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# The Diet of Widow Rockfish *Sebastes entomelas* in Northern California

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## ABSTRACT

**The diet of widow rockfish (*Sebastes entomelas*) taken in the commercial and partyboat fisheries from Northern California was examined. The only sampling category that had sufficient numbers to be reliable was the commercial catch from the Eureka area. The diet of these fish is dominated by four prey categories: salps; fish, primarily myctophids; caridean shrimp, almost exclusively *Sergestes similis*; and euphausiids. There is a seasonal trend in the composition of these four prey categories which corresponds with their life history. There are also size related trends in diet composition. These four major prey groups comprise the deep sounding layer. At night when the widow rockfish are caught at depths of around 140 m, the deep sounding layer is near the surface. This suggests that the widow rockfish is feeding during the day when the deep sounding layer is in deeper waters (400 m). The strong similarity between widow rockfish and blue rockfish (*Sebastes mystinus*) is pointed out, which suggests strong parallel forces are important in the evolution of both of these species.**

## INTRODUCTION

With the exception of nearshore species, very little work has been done on the feeding of rockfishes (Genus *Sebastes*). The only information available on commercially important rockfishes in California are comments by Phillips (1964) in his report on age and growth. In that paper he states, "The widow rockfish is mainly a macroplankton feeder, with hyperiid amphipods dominating their diet, but small fish are also eaten at times." From this he concludes that "Since amphipods are seldom found in the diet of other macroplankton-feeding rockfish, the widow rockfish might occupy a somewhat different habitat." In these comments and those on the relatively pure nature of widow rockfish commercial catches, Phillips makes the suggestion that the feeding behavior of the widow rockfish is radically different from other commercially important species of rockfish. This possibility warrants more detailed examination in light of the recent dramatic increase in the importance of the widow rockfish in the commercial fishing industry from San Francisco northward (Demory 1987; Quirollo 1987; Tagart 1987).

## METHODS

The stomachs of widow rockfish were sampled from both commercial and partyboat catches at ports between Eureka and Monterey. From each catch a maximum of 20 fish was sampled. The sampling began March 1980 and continued until February 1981. All fish lengths used in this paper are total lengths. The digestive tract of each fish specimen was removed and preserved in 4% formaldehyde solution. For analysis, the contents were examined under a binocular dissecting microscope and, when necessary, a binocular compound microscope. A list was then compiled of the items in the gut, with species identified whenever feasible. The following data were then noted for the items in each listed category: 1) the number present; 2) prey size range; and 3) an estimate of its representation in the gut as a percent by volume of the contents. Empty stomach samples were excluded from the data.

## RESULTS

Most of the stomach samples (74% or 283/381) of widow rockfish came from commercial catch sampling in the Eureka-Fields Landing area. This is the only sampling category that had sufficient numbers to be reliable. These samples came predominantly (over 75%) from the same California Department of Fish and Game statistical block just south of Cape Mendocino. The diet item with the largest mean percent volume (the average for any one prey category of its percent volume from all non-empty fish) was thaliacean urochordates or salps (Table 1). Salps are gelatinous herbivorous holoplankton which have the capacity for rapid population increase due to high growth rates and short generation time (Blackburn 1979). Because of this, they are considered opportunistic species, able to quickly produce large formations when high concentrations of food become available. Almost equally important in the diet are fish, which when identifiable are usually myctophids or Pacific hake. Myctophids are small fish with photophores which give off bioluminescence. They are probably the most common fish in midwater (Paxton 1967). Pacific hake (*Merluccius productus*) is a semipelagic fish extremely abundant off the coasts of California, Oregon, and Washington. The hake found in widow rockfish stomachs are all in the size range of age-1 fish or younger (Dark

