

Commercial Passenger Fishing Vessel Landings of Widow Rockfish *Sebastes entomelas* in Central California

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ABSTRACT

Commercial fishing for widow rockfish (*Sebastes entomelas*) has increased significantly in northern and central California since the summer of 1981. In central California, widow rockfish are also found in commercial passenger fishing vessel landings. For this reason, the importance of widow rockfish to the central California recreational partyboat fishery was investigated during a three-year study period from 1977 to 1979. Landings of widow rockfish by the recreational partyboat fishery were minor. Only 3.7% of the catch per unit of angling effort were widow rockfish. The catch of widow rockfish was greatest in northern ports and on trips taken during winter months. This rockfish may have been the target species of some winter recreational partyboat trips at San Francisco and Bodega Bay.

INTRODUCTION

Rockfish fishing by commercial passenger fishing vessels (CPFV) and commercial trawl vessels is highly developed in some areas of northern and central California. Landings of rockfish by the commercial trawl fishery have been increasing since 1977, and projections indicate that they will continue to do so (Pac. Fish. Manage. Council 1981). Increased markets as well as the ability of commercial fishermen to target on one species, widow rockfish (*Sebastes entomelas*), have contributed significantly to these landings. Concurrently, the increasing proportion of rockfish (genus *Sebastes*) in the CPFV catch is projected to be a trend in the recreational partyboat landings of central California for the next ten years (Gruen and Gruen 1979). Potential exists, therefore, for competition between the recreational partyboat and commercial trawl fisheries for the available resource. This paper presents analyses of the CPFV rockfish fishery, the relative importance of widow rockfish to this fishery, and the estimated effect upon the recreational partyboat catch in the event of a significantly reduced widow rockfish stock.

Very few data are available from the complex recreational and commercial fisheries for rockfish of central California. These fisheries are complex due to their multispecies nature, the fact that landing and catch-per-unit-effort statistics do not specify species, and sampled landings traditionally have not included age and sex composition. Because of this lack of necessary data, the Tiburon Laboratory of the National Marine Fisheries Service and the California Department of Fish and Game have been cooperating since 1977 in a program to routinely sample both recreational and commercial landings for species, sex, length, and age composition. Presented here is an analysis of the central California CPFV fishery sample data obtained during a three-year study period from 1977 to 1979. Also presented, for comparison, are expanded sample data from the central and northern California commercial trawl fishery for the same period. Because a change in the widow rockfish fishery occurred during 1981, preliminary data for that year are also reviewed.

METHODS

Sampling was concentrated on rockfishing trips around the major ports of Monterey, Half Moon Bay, San Francisco, Bodega Bay, Fort Bragg, and Eureka. There were, however, virtually no CPFV landings of rockfish north of Bodega Bay. Sampling effort averaged 290 samples per year; each sample consisted of from one to four clusters. Fish traditionally were landed whole and placed in burlap bags. The fish in a bag often were the combined catches of several anglers and there was little possibility of telling which fish were caught by a particular angler. Tomlinson's (1977) recommended sampling frame used, therefore, not the more traditional angler but the burlap bag as the sampling unit.

Catch data were obtained from interviews of a random sample of anglers for each sampled trip. A principal assumption during the interview was that the content of each bag was the catch of one angler. However, since more than one angler may contribute to one bag, estimates of catch per angler may be positively biased. Biological data, including species, sex, length, and otoliths, were collected in the field. Age determinations were made later at the Tiburon Laboratory.

