



UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
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August 1, 2007

MEMORANDUM TO: D. Robert Lohn. Regional Administrator
Northwest Region

Usha Varanasi

FROM: Usha Varanasi, Ph.D., Science and Research Director
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SUBJECT: Scientific review of Petition to List Five Rockfish
Species in Puget Sound as Endangered or
Threatened under the Endangered Species Act

This memo is in response to your May 17th, 2007 request for a technical review of Mr. Sam Wright's petition to delineate and list Puget Sound Distinct Population Segments (DPSs) of bocaccio (*Sebastes paucispinis*), canary rockfish (*S. pinniger*), yelloweye rockfish (*S. ruberrimus*), greenstripe rockfish (*S. elongatus*) and redstripe rockfish (*S. proriger*) as endangered or threatened species under the ESA. Specifically, the NWFSC was asked to address two questions:

- (1) Does the petitioner present substantial information indicating that the five petitioned rockfish species may warrant delineation into Puget Sound DPSs?
- (2) Do the anecdotal information and the catch records for the petitioned species represent substantial information indicating that such DPSs may be in danger of extinction or likely to become endangered in the foreseeable future?

Regarding (1), the delineation of the five species into Puget Sound DPSs, the petitioner provides no new data regarding the species in question. As far as we are aware, he is correct in asserting that no such information exists for the five species—with one exception¹ that is not specific to Puget Sound but is germane to the problem (see below).

Instead, the petitioner relies on several related lines of information to suggest that the petitioned five species likely have Puget Sound DPSs: (1) the relatively closed circulation patterns in Puget Sound, (2) the previous delineation of Puget Sound DPSs for three other rockfish species (copper *S. caurinus*, brown *S. auriculatus* and quillback *S. maliger*)², and (3) similarity

in life-history characters (live bearing, larval duration, etc) between these three species and the five species in the current petition. The assumption is that there is little mixing of water into Puget Sound Proper from areas to the north, and thus, a low probability of delivery of larvae from sources external to Puget Sound Proper. Since the five species in this petition have similar life-histories to the three rockfish with identified Puget Sound DPSs, they should have similar dispersal potentials, and petitioner believes it is likely that they have Puget Sound DPSs. Genetic isolation of Puget Sound populations of copper and brown rockfishes has been supported by more recent genetics work^{3, 4}

Long pelagic larval duration (PLD) and high fecundity are life-history traits generally associated with higher dispersal potential. Longer PLD increases the time a larva's position is influenced by currents, and high fecundity increases the chance that some larvae will survive the pelagic stage and successfully disperse to suitable habitat. While most rockfish have generally similar life-history traits (in particular, live brooding, larval dispersal and site fidelity generally to rocky habitats), there are some differences between the three species with identified Puget Sound DPSs and the five subject to Mr. Wright's petition, which suggest differences in dispersal potential among these species. Estimates of PLD are ~ 90 days for copper and quillback rockfish^{3, 5}. Bocaccio (PLD of 155 days) and canary (PLD of 116 days) have somewhat longer⁶ PLDs suggesting greater dispersal potential and a lower likelihood of geographic isolation. Estimates of PLD do not exist for redstripe, yelloweye and and greenstripe. However, we expect PLD for these species would be similar to or lower than that for bocaccio or canary. There are differences in fecundity as well. Bocaccio (20k to 2+ million eggs), canary (260k to 1.9 million) and yelloweye (1.2 to 2.7 million) are also more fecund than brown (55-339k) or copper rockfish (16-640k)⁵ (although greenstripe are not). Thus bocaccio, canary and potentially yelloweye may have greater dispersal potential than copper or quillback rockfish, which would initially suggest that Puget Sound DPSs are less likely for these fishes.

Although a species may have relatively high dispersal 'potential', its realized dispersal is determined to a large extent by current patterns and larval behavior. There are no population genetic studies of the five petitioned species that include samples from Puget Sound, but other studies of west coast rockfish suggest that it is reasonable to suspect Puget Sound DPSs for the five species. Recent genetic work on copper³ and brown⁴, blue⁷ *S. mystinus*, rosethorn⁸ *S. helvomaculatus* and bocaccio¹ indicates that all exhibit some level of genetic population structure on the west coast. Those studies that do include Puget Sound samples generally show that Puget Sound samples are genetically distinct from those obtained from other



geographic areas^{3, 4}. Work in Japan has found similar geographic difference in allelic frequencies among populations of rockfishes⁹. In all these cases, the differences appear to be related to circulation patterns and biogeographic barriers, many of which are probably less restrictive than the entrance into Puget Sound Proper in terms of the potential for trans-boundary larval dispersal. Importantly, both bocaccio (PLD of 155 days) and blue rockfish (PLD of 90-150 days) have long potential dispersal times but still show genetic structure on the open coast. Since bocaccio shows some level of genetic population structure on the open coast¹, it is reasonable to suspect that it would also show some isolation within Puget Sound proper versus other areas. Under the joint DPS policy, genetic isolation reflecting “discreteness” does not necessarily indicate that a population is also “significant” and hence a DPS, but we see no biological reason why copper, quillback, and brown rockfish would have “discrete” and “significant” DPSs in Puget Sound proper, and the five petitioned species would not.

Regarding point (2) and the potential for extinction, the petitioner provides fisher-dependent catch estimates for approximately 12 years in the mid 1970’s to mid 1980’s, as well as anecdotal evidence for the near disappearance of the five species in Puget Sound proper.

The catch data are difficult to assess because no information is given regarding effort or changes in fisheries practices or regulations during the period. For example, the petitioner notes that bocaccio and redstripe catches coincide spatially with the walleye pollock fishery that operated during the 1970s and 1980s. CPUE for pollock was higher during the 1970s to early 1980s than it was before or after this period¹⁰. Therefore it is possible that catches in this period represent some sort of peak for Puget Sound as a whole, perhaps related to environmental conditions, but is impossible to tell at this point.

If the data are taken at face value, they appear to show strong declines for bocaccio, greenstripe and redstripe rockfishes. Catch of bocaccio declined to only 3.7% of its historical high; greenstripe to 10.8% of its high in 1985 before dropping to zero afterwards; and redstripe dropped to as low as 1.4% of its historical high before zeroing out. Assuming these data represent actual population trends, they would warrant concern about the status of these species. For canary and yelloweye, the catch data do not suggest declines over the time period of the data as the highest catches came in 1986, the end of the data set, and were generally twice as high as the average.



For canary rockfish the petitioner contends that anecdotal evidence does suggest that they were significantly more common in the 1960s than at present. WDFW documents¹¹ do list canary as one of the three most common rockfish caught in Puget Sound. However, it is not entirely clear as to how Puget Sound is defined, and the statement appears to be directed at a 'greater' Puget Sound and not Puget Sound proper—the focus of the present petition. For example, in Holmbert et al.¹¹ rockfish catch is discussed in regard to Hecate Strait, Queen Charlotte Sound, NW coast of Vancouver Island, SW Vancouver Island, N Washington coast, S Washington coast, and Puget Sound. The statement and data could therefore apply to areas outside of Puget Sound proper.

In conclusion,

- (1) While there are no direct data supporting Puget Sound DPSs for the five proposed fishes, indirect information suggests that it would be reasonable to suspect that Puget Sound DPSs might exist for these species.
- (2) Much of the catch and anecdotal data for a decline is weak, but taken as a whole, the data and observations do suggest substantial declines in these species in Puget Sound proper.

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