**Table 1—Diet of widow rockfish from catch samples landed in the Eureka-Fields Landing area. (Average TL = 467 mm, *n* = 283, min. size = 370 mm, max. size = 795 mm).**

| | Mean number | Mean % volume | Mean prey size (mm) | Freq. of occurrence |
|---|---|---|---|---|
| Hydromedusae | | | | |
| Unid. sp. | 0.01 | 0.017 | — | 0.004 |
| Physonectid siphonophore | 0.22 | 1.359 | 11.00 | 0.028 |
| Ctenophora | | | | |
| *Pleurobrachia bachei* | 0.13 | 0.836 | 20.63 | 0.018 |
| Oligochaeta | | | | |
| Unid. sp. | — | 0.042 | 90.00 | 0.004 |
| Polychaeta | | | | |
| Alciopidae | 0.01 | 0.408 | — | 0.007 |
| *Heteronereis* sp. | 0.09 | 0.428 | 26.00 | 0.004 |
| Gastropoda | | | | |
| Unid. sp. | 0.07 | 0.491 | 1.50 | 0.018 |
| Turridae | 0.07 | 0.038 | — | 0.004 |
| Vermiculuridae | 0.07 | 0.428 | — | 0.004 |
| Cephalopoda | | | | |
| Unid. sp. | 0.15 | 0.352 | 181.00 | 0.028 |
| *Loligo opalescens* | 0.02 | 0.338 | 46.25 | 0.007 |
| *Octopus* sp. | 0.01 | 0.193 | 33.50 | 0.007 |
| Mysidacea | | | | |
| Unid. sp. | 0.01 | 0.022 | 10.00 | 0.004 |
| Isopoda | | | | |
| *Jaeropsis* sp. | 0.01 | 0.428 | 12.50 | 0.004 |
| Gammaridea | | | | |
| Unid. sp. | 0.06 | 0.587 | 2.80 | 0.028 |
| Hyperiidae | | | | |
| Unid. sp. | 0.57 | 1.281 | 70.38 | 0.109 |
| Phronimidae | 0.02 | 0.095 | 26.25 | 0.007 |
| Vibilliadae | 0.73 | 0.639 | 36.00 | 0.085 |
| Caprellidea | | | | |
| Unid. sp. | — | 0.008 | 35.00 | 0.004 |
| Euphausiacea | | | | |
| Unid. sp. | 27.36 | 17.759 | 49.86 | 0.325 |
| Unid. larvae | 3.53 | 0.428 | — | 0.004 |
| *Euphausia pacifica* | 0.02 | 0.428 | 24.50 | 0.004 |
| *Thysanoessa spinifera* | — | 0.013 | — | 0.004 |
| Natantian Decapoda | | | | |
| Unid. sp. | 5.14 | 9.513 | 30.94 | 0.102 |
| Unid. megalopa | 0.01 | 0.150 | 10.00 | 0.007 |
| Caridea | — | 0.428 | — | 0.004 |
| *Pandalus jordani* | 0.01 | 0.107 | — | 0.004 |
| *Sergestes similis* | 8.44 | 11.600 | 27.75 | 0.166 |
| Thaliacea | | | | |
| Unid. sp. | 14.87 | 25.332 | 131.07 | 0.329 |
| Larvacea | | | | |
| Unid. sp. | 0.14 | 0.008 | 4.50 | 0.004 |
| Chaetognatha | | | | |
| Unid. sp. | — | 0.428 | 35.00 | 0.007 |
| *Sagitta* sp. | — | 0.408 | — | 0.004 |
| Fish | | | | |
| Unid. sp. | 0.05 | 10.045 | 124.84 | 0.113 |
| *Mustelus henlei* | 0.05 | 0.034 | 22.50 | 0.004 |
| *Engraulis mordax* | 0.02 | 1.029 | 60.00 | 0.004 |
| Myctophidae | 6.01 | 5.513 | 37.46 | 0.152 |
| *Lampanyctus ritteri* | — | 0.215 | 60.00 | 0.004 |
| *Tarletonbeania crenularis* | 0.02 | 1.221 | 63.25 | 0.014 |
| *Merluccius productus* | 0.14 | 6.812 | 114.07 | 0.060 |
| *Aulorhynchus flavidus* | — | 0.086 | 56.00 | 0.004 |
| *Anoplopoma fimbria* | — | 0.428 | — | 0.004 |
| *Mycteroperca jordani* | 0.03 | 0.019 | 27.50 | 0.004 |