Expansion of sample data to the total catch, as depicted in each table, was completed at the Tiburon Laboratory, using the Lawrence Berkeley Laboratory CDC 7600, by the method indicated below:

$$\widehat{YR} = \widehat{A} \widehat{YR}$$

where \widehat{YR} = estimated total number of fish captured (species-sex-length-age) derived from total trips and mean number of anglers per trip.

$$\widehat{A} = N \bar{a}$$

where \widehat{A} = estimated total rockfish anglers,
 N = total number of rockfish trips,
 \bar{a} = mean number of anglers per sampled trip,

$$\widehat{YR} = \sum_{i=1}^n (y_i/l_i) L_i / \sum_{i=1}^n A_i$$

where \widehat{YR} = mean number of fish (species-sex-length-age) captured per angler,

n = sampled trips,
 A_i = anglers per trip i ,
 y_i = fish (species-sex-length-age) sampled per trip i ,
 l_i = total fish sampled per trip i ,

$$L_i = \left(\sum_{j=1}^{m_i} l_{i,j} \right) A_i / m_i$$

where L_i = total fish captured per trip i ,
 $l_{i,j}$ = catch for j th bag i th trip,
 m_i = number bags examined during interview (assumed equal to number of anglers interviewed) per trip i .

All variables were derived from sampled data with the exception of N which is summary information provided by California Department of Fish and Game CPFV logs. Mean catch per sample

unit $\left[\left(\sum_{j=1}^{m_i} l_{i,j} \right) / m_i \right]$ data were insufficient to conduct within-trip

expansion of the 1977 sample data. Estimates of average $l_{i,j}$ from 1978 and 1979 were substituted, therefore, to provide total fish number expansion values presented in Tables 1 and 2.

RESULTS AND DISCUSSION

Species composition

The estimated number of rockfish landed by the CPFV and commercial trawl fisheries during 1977-79 in northern and central California ports totaled 13,310,187. Rockfish landings from CPFV accounted for 30.5% of this total (Table 1). An estimated 244,511 widow rockfish also were landed by both gear types, of which the CPFV fishery contributed 50.7%. There was no evidence, at the time of this study, of a clear gear-type dominance in the number of widow rockfish landed. Subsequent to this study, a large expansion of the northern and central California commercial trawl fishery occurred. During 1981, the first year of the expanded fishery, the annual number of widow rockfish landed by the commercial trawl fishery increased by a factor of 35. Preliminary data do not indicate that there was a comparable expansion of the CPFV fishery. Thus the relative importance of the partyboat fishery in landings of all rockfish and widow rockfish probably has declined since 1979.

The CPFV fishery landed more rockfish in the second and third quarters than during the other quarters (Table 2). Both the number of trips and anglers were also higher during the two middle quarters (Table 3). However, when compared to the two middle quarters, fishing success was considerably higher for widow rockfish and all rockfish combined during the first and fourth quarter (Table 3). Thus the relatively high landing of fish during the middle quarters was due to high fishing effort, not high fishing success.

While the largest percentage of rockfish partyboat trips, rockfish anglers (Table 5), and all rockfish landed by the CPFV fishery (Table 4) occurred in the port of Monterey, the largest contribution by widow rockfish to the catch-per-unit of sampling effort was made in the northern ports of San Francisco and Bodega Bay (Table 5). Widow rockfish contributed 4 percent to this annual catch and 7 percent during the first and fourth quarter in the northern ports. When widow rockfish did appear in the catch of trips taken from the northern ports, they appeared in relatively large concentrations. The mean percent of widows in the catch-per-bag, for those trips with any widows in the catch, was 19% for the first and fourth quarter. Furthermore, when all trips are considered, widow rockfish were important to the success of certain trips taken during the first and fourth quarter and from the northern ports of San Francisco and Bodega Bay. During the last quarter of the year, the catch for over 12% of the trips was more than 25% widow rockfish, and in 5 percent of the trips widow rockfish comprised at least 45% of the total catch.

Age composition

A comparison of data between sample years 1978 and 1979 indicates a noticeable increase in landings of younger widow rockfish (Fig. 1). An estimated 26% of the widow rockfish landed during 1978 were less than 9 years old, and 7 percent were 4 years and younger. In 1979, landings of widow rockfish less than 9 years old increased to 53%, and those less than 4 years increased to 22%. Widow rockfish first became vulnerable to the CPFV fishery at the age of 4 and 2 years during 1978 and 1979, respectively.

