

FREEZING AND COLD STORAGE OF PACIFIC NORTHWEST FISH AND SHELLFISH PART I - STORAGE LIFE OF VARIOUS ROCKFISH FILLETS

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ABSTRACT

DATA ON INITIAL PALATABILITY AND COLD-STORAGE (0° F.) KEEPING QUALITY ARE PRESENTED FOR SINGLE SAMPLE LOTS OF SEVEN SPECIES OF PACIFIC COAST ROCKFISH, PACIFIC OCEAN PERCH, AND FOR OCEAN PERCH (ATLANTIC) AS A COMPARISON.

INTRODUCTION

Rockfish of the genera *Sebastes* and *Sebastes* are landed in large quantities by fishermen along the Pacific coast. These fish are usually filleted and are marketed both fresh and frozen under the general label "rockfish fillets." The various species of rockfish fillets differ in palatability, texture, and cold-storage keeping quality. Cold-storage life of the rockfish fillets is limited largely because of the development of rancidity and undesirable changes in texture.

Table 1 - Description of Nine Species of Rockfish and Cold-Storage Life of the Rockfish Fillets at 0° F.

Species of Rockfish		General Description	Source of Sample	No. of Fillets per 1-lb. Package	Initial Rating	Quality of Fillets/ Rating After Storage at 0° F. For:					
Common Name	Scientific Name					W E E K S					
						9-12	13-16	17-20	21-24	25-28	29-32
Pacific ocean perch	<i>Sebastes alutus</i>	Color: bright carmine-red on dorsal surface; lighter on ventral surface with some silvery sheen. Length: to 19 inches.	Newport, Oregon	4 to 5	VG	G	M	M	M to F	F	U
Lobe-jawed rockfish	<i>Sebastes diploproa</i>	Color: rose-red to brick-red on dorsal surface; silvery sheen on ventral surface. Length: to 12 inches.	Newport, Oregon	4 to 5	G	M	M	M to F	-	U	
Bocaccio	<i>Sebastes paucispinis</i>	Color: light-green to dark-brown on dorsal surface; shading into reddish-bronze to white on ventral surface. Length: to 3 ft.	Eureka, California	3 to 5	VG	G	M	M	F	F	U
Chilipepper	<i>Sebastes goodei</i>	Color: pinkish red on dorsal surface; shading into pink on ventral surface. Length: to 22 inches.	Eureka, California	4 to 5	VG	M	F	F	U		
Orange or red rockfish	<i>Sebastes pinniger</i>	Color: light-olive gray with orange-red, red predominating, on dorsal surface; paler to nearly white on ventral surface. Length: to 2½ feet.	Seattle, Washington	2 to 3	VG	M to F	F	F to U	U		
Red rockfish or "red snapper"	<i>Sebastes ruberrimus</i>	Color: deep vermilion-red on dorsal surface; paler on ventral surface. Length: to 3 ft.	Seattle, Washington ^{1/}	1 to 2	G	M	F	F	F	U	
Vermilion rockfish	<i>Sebastes miniatus</i>	Color: vermilion-red on dorsal surface; light-red on ventral surface; black dots on back and sides. Length: to 3 feet.	Seattle, Washington ^{1/}	1 to 2	G	U ^{2/}					
Channel rockfish or "Idiot"	<i>Sebastes alascanus</i>	Color: bright-red; dark blotches on fins; cheeks spiny. Length: to 2 feet.	Newport, Oregon	11 to 12	-	-	M	M to F	-	U	
Ocean perch (Atlantic) or rosefish	<i>Sebastes marinus</i>	Color: orange-red or red on dorsal surface; paler on ventral surface. Length: to 2 ft.	Gloucester, Mass.	4 to 5	VG	G	M	M	-	F	U

^{1/} SAMPLES OF RED ROCKFISH (*SEBASTES RUBERRIMUS*) AND VERMILION ROCKFISH (*SEBASTES MINIATUS*) WERE PREPARED AT THE FISHERY TECHNOLOGICAL LABORATORY, SEATTLE, WASHINGTON, FROM FISH CAUGHT OFF THE COAST OF WASHINGTON BY THE SERVICE'S LABORATORY VESSEL JOHN B. COBB. THESE FISH WERE FROZEN WHOLE ABOARD THE VESSEL. AT THE LABORATORY THE FISH WERE THAWED IN COLD RUNNING WATER AND FILLETED; THE FILLETS WERE PACKAGED AND REFROZEN.

^{2/} FACTORS DETERMINING QUALITY ARE APPEARANCE, FLAVOR, TEXTURE, AND ODOR; VG = VERY GOOD (HIGHEST PREFERENCE), G = GOOD (NORMAL QUALITY OF FRESH FILLETS), M = MEDIUM (SOME LOSS IN ORIGINAL QUALITY), F = FAIR (APPRECIABLE DETERIORATION IN QUALITY), U = UNACCEPTABLE (POOR TO UNFIT FOR CONSUMPTION).