1974). Data on age-1 fish suggest that they are almost completely segregated, even from age-2 fish (J. Taynor, Northwest and Alaska Fish. Cent., Natl. Mar. Fish. Serv., NOAA, unpubl. data). Hake spawn from February to April, peaking in March (Ahlstrom and Counts 1955). In the January-March quarter, hake appear in the diet of widow rockfish both as young-of-the-year fish and 1-yr fish. Hake then virtually disappear from the diet until the October-December quarter when they are the major item. Caridean shrimp, almost all those identifiable being *Sergestes similis*, account for another 22% of the diet. The final major prey category of the widow rockfish is euphausiid crustaceans which comprise about 19% of the diet.

These prey types represent about 91% of the diet of widow rockfish, again in terms of volume. The stomach contents of an individual averaged 1.8 different types of prey per stomach. There are virtually no hyperiid amphipods (1.25%) in the widow rockfish's diet, and most of those which are identified (Vibilliadae 0.95%) are from a genus that has been reported as living in association with salps (Madin and Harbison 1977). In fact, these data are pretty much in direct contradiction with Phillips' description of the widow rockfish's diet of "primarily hyperiid amphipods, occasionally salps, pyrosomes, small squid and anchovies." This contradiction may be due to difference in location of fish capture and to differences in sample sizes.

Seasonality in the diet of widow rockfish was examined through quarterly diets (Jan.-Mar., Table 2; Apr.-June, Table 3; July-Sept., Table 4; Oct.-Dec., Table 5). Average size of fish was similar for all quarters (range 449 to 487 mm), but samples were small for some quarters. The four major groups mentioned above account for between 73 and 97% of the quarterly diet volumes (versus 91% for the annual diet), but the distribution of diet volume during the quarters is different among these groups. In the winter quarter, shrimp, primarily sergestids, are an important part of the diet. This was true both in 1980 and 1981. The seasonal occurrence of these prey may be due to an onshore migration during this period (Pearcy and Forss 1966a). The spring quarter (April through June) is the only time that salps are a major part of the diet. This is also the period of high absolute volume of prey per millimeter of fish size and highest number of prey species per fish, but neither is statistically significant. The diet information from the summer quarter is limited by sample size, but during this period euphausiids dominate the diet. During the fall, fish is the principal prey item, particularly juvenile hake.

To investigate possible changes in feeding with size, the widow rockfish from Fields Landing are broken down into three size classes: <450 mm, 450-500 mm, and >500 mm. The two major trends in diet with increasing fish size are the decreasing importance of euphausiids and a corresponding increase of fish in the diet (Table 6). The increase of fish is greater than the decrease in euphausiids, but there is also a slightly increasing trend in salps with larger fish size. Prey size generally increases as the fish size-class increases, with the exception of shrimp. The larger fish come from several collections spread over different months, so it is not likely that these changes are simply a sampling artifact.

There are numbers of fish collected from May and June at each of the three southern areas: Fort Bragg, San Francisco, and Monterey. Average sizes of fish from these three areas are within 100 mm of those from Eureka. In the Fort Bragg samples (Table 7), which are commercially caught, the diet is predominantly salps. In San Francisco Bay (Table 8), where the samples are sport-caught, the diet is predominantly euphausiids. In Monterey, where the samples are a mixture of commercial and sport-caught fish, the diet is a mixture of salps and euphausiids (Table 9). Fish and shrimp are virtually absent from these samples.

