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FISH & WILDLIFE OFFICE

26 November 2002

Field Supervisor
Sacramento Fish and Wildlife Office
US Fish and Wildlife Service
2800 Cottage Way, Suite W-2605
Sacramento CA 95825

Re: Sacramento splittail final rule

Please accept the following comments on the listing of the splittail, as published in the Federal Register (67:55: 13095-13098)on 21 March 2002.

1. The statistical analysis using the multiple linear regression analysis is flawed. The text seems to indicate that 6 of the 20 coefficients show a positive trend in splittail numbers. In fact, the statistics tell us that most of the purported trends, positive and negative, show no trend at all; they are not significant. This is not particularly surprising given the nature of the sampling programs, most of which do not sample splittail adequately. Midwater trawling programs only fortuitously catch splittail, which are a benthic fish (and their catches are small as a consequence). Likewise, the Bay Study catches only small numbers because it samples habitat that is marginal for splittail, at the edge of their range in the estuary. Timing of the sampling is also important. For example, the Chipps Island midwater trawl survey has more validity for splittail than the fall midwater trawl survey because it takes place in spring, when YOY splittail are moving downstream into Suisun Bay, so are more vulnerable to capture. The best of the surveys is my own (UC Davis) Suisun Marsh survey because it has focused since its inception on native estuarine fishes, including splittail, and captures splittail all year around. The inadequacies of the various surveys are addressed in the draft splittail white paper (Moyle et al. 2001), which is also used as the source of information for the rest of this opinion. Despite the inadequacies of the surveys and analysis, it is worth noting that the only significant values showed declining trends in splittail numbers during the analysis period.

2. It is not necessary to show declining trends in splittail numbers in the last 20 years to be concerned about their long-term survival. As discussed in the my book *Inland Fishes of California* (2002, Univ. Calif. Press), the present range of the splittail is a fraction of its historic range. It is now endemic to the San Francisco Estuary, which is still changing in many unpredictable ways. Any species which depends on the SF Estuary for its existence, given the

uncertainties about the estuary's future, should be regarded as threatened with extinction.

3. The splittail has a life cycle that has protected it from extinction so far, but may not in the future. It has a boom-or-bust population cycle because of its ability to produce large numbers of young when the Yolo Bypass and other areas are flooded for a long enough period. Thus in the past year splittail numbers in Suisun Marsh have become comparable to the numbers collected at the beginning of the study, around 1980. However, to persist, the splittail will have to make it through longer periods of drought (natural and human-made) than it has since the 1960s when the State Water Project went on line. The life cycle of the splittail can be divided into three sections, each of which needs special management: (1) spawning and early life history rearing on riverine flood plains; (2) migrating adults and juveniles passing through the Delta, which is increasingly unfavorable habitat for them (see below); (3) raring for most of the rest of the life cycle, in brackish water marsh and shallow bay habitats, which seems to becoming less favorable to splittail. If all three areas individually are not safe for splittail, then their long-term survival is problematical.

4. One of the keys to long-term survival of splittail is their apparent ability to produce weak year classes even under drought conditions. This requires that adults move upstream from brackish water (especially Suisun Marsh and Bay) to spawning areas, presumably on river margins, that are flooded long enough for spawning and rearing through the larval and early juvenile stages to take place. The juveniles then have to make their way downstream through the Delta to rearing areas. While this has apparently happened in the past, there is no guarantee it will continue to happen. The Delta is increasingly a hostile environment for small splittail, especially when flows are low, increasing transit time. The extensive invasion of *Egeria densa* has made shallow water habitats increasingly scarce along the out-migration routes, habitats that are already scarce because of levees and rip-rap. Probably because of the habitat created by the macrophyte beds, populations of largemouth bass (*Micropterus salmoides*) and spotted bass (*M. punctulatus*) have increased greatly in the past decade. Both are piscivores that selectively prey on cyprinids (Moyle 2002). Thus it is likely that the probability of juvenile survival in dry years has decreased considerably. Large bass will also prey on adult splittail.

5. The populations of adult striped bass *(Morone saxatilis)* are now at the highest levels they have been in decades, apparently 2-3 million fish. Large striped bass are a predator on splittail and so increased adult splittail mortality is likely, which could be important in years when splittail numbers are low. In addition, a study by Freyer et al.(2001) indicates that juvenile striped bass are now smaller when they begin feeding on fish than they were previously, because of the decline in their preferred prey, mysid shrimp. This suggests an additional threat to juvenile splittail during years of low spawning success.

6. In the past 2-3 years, a large (4-5 cm carapace length) predatory shrimp (*Exopaleomon modestus*) has invaded the fresh and brackish parts of the estuary in large numbers. Although this shrimp has not yet been studied, it is quite likely that it preys on mysid shrimp. Even prior to this invasion, mysid populations were in decline, resulting in a reduction in splittail growth rate (see

white paper).. Mysid shrimp are also a preferred prey of splittail of all sizes. The long-term impact of the *Exopalemon* invasion on splittail is highly speculative, yet it represents the kind of unexpected threat that continually appears in the estuary.

7. Selenium levels are increasing in adult splittail, apparently because large adults are increasingly feeding on the alien overbite clam, *Potamocorbula amurensis* (R. Stewart, USGS, pers. comm.) While the impact of selenium on splittail physiology and reproduction is uncertain, it is indicative of the general problem of heavy metals and other toxicants in the estuary, which can have unexpected consequences.

8. We have learned a great deal about splittail biology in the past few years that indicates there are many actions that can be taken to increase its populations and to reduce year-to-year variability in spawning success. Artificial flooding of part of the Yolo Bypass, increasing floodplain habitat along rivers such as the Cosumnes, rearing splittail in ponds, and increasing rearing habitat in brackish water areas all have great potential as splittail restoration strategies. However, these actions are mostly still in the planning or preplanning stages and they still need study. I think the future of the splittail will not be secure until a number of these projects have been completed and demonstrated to favor splittail over a wide variety of climatic conditions.

In short, in my professional opinion, there is too much uncertainty regarding the long-term survival of splittail not to have it protected under the Endangered Species Act. It is a species which helps to define the health of the entire estuarine ecosystem. When we have a healthy, functioning estuary, as discussed in the CALFED Ecosystem Restoration Program plan, it is likely the splittail population will be secure. Until then, it needs protection under the ESA.

Sincerely,

Peter B. Moyle
Professor, Fish Biology