Full recruitment is traditionally defined as that point in the catch curve closest to the modal age (Ricker 1975). The first ages at which recruitment could be considered complete for widow rockfish captured by the CPFV fishery were 10 years-old in 1978 and 4 or 5 years-old in 1979. By comparison, the northern and central California commercial fishery during the same sampling period typically had modal ages for widow rockfish of 9 and 10 (W. H. Lenarz, Tiburon Lab., Natl. Mar. Fish. Serv., NOAA, Tiburon, CA, pers. commun.). Therefore, it appears widow rockfish may be fully recruited to the recreational partyboat fishery 5 years earlier than to the commercial fishery during periods of influx by a strong year-class. Other than during such times, the data indicate that both fisheries tend to rely upon the same year-classes.

Table 1—Comparison of the estimated number of all rockfish and widow rockfish, *Sebastes entomelas*, landed by the commercial passenger fishing vessel (CPFV) and commercial trawler rockfish fisheries at Monterey, Half Moon Bay, San Francisco, and Bodega Bay, CA.

| Year | CPFV | | Commercial trawler | |
|-------------------|--------------|----------------|--------------------|----------------|
| | All rockfish | Widow rockfish | All rockfish | Widow rockfish |
| 1977 | 1,488,939 | 67,796 | 2,574,463 | 9,817 |
| 1978 | 1,269,921 | 20,506 | 2,519,546 | 39,673 |
| 1979 | 1,298,904 | 35,764 | 4,158,414 | 70,955 |
| 1981 ¹ | | | 5,487,582 | 1,403,020 |

¹First year of widow rockfish fishery expansion into study area.

Table 2—Quarterly landings at Monterey, Half Moon Bay, San Francisco, and Bodega Bay, CA, of widow rockfish, *Sebastes entomelas*, and all rockfish, by the commercial passenger fishing vessel (CPFV) and commercial trawler rockfish fisheries, 1977-79 and 1981.

| Quarter | CPFV 1977-79 | | | |
|---------|--------------|----------------|--------------|----------------|
| | All rockfish | Widow rockfish | All rockfish | Widow rockfish |
| 1 | 177,280 | 6,228 | | |
| 2 | 340,547 | 5,820 | | |
| 3 | 517,936 | 9,262 | | |
| 4 | 248,651 | 6,826 | | |

| Quarter | Commercial trawler | | | |
|---------|--------------------|----------------|--------------|----------------|
| | 1977-79 | | 1981 | |
| | All rockfish | Widow rockfish | All rockfish | Widow rockfish |
| 1 | 655,738 | 35,086 | 834,094 | 98,604 |
| 2 | 946,250 | 1,356 | 866,825 | 8,572 |
| 3 | 752,484 | 18,366 | 1,426,128 | 122,832 |
| 4 | 984,510 | 507 | 2,360,535 | 1,173,012 |

Table 3—Estimates derived from expanded sample data of fishing effort by quarter for commercial passenger fishing vessels (CPFV) at Monterey, Half Moon Bay, San Francisco, and Bodega Bay, CA, 1977-79.

| Quarter | Percent | | Catch per bag | |
|---------|------------|-------------|---------------|----------------|
| | Boat trips | Angler days | All rockfish | Widow rockfish |
| 1 | 14.9 | 14.7 | 15.0 | 0.52 |
| 2 | 27.0 | 26.1 | 11.5 | 0.23 |
| 3 | 35.7 | 39.7 | 12.2 | 0.30 |
| 4 | 22.5 | 19.6 | 13.7 | 0.89 |

Table 4—Estimates derived from expanded sample data of percentage of all rockfish and widow rockfish landed in N. Calif. by area, commercial passenger fishing vessel (CPFV), and commercial trawler rockfish fisheries.