Table 2—Diet of widow rockfish from Eureka, January-March 1981. (Average TL = 487 mm, n = 32, min. size = 419 mm, max. size = 795 mm).

| | Mean number | Mean % volume | Mean prey size (mm) | Freq. of occurrence |
|---|---|---|---|---|
| Hyperiidea | | | | |
| *Paraphronima* sp. | 5.63 | 3.215 | 32.50 | 0.063 |
| Euphausiacea | | | | |
| Unid. sp. | 0.44 | 3.723 | 13.75 | 0.094 |
| Natantian Decapoda | | | | |
| Unid. sp. | 19.13 | 27.074 | 31.43 | 0.250 |
| *Sergestes similis* | 23.88 | 35.159 | 30.91 | 0.375 |
| Thaliacea | | | | |
| Unid. sp. | 0.19 | 3.723 | 20.00 | 0.063 |
| Fish | | | | |
| Unid. sp. | 0.03 | 2.031 | 25.00 | 0.094 |
| *Merluccius productus* | 1.13 | 1.558 | 36.25 | 0.156 |
| Myctophidae | 0.22 | 23.518 | 118.00 | 0.219 |

Table 3—Diet of widow rockfish from Eureka, April-June 1980. (Average TL = 467 mm, n = 176, min. size = 390 mm, max. size = 528 mm).

| | Mean number | Mean % volume | Mean prey size (mm) | Freq. of occurrence |
|---|---|---|---|---|
| Ctenophora | | | | |
| *Pleurobrachia bachei* | 0.22 | 1.342 | 20.63 | 0.028 |
| Oligochaeta | | | | |
| Unid. sp. | 0.01 | 0.069 | 9.00 | 0.006 |
| Gastropoda | | | | |
| Unid. sp. | 0.03 | 0.079 | 1.50 | 0.017 |
| Turridae | 0.11 | 0.062 | — | 0.006 |
| Vermiculuridae | 0.11 | 0.688 | — | 0.034 |
| Cephalopoda | | | | |
| Unid. sp. | 0.23 | 0.544 | 65.00 | 0.034 |
| *Loligo opalescens* | 0.02 | 0.516 | 52.50 | 0.006 |
| *Octopus* sp. | 0.01 | 0.275 | 55.00 | 0.006 |
| Isopoda | | | | |
| *Jaeropsis* sp. | 0.01 | 0.688 | 12.50 | 0.006 |
| Gammaridea | | | | |
| Unid. sp. | 0.10 | 0.254 | 2.80 | 0.045 |
| Hyperiidae | | | | |
| Unid. sp. | 0.48 | 0.164 | 15.81 | 0.091 |
| Phronimidae | 0.03 | 0.151 | 26.25 | 0.011 |
| Vibilliadae | 1.15 | 0.971 | 15.43 | 0.114 |
| Caprellidea | | | | |
| Unid. sp. | 0.01 | 0.013 | 35.00 | 0.006 |
| Euphausiacea | | | | |
| Unid. sp. | 42.11 | 22.101 | 15.50 | 0.415 |
| Unid. larvae | 5.68 | 0.688 | — | 0.006 |
| Natantian Decapoda | | | | |
| Unid. sp. | 4.78 | 9.763 | 30.76 | 0.119 |
| Unid. megalopa | 0.01 | 0.172 | 10.00 | 0.006 |
| Caridea | — | 0.688 | — | 0.006 |
| *Sergestes similis* | 9.19 | 10.642 | 26.11 | 0.188 |
| Thaliacea | | | | |
| Unid. sp. | 23.20 | 37.019 | 158.21 | 0.472 |
| Fish | | | | |
| Unid. sp. | 0.35 | 4.527 | 26.67 | 0.142 |
| *Mustelus henlei* | 0.08 | 0.054 | 22.50 | 0.006 |
| Myctophidae | 9.46 | 8.530 | 37.62 | 0.216 |

Table 4—Diet of widow rockfish from Eureka, July-September 1980. (Average TL = 449 mm, n = 27, min. size = 374 mm, max. size = 506 mm).