^{3/} UNACCEPTABLE AFTER 3 WEEKS.

"-" INDICATES NO OBSERVATION.

The rate of deterioration during storage varies from species to species. This report presents data on the initial palatability and the cold-storage keeping quality of eight species of Pacific coast rockfish (table 1). Data on the ocean perch (Atlantic), *Sebastes marinus*, a species of rockfish found on the Atlantic coast, are included for comparison. Although this study was limited to storage tests with only one lot of samples for each species, the information may serve as a guide to the commercial processor in the packing and marketing of these fish. It may be advantageous, for example, for the processor to promote separately those species of rockfish which show high acceptability and good cold-storage keeping quality.

EXPERIMENTAL PROCEDURE

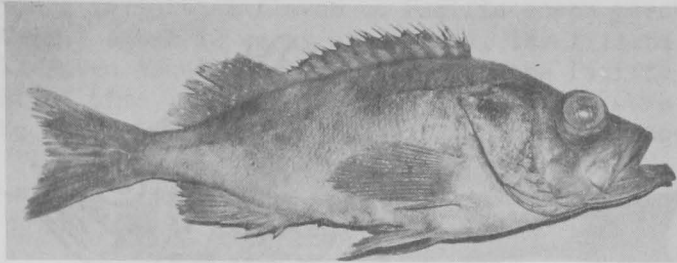
Fillet samples of Pacific ocean perch (*S. alutus*), bocaccio (*S. paucispinis*), lobe-jawed rockfish (*S. diploproa*), orange or red rockfish (*S. pinniger*), chili-

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pepper (S. goodei), and channel rockfish or "idiot" (Sebastolobus alascanus) were prepared and frozen in one-pound packages in commercial filleting plants, using regular commercial procedures.

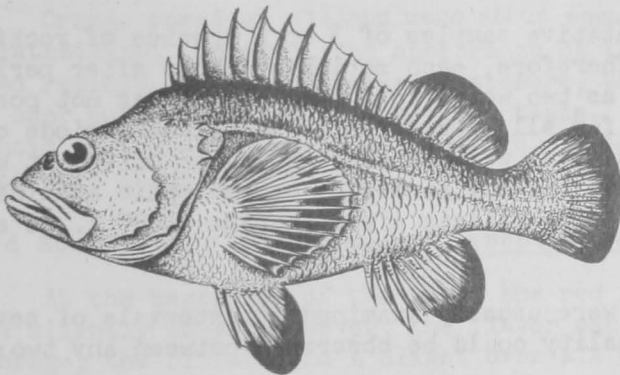
Samples of vermilion rockfish (Sebastodes miniatus) and red rockfish or "red snapper" (S. ruberrimus) were prepared at the Seattle Technological Laboratory from fish caught off the coast of Washington by the Service's exploratory fishing vessel, John N. Cobb. These



PACIFIC OCEAN PERCH (SEBASTODES ALUTUS)

fish had been frozen whole aboard the vessel. At the laboratory they were thawed in cold running water and filleted. The fillets were packaged and refrozen. The exact effect of this procedure on the cold-storage keeping quality of the fillets is not known. The results of the storage tests on these samples may be of interest, however, and are included in this report.

The skin was removed from the fillets of red rockfish (Sebastes ruberrimus), vermilion rockfish (S. miniatus), and orange rockfish (S. pinniger) before packing and freezing. The fillets of the remaining species were packed with the skin on.



RED ROCKFISH (SEBASTODES RUBERRIMUS)

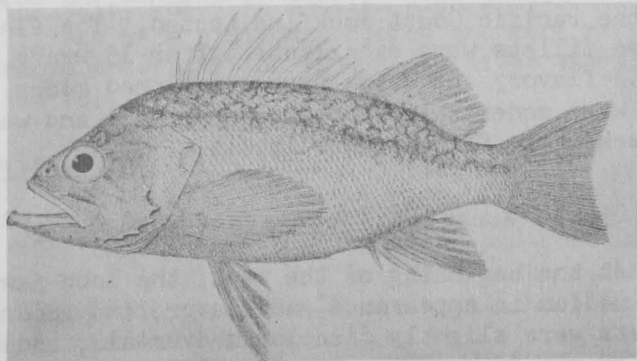
bles that of some of the Pacific Coast rockfish, especially the Pacific ocean perch (Sebastes alutus). For these reasons it was included in these tests as a basis for comparison.