| Port | CPFV 1977-79 | |
|------------------------------|--------------|----------------|
| | All rockfish | Widow rockfish |
| Monterey | 43.3 | 20.9 |
| Half Moon Bay | 23.7 | 14.5 |
| San Francisco and Bodega Bay | 32.7 | 64.6 |

| Port | Commercial trawler | | | |
|------------------------------|--------------------|----------------|--------------|----------------|
| | 1977-79 | | 1981 | |
| | All rockfish | Widow rockfish | All rockfish | Widow rockfish |
| Monterey | 55.3 | 45.8 | 31.4 | 9.9 |
| Half Moon Bay | 2.5 | 2.2 | 0.2 | 0.1 |
| San Francisco and Bodega Bay | 42.2 | 52.0 | 68.4 | 90.0 |

Table 5—Estimates derived from expanded sample data of fishing effort by area for commercial passenger fishing vessel rockfish fishery during 1978 and 1979.

| Area | Percent | | Catch per bag | |
|------------------------------|------------|-------------|---------------|----------------|
| | Boat trips | Angler days | All rockfish | Widow rockfish |
| Monterey | 44.0 | 48.6 | 13.9 | 0.1 |
| Half Moon Bay | 30.6 | 24.4 | 11.2 | 0.4 |
| San Francisco and Bodega Bay | 25.4 | 27.0 | 14.4 | 0.7 |

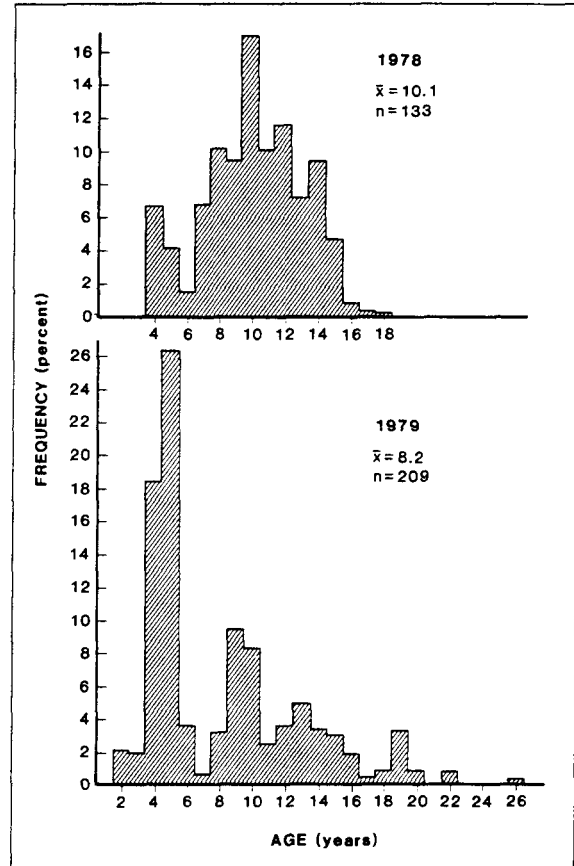


Figure 1—Age composition of widow rockfish, *Sebastes entomelas*, from 1978 and 1979 commercial passenger fishing vessel samples expanded to total landings for Monterey, Half Moon Bay, San Francisco, and Bodega Bay. Mean age (\bar{x}) and number of specimens sampled (n) indicated.

CONCLUSION

Widow rockfish is not an important species in the total landings of the CPFV rockfish fishery in central California. A depletion of widow rockfish stocks would decrease the annual catch of a CPFV angler by less than one-half a fish. Widow rockfish stock depletion would, however, noticeably reduce the CPFV catch in the northern ports, especially during the fourth quarter. The high percentage of widow rockfish landed on some trips taken out of Bodega Bay and San Francisco during the last quarter suggests fishermen were targeting on widow rockfish. A reduction in widow rockfish availability may then necessitate a change in CPFV fishing tactics in northern ports during portions of a year.

The results of this study suggest that monitoring the CPFV fishery age-catch data would be useful in indicating the presence of a strong year-class of widow rockfish 4-5 years prior to its full recruitment by the commercial trawl fishery. They would provide evidence for projections of widow stock strength or weakness.

CITATIONS

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