| | Mean number | Mean % volume | Mean prey size (mm) | Freq. of occurrence |
|---|---|---|---|---|
| Hydromedusae | | | | |
| Unid. sp. | 0.07 | 0.257 | — | 0.037 |
| Physonectid siphonophore | 0.11 | 1.285 | — | 0.037 |
| Gastropoda | | | | |
| Heteropod | 0.56 | 6.423 | — | 0.037 |
| Cephalopoda | | | | |
| *Loligo opalescens* | 0.11 | 0.257 | 40.00 | 0.037 |
| Mysidacea | | | | |
| Unid. sp. | 0.11 | 0.321 | 10.00 | 0.037 |
| Hyperiidae | | | | |
| Unid. sp. | 2.59 | 18.175 | 9.50 | 0.360 |
| Vibilliadae | 0.11 | 0.513 | 7.50 | 0.111 |
| Euphausiacea | | | | |
| Unid. sp. | 3.93 | 46.564 | 20.00 | 0.444 |
| *Euphausia pacifia* | 0.22 | 6.423 | 24.50 | 0.037 |
| Natantian Decapoda | | | | |
| *Pandalus jordani* | 0.11 | 1.606 | — | 0.037 |
| Thaliacea | | | | |
| Unid. sp. | 0.44 | 1.477 | — | 0.740 |
| Fish | | | | |
| Unid. sp. | 0.08 | 3.853 | — | 0.037 |
| *Anoplopoma fimbria* | 0.04 | 6.423 | — | 0.037 |
| *Merluccius productus* | 0.04 | 6.423 | — | 0.037 |

Table 5—Diet of widow rockfish from Eureka, October-December 1980. (Average TL = 465 mm, n = 48, min. size = 370 mm, max. size = 531 mm).

| | Mean number | Mean % volume | Mean prey size (mm) | Freq. of occurrence |
|---|---|---|---|---|
| Hydromedusae | | | | |
| Physonectid siphonophore | 1.21 | 7.296 | 11.00 | 0.146 |
| Polychaeta | | | | |
| Alciopidae | 0.04 | 2.333 | — | 0.042 |
| Gastropoda | | | | |
| Unid. sp. | 0.02 | 0.074 | — | 0.021 |
| Cephalopoda | | | | |
| Unid. sp. | 0.04 | 0.074 | 13.00 | 0.042 |
| *Octopus* sp. | 0.02 | 0.123 | 12.00 | 0.021 |
| Hyperiidae | | | | |
| Unid. sp. | 0.14 | 0.467 | 4.33 | 0.104 |
| Vibilliadae | 0.02 | — | 5.00 | 0.021 |
| Euphausiacea | | | | |
| Unid. sp. | 4.42 | 2.333 | 12.50 | 6.083 |
| *Thysanoessa spinifera* | 0.02 | 0.074 | — | 0.021 |
| Natantian Decapoda | | | | |
| *Sergestes similis* | 0.13 | 2.948 | 32.50 | 0.042 |
| Thaliacea | | | | |
| Unid. sp. | 2.21 | 9.702 | 18.42 | 0.125 |
| Larvacea | | | | |
| Unid. sp. | 0.83 | 0.050 | 4.50 | 0.021 |
| Chaetognatha | | | | |
| Unid. sp. | — | 2.456 | — | 0.021 |
| Fish | | | | |
| Unid. sp. | 1.14 | 38.442 | 35.00 | 0.542 |
| *Engraulis mordax* | 0.10 | 5.895 | 60.00 | 0.063 |
| *Lampanyctus ritteri* | 0.02 | 1.228 | 60.00 | 0.021 |
| *Tarletonbeania crenularis* | 0.13 | 7.001 | 63.25 | 0.083 |
| *Merluccius productus* | 0.69 | 19.503 | 104.25 | 0.188 |

**Table 6—Diet of widow rockfish broken down into size classes from Eureka-Fields Landing area using only major prey categories.**

| | Mean number | Mean % volume | Mean prey size (mm) | Freq. of occurrence |
|---|---|---|---|---|
| Widow rockfish <450 mm (Avg. TL = 435 mm, *n* = 89) | | | | |
| Fish | 1.98 | 18.272 | 51.60 | 0.161 |
| Euphausiids | 67.10 | 21.554 | 17.50 | 0.301 |
| Shrimp | 10.56 | 13.288 | 41.22 | 0.277 |
| Salps | 6.90 | 19.560 | 27.50 | 0.313 |
| Widow rockfish 450-500 mm (Avg. TL = 473 mm, *n* = 186) | | | | |
| Fish | 7.95 | 22.322 | 46.55 | 0.304 |
| Euphausiids | 17.98 | 14.785 | 63.63 | 0.352 |
| Shrimp | 16.00 | 22.414 | 37.67 | 0.296 |
| Salps | 18.29 | 22.987 | 41.00 | 0.333 |
| Widow rockfish >500 mm (Avg. TL = 512, *n* = 29) | | | | |
| Fish | 1.05 | 32.264 | 76.66 | 0.385 |
| Euphausiids | 2.93 | 6.857 | 50.00 | 0.069 |
| Shrimp | 12.96 | 19.668 | 45.84 | 0.241 |
| Salps | 22.76 | 29.159 | 45.00 | 0.379 |

