

**Tidewater Goby**  
*(Eucyclogobius newberryi)*

**5-Year Review:  
Summary and Evaluation**



Photo by U.S. Fish and Wildlife Staff

**U.S. Fish and Wildlife Service  
Ventura Fish and Wildlife Office  
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**5-YEAR REVIEW**  
**Tidewater Goby (*Eucyclogobius newberryi*)**

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**5-YEAR REVIEW**  
**Tidewater Goby/*Eucyclogobius newberryi***

**1. GENERAL INFORMATION**

**1.1. Reviewers**

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