

achieved with fewer populations. We have concluded that identification of critical habitat that would provide for the number of populations outlined in Table 1 for each species is essential to their conservation.

TABLE 1.—NUMBER OF DISTINCT VIABLE STREAM POPULATIONS OF FIVE CUMBERLANDIAN MUSSELS REQUIRED BEFORE DELISTING CAN OCCUR AS OUTLINED IN DRAFT AGENCY RECOVERY PLAN (SERVICE 2003)

Species	Number of populations required for delisting
Cumberland elktoe	10
Oyster mussel	11
Cumberlandian combshell	10
Purple bean	4
Rough rabbitsfoot	3

Our approach to delineating specific critical habitat units, based on the recovery strategy outlined above, focused first on considering the historic ranges of the five mussels. We evaluated streams and rivers within the historic ranges of these five mussels for which there was evidence that these species had occurred there at some point (*i.e.*, collection records). Within the historic range of these species, we found that a large proportion of the streams and rivers in the Tennessee and Cumberland River Basins that historically supported these mussels has been modified by existing dams and their impounded waters. Extensive portions of the Tennessee and Cumberland River drainages, including the mainstem of the Cumberland River, segments of the Holston River, the Powell River, the Tennessee River mainstem, and numerous tributaries of these rivers, cannot be considered essential to the conservation of these species because they no longer provide the physical and biological features that are essential for their conservation (see Primary Constituent Elements discussion above). We also did not consider several streams with single site occurrence records of a single species as essential to the conservation of these species because these areas exhibited limited habitat availability, isolation, degraded habitat, and/or low management value or potential (*e.g.*, Cedar Creek in Colbert County, Alabama; Little Pigeon River in Sevier County, Tennessee). Similarly, we did not consider as essential areas from which there have been no collection records of these species for several decades (*e.g.*, portions of the

upper Holston River system in Tennessee and Virginia, Buffalo River, Little South Fork of the Cumberland River, Laurel River).

We then identified 13 stream or river reaches (units) within the historic range of these species for which our data (*i.e.*, collection records over the last 15 years and view of experts) indicate that one or more of the 5 mussel species are present along with the primary constituent elements (see Table 2; Index map). These units total approximately 892 rkm (544 rmi), in Alabama, Kentucky, Mississippi, Tennessee, and Virginia. We believe that these areas support darters, minnows, sculpins, and other fishes that have been identified as hosts or potential hosts for one or more of the mussels, as evidenced by known fish distributions (Etnier and Starnes 1998), the persistence of the mussels over extended periods of time, or field evidence of recruitment (Ahlstedt pers. comm. 2002, B. Butler, pers. comm. 2002). We consider all of these 13 reaches essential for the conservation of these 5 mussels. As discussed in the agency draft recovery plan, long-term conservation of these five mussels is unlikely in their currently reduced and fragmented state. Therefore, it is essential to include in this designation these 13 reaches within the historic range of all 5 mussels that still contain mussels and the primary constituent elements of habitat.

We then considered whether these essential areas were adequate for the conservation of these five mussels. As indicated in the agency draft recovery plan, threats to the five species are compounded by their limited distribution and isolation and it is unlikely that currently occupied habitat is adequate for the conservation of all five species. Conservation of these species requires expanding their ranges into currently unoccupied portions of their historic habitat because small, isolated, fragmented aquatic populations, as discussed previously, are subject to chance catastrophic events and to changes in human activities and land use practices that may result in their elimination. Larger, more contiguous populations can reduce the threat of extinction.

Each of the 13 habitat units is currently occupied by 1 or more of the 5 listed mussels. Because portions of the historic range of each of the 5 mussels are shared with three or more of the other mussel species, there is considerable overlap between species' current and historic distribution within the 13 habitat units. This offers opportunities to increase each species' current range and number of extant

populations into units currently occupied by other listed species included in this designation. For example, the oyster mussel historically inhabited seven units and currently inhabits five. Successful reintroduction of the species into units that they historically occupied (and that are currently occupied by one or more of the five mussels) would expand the number of populations, thereby reducing the threat of extinction.

We believe that the habitat proposed for designation in these 13 units is essential to the conservation of all 5 mussels and that the 13 units encompass sufficient habitat necessary for the recovery of 3 of these 5 species (the Cumberland elktoe, purple bean, and rough rabbitsfoot.) However, we do not believe that the 13 units provide sufficient essential habitat for the conservation of the oyster mussel and Cumberlandian combshell, based on the number of viable populations required for conservation and recovery of these two species (Table 1). For example, these 13 proposed units include occupied habitat for 5 existing oyster mussel populations and include unoccupied habitat in three other areas that could support oyster mussel populations. Our agency draft recovery plan, however, requires 11 viable populations of the oyster mussel before it may be delisted. The essential area as defined by our 13 units is not adequate to ensure the conservation of the oyster mussel and Cumberlandian combshell. Therefore, we then considered free-flowing river reaches that historically contained the Cumberlandian combshell and oyster mussel but that have had no collection records for the past 15 years, and that, resulting from water quality and quantity improvements, likely contain suitable habitat for these mussels. Through our analysis, we identified 4 such reaches that are separated by dams and impoundments from free-flowing habitats that contain extant populations of oyster mussels and Cumberlandian combshells. These areas are the lower French Broad River below Douglas Dam to its confluence with the Holston River, Sevier and Knox Counties, Tennessee; the free-flowing reach of the Holston River below Cherokee Dam to its confluence with the French Broad River, Jefferson, Grainger, and Knox Counties, Tennessee; the Tennessee River mainstem below Wilson Dam in Colbert and Lauderdale Counties, Alabama; and a stretch of the Rockcastle River in Laurel, Rockcastle, and Pulaski Counties, Kentucky. Natural recolonization of these areas by these two species is unlikely; however, these