All samples were stored at 0° F. Organoleptic observations were made on the thawed fillets and on the cooked product. These tests were made prior to freezing and storage, and thereafter at periodic intervals of several weeks. Two or more packages of fillets of each species were taken from cold storage and allowed to thaw at room temperature. Thawing was hastened by directing the air blown from an electric fan over the packages. Appearance and odor of the thawed fillets were noted.

Samples of ocean perch (Atlantic), Sebastes marinus, fillets were obtained from Gloucester, Massachusetts, where they had been prepared, packaged, and frozen under regular commercial conditions. These fillet samples were shipped frozen (using dry ice) via air express to Seattle, Washington.

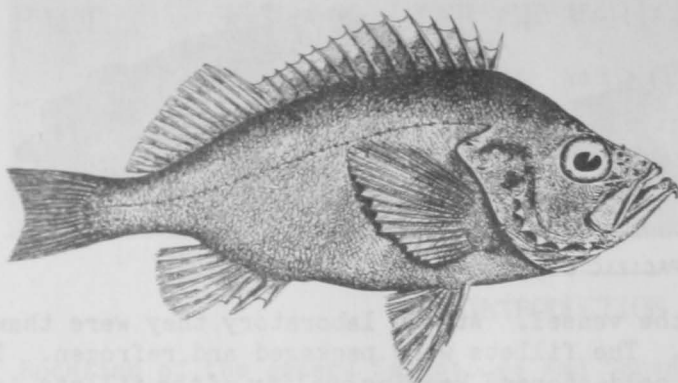
The ocean perch (Atlantic), S. marinus, catch leads that of any other fish in the New England area. Also, the general external appearance of this species resem-

especially the Pacific ocean



VERMILION ROCKFISH (SEBASTODES MINIATUS)

For tests on the cooked product, 3 to 5 individual fillets were used. These were immersed in a 6-percent brine solution for 5 minutes; drained; wrapped in vegetable parchment; and then steamed for 20 minutes. These cooked fillets were judged for quality by members of a selected taste panel, which consisted of 4 or 5 testers. Observations were made for appearance, flavor, texture, and odor. A low score for any one of the factors for the thawed or cooked fillets made them unacceptable. Whenever possible, each series of tests was repeated in the next day or two to determine the consistency of the organoleptic observations and



(ATLANTIC) OCEAN PERCH (SEBASTES MARINUS)

to eliminate any possible gross error in sampling. Inasmuch as a fresh reference standard of each species could not be used for each test, frozen Pacific ocean perch (Sebastes alutus) was used as the standard for comparison.

DISCUSSION

Each test was limited to representative samples of 3 or 4 species of rockfish and was repeated within a few days. Therefore, each series of tests after periodic intervals of storage required as much as two weeks to complete. It was not possible to make organoleptic examinations for all species after identical periods of cold storage. Since samples of some species were obtained at later dates, it was not possible to make all storage periods for any series of organoleptic examinations coincide. The general quality of the fillets after storage at 0° F. is summarized by 4-week periods in table 1.

Although samples of each species were usually examined at intervals of several weeks, often no definite changes in quality could be observed between any two consecutive examinations.

The summary of results that follows presents only those data in which the organoleptic observations showed a clear-cut change in the quality of the samples.

Pacific Ocean Perch (Sebastes alutus)

Fillets of Pacific ocean perch had the best cold-storage keeping quality of all the Pacific Coast rockfish tested. The flavor and texture of the freshly-frozen fillets were excellent. After 15 weeks of storage, some fillets were lacking in flavor, and a few were discolored along the edges. After 25 weeks, the fillets were moderately discolored over-all and were somewhat rancid in flavor. After 32 weeks, the fillets were inedible.

Lobe-Jawed Rockfish (Sebastes diploproa)

At the beginning of the test, the lobe-jawed rockfish fillets were rated about medium in appearance and flavor, and good in texture. After 12 weeks, the fillets were slightly discolored over-all, and a few samples were slightly rancid in flavor. After 20 weeks, the fillets were moderately discolored and moderately rancid in flavor. After 26 weeks, the fillets were inedible.

Bocaccio (Sebastes paucispinis)

Bocaccio fillets were about equal in initial flavor to Pacific ocean perch but had a firmer and flakier texture. After 12 weeks of storage, the fillets were slightly tough but were still rated about equal in flavor to the Pacific ocean perch stored the same amount of time. After 19 weeks, the fillets were fairly good in appearance, flat to slightly rancid in flavor, and somewhat tough in texture. After 29 weeks, the fillets were inedible because of toughness. Also they were slightly darkened over-all, the light meat was flavorless, and the dark meat was rancid.