**Table 7—Diet of widow rockfish from the Fort Bragg area. (Average TL = 457 mm, *n* = 28, min. size = 380 mm, max. size = 524 mm).**

| | Mean number | Mean % volume | Mean prey size (mm) | Freq. of occurrence |
|---|---|---|---|---|
| Hydromedusae | | | | |
| Calycophoran siphonophore | 0.04 | 0.781 | 30.00 | 0.036 |
| Gammaridea | | | | |
| Unid. sp. | 0.04 | 0.039 | — | 0.036 |
| Hyperiidae | | | | |
| Vibilliadae | 2.04 | 4.609 | 4.00 | 0.250 |
| Euphausiacea | | | | |
| Unid. sp. | 15.29 | 5.469 | 7.50 | 0.179 |
| *Thysanoessa spinifera* | 0.11 | 0.196 | 2.50 | 0.036 |
| Ascidiacea | | | | |
| Dolioid | 0.21 | 3.125 | 17.50 | 0.036 |
| Thaliacea | | | | |
| Unid. sp. | 26.64 | 82.070 | 74.00 | 0.607 |
| Fish | | | | |
| *Sebastes saxicola* | 0.04 | 0.781 | 30.00 | 0.036 |

**Table 8—Diet of widow rockfish from the San Francisco Bay area. (Average TL = 382 mm, *n* = 20, min. size = 305 mm, max. size = 461 mm).**

| | Mean number | Mean % volume | Mean prey size (mm) | Freq. of occurrence |
|---|---|---|---|---|
| Hyperiidae | | | | |
| Unid. sp. | 0.20 | 1.113 | 13.50 | 0.150 |
| Vibilliadae | 0.45 | 4.016 | 8.50 | 0.200 |
| Euphausiacea | | | | |
| Unid. sp. | 6.90 | 70.481 | 26.57 | 0.500 |
| Natantian Decapoda | | | | |
| Sergestid larvae | 0.50 | 5.750 | 3.50 | 0.050 |
| Thaliacea | | | | |
| Unid. sp. | 0.50 | 9.274 | 15.00 | 0.050 |
| Gelatinous material, undet. | — | 9.274 | 3.00 | 0.050 |
| Fish | | | | |
| Unid. sp. | 0.05 | 0.093 | 6.00 | 0.050 |

**Table 9—Diet of widow rockfish from the Monterey area. (Average TL = 436 mm, *n* = 50, min. size = 266 mm, max. size = 557 mm).**

| | Mean number | Mean % volume | Mean prey size (mm) | Freq. of occurrence |
|---|---|---|---|---|
| Hydromedusae | | | | |
| Calycophoran siphonophore | 0.02 | 0.061 | 4.00 | 0.020 |
| Physonectid siphonophore | 1.56 | 1.768 | 21.67 | 0.100 |
| Gastropoda | | | | |
| *Carinaria japonica* | 0.04 | 2.439 | 70.00 | 0.040 |
| Isopoda | | | | |
| Unid. sp. | — | 0.030 | 2.00 | 0.020 |
| Gammaridea | | | | |
| Unid. sp. | 0.14 | 0.152 | — | 0.060 |
| Caprellidea | | | | |
| Unid. sp. | — | 0.061 | — | 0.020 |
| Hyperiidae | | | | |
| Unid. sp. | 0.10 | 0.640 | 6.25 | 0.080 |
| Vibilliadae | 1.56 | 1.280 | 4.00 | 0.100 |
| Euphausiacea | | | | |
| Unid. sp. | 11.72 | 39.268 | 10.00 | 0.380 |
| Decapoda | | | | |
| Glaucothoe larvae | 0.16 | 3.049 | 9.00 | 0.020 |
| Thaliacea | | | | |
| Unid. sp. | 8.60 | 46.341 | 57.50 | 0.420 |
| Fish | | | | |
| Unid. sp. | 0.40 | 4.695 | 80.00 | 0.060 |
| Unid. larvae | 0.06 | 0.152 | 25.00 | 0.020 |
| Agonidae | 0.02 | 0.061 | 19.00 | 0.020 |

