age group 1) appeared in the fishery; in fact, 50% of the 1982 catch consisted of this single year class (Figure 5).

MANAGEMENT RECOMMENDATIONS

Spot Prawn

Data from the age and reproduction studies revealed several trends. First, the population presently comprises older males and females (age groups 3 through 5). Spawning and ovigerous stage occur primarily from October through March. A winter closure from November through January was recommended to protect ovigerous females because the winter catches were the highest on record during 1981. This recommendation was adopted by the California Fish and Game Commission and implemented for the 1983-84 season. Incidental take of 22.7 kg of spot prawns is allowed during the closed season. Existing regulations include a 3-mile closure from the mainland and off-

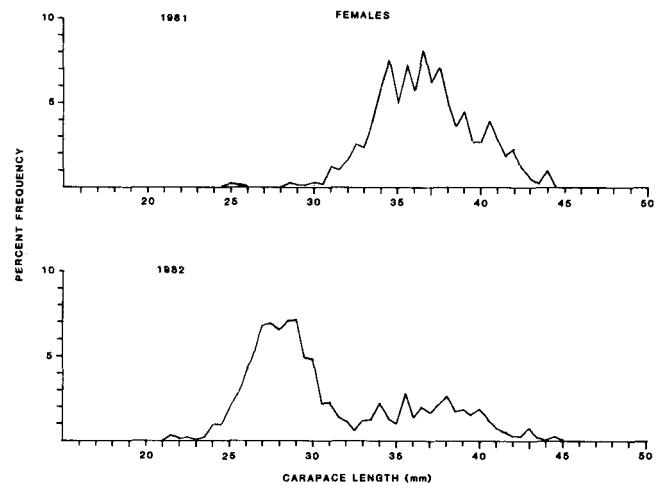


Figure 5. Female ridgeback prawn length distributions for 1981 and 1982.

shore islands to all trawling activities, and a restriction of 1½-in. mesh for single-walled bag or 3-in. mesh for double-walled bag.

Ridgeback Prawn

The ridgeback prawn resource, a relatively new fishery, has sustained heavy fishing pressure in only a few years. This rapid growth of landings and fishing effort coupled with recent declines in the catch rates indicates some distress of the population. Causes for this decline are numerous, but to provide protection for spawning females and the young-of-the-year prawns, a summer closure (June 1 through September 30) was adopted by the California Fish and Game Commission for the 1982 season. Incidental take of 22.7 kg of ridgeback prawn is allowed during the closed period. Other regulations include a 3-mile closure from the mainland and offshore islands to all trawling, and a restriction of 1½-in. mesh for single-walled bag or 3-in. mesh for double-walled bag.

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