Chilipper (Sebastes goodei)

Chilipepper fillets were found to be about equal in initial palatability to Pacific ocean perch and bocaccio and were rated very good. After 11 weeks in storage, the quality of the fillets had definitely dropped; all the samples showed a general discoloration and had toughened somewhat; and a few of the samples had a flat flavor while others had an off-flavor. After 17 weeks, the fillets were discolored, and some samples were rancid in flavor. After 22 weeks the fillets were all poor in quality because of rancidity and toughness.

Orange or Red Rockfish (Sebastes pinniger)

Orange rockfish fillets were about equal to Pacific ocean perch in initial palatability. However, the appearance of the orange rockfish fillets deteriorated rapidly. After 12 weeks of storage, the fillets were discolored and rancid in odor but only slightly rancid in taste. After 16 weeks, the fillets were also rancid in taste and were only fair in over-all quality. After 22 weeks, the fillets were inedible.

Red Rockfish or "Red Snapper" (Sebastes ruberrimus)^{1/}

At the beginning of the test, the red rockfish fillets were flaky in texture and slightly tough; however, the flavor was considered good. After 9 weeks of storage, the fillets had a slight over-all discoloration and a rancid odor. After 16 weeks the fillets were only fair in appearance and flavor. After 26 weeks, the fillets were inedible because of poor appearance and rancid flavor.

Vermilion Rockfish (Sebastes miniatus)

In initial palatability, the vermilion rockfish fillets were rated good in flavor but were slightly tough. (Vermilion rockfish are usually discarded at sea because of the poor appearance of the skin, which is mottled with gray-black dots.) After three weeks of storage, the fillets were badly discolored and were rancid in flavor and odor. Because of this rapid deterioration in quality after storage, this species does not appear suitable for freezing.

Channel Rockfish or "Idiot" (Sebastes alascanus)

The first organoleptic test was made on the samples of channel rockfish after 15 weeks of storage, at which time the fillets were flat in taste and soft in texture. After 20 weeks, one sample was poor in flavor and mushy in texture, and the remaining samples were about medium in quality. After 28 weeks, all the fillets were rated inedible because of poor flavor and texture.

^{1/} FILLETS FROM THIS SPECIES OF FISH WERE NOT PREPARED IN THE USUAL COMMERCIAL MANNER BUT AS FOLLOWS: THE ROUND FISH WERE FROZEN AT SEA ABOARD SHIP. AT THE LABORATORY THE FROZEN FISH WERE THAWED AND FILLETED. THE FILLETS WERE THEN PACKAGED AND REFROZEN.

Ocean Perch (Atlantic) or Rosefish (Sebastes marinus)

In initial palatability, ocean perch (Atlantic) fillets was preferred over the other species of rockfish. However, there was not much difference in palatability between ocean perch and Pacific ocean perch. The difference was largely in texture, the ocean perch being somewhat more tender. After 12 weeks of storage and for the remainder of its storage life, the quality of the ocean perch (Atlantic) fillets were comparable to that of Pacific ocean perch fillets which had been in storage for the same length of time. After 13 weeks, a few of the ocean perch fillets were discolored along the edges and were lacking in flavor. After 25 weeks, some fillets were discolored over-all and were rancid in flavor along the edges. After 29 weeks, the fillets had a moderate over-all darkening, a discoloration along the edges, an accumulation of fat in patches, and a rancid flavor and odor. They were, therefore, considered inedible after this period of storage.

SUMMARY

Singles lots of various species of Pacific Coast rockfish fillets tested prior to freezing and storage at 0° F. differed in appearance, texture, or flavor. Pacific ocean perch (Sebastes alutus), red rockfish (Sebastes pinniger), bocaccio (Sebastes paucispinis), and chilipepper (Sebastes goodei) were rated very good. The group next in choice, rated good, consisted of red rockfish (Sebastes ruberrimus), lobe-jawed rockfish (Sebastes diploproa), vermilion rockfish (Sebastes miniatus). No observation was made on the initial palatability of channel rockfish (Sebastes alascanus).

Pacific ocean perch fillets (Sebastes alutus) had the best cold-storage keeping quality and the longest cold-storage life. Although bocaccio (Sebastes paucispinis), fillets had a storage life about equally long, they did become tough. The cold-storage life for Pacific ocean perch fillets was 32 weeks and bocaccio 29 weeks. Vermilion rockfish (Sebastes miniatus) deteriorated so rapidly in quality that they were not considered suitable for frozen storage. The other species of Pacific Coast rockfish fillets tested had a cold-storage life of 5 or 6 months.

Ocean perch (Sebastes marinus) fillets were given a slight preference over the Pacific Coast rockfish in initial palatability. The fillets were quite similar to Pacific ocean perch (Sebastes alutus) in appearance, flavor, and texture throughout most of the storage period. They had a cold-storage life of 29 weeks.

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