## DISCUSSION

The four major groups—salps, euphausiids, sergestid shrimp, and myctophids—include mostly species reported to be strong vertical migrators (salps - Harbison and Campenot 1979, Wiebe et al. 1979; euphausiids - Brinton 1967; *Sergestes similis* - Pearcy and Forss 1966b; myctophids - Pearcy 1964, Pearcy and Laurs 1966, Paxton 1967). These species comprise the major components of what has been labeled the deep sounding layer. So the principal prey species of the widow rockfish are those that migrate up toward the surface (upper 100 m) during the night and back down into deeper water (400 m) during the day. This means that the widow rockfish is feeding in the upper levels of the water column at night or in deeper water during the day. The commercial fishery operates predominantly at night and makes large, relatively pure catches of widow rockfish exclusively at depths greater than 100 m (Demory 1987; Quirollo 1987; Tagart 1987). There is also evidence that widow rockfish disperse around sunrise and reform during nighttime (Gunderson et al. 1981). These catches from large, tight nocturnal aggregations rule out feeding in the upper levels during the day and indicate that these fishes are feeding either at deeper depths predominantly during the day or crepuscularly on the deep sounding layer during its ascent or descent. The bulk of the stomach samples come from the spring quarter, and this interpretation may be somewhat limited by seasonal feeding patterns. Gunderson et al. (1980) examined a limited number of stomach samples of widow rockfish from nighttime tows when the fish are in schools. They concluded that their data indicated little night feeding by widow rockfish was occurring and that most prey were captured during diurnal periods.

There are major differences in the seasonal diets of widow rockfish, while there is little seasonal variation in abundance of the prey species in plankton collections (Pearcy et al. 1977). Most prey items are at their greatest abundance during the April-June quarter, which is the most intense feeding period. This period directly follows the release of the young larval fish by the adult widow rockfish, at which time fat reserves are traditionally low. Over the range of fish sizes available here, there are some significant changes in diet. Euphausiids are gradually replaced by fish in the diet. This, plus a general increase in size in all diet categories, results in an increase in average prey size with increasing fish size. The results from the geographical data are confounded with the effects of commercial and sport-caught fish. The results are intriguing, but sampling sizes are too small to be reliable.

Most species of rockfish have apparent defense structures, such as strong head spines and large dorsal fins, and live on and/or near-bottom (Phillips 1957). However, the widow rockfish is a member of a group of rockfish species, including most commercially and sport-caught species, which have evolved a streamlined body shape with reduced head spines and a smaller dorsal fin for living high in the water column. This smoother, more fusiform shape plus a smaller head (32.8% of standard length), smaller mouth (13.6%), and a smaller orbit diameter (7.9%), characterize the widow rockfish's unique morphology (Phillips 1957). The other rockfish species which is the most similar (streamlined body, small mouth, eyes and head) is the blue rockfish, *Sebastes mystinus*. This species is traditionally the most important component of the partyboat and skin-diving fishery in central California. The blue rockfish is a near-shore species which is active during the daytime and hides among rocks and algae at night (Ebeling and Bray 1976). The diet of the blue rockfish is also similar to that of the widow rockfish. The principal components are gelatinous plankton (tunicates and scyphozoids), crustaceans (amphipods), and fish (Gotshall et al. 1965). The similarities in morphology and diet of these two species suggests strong parallel forces are important in their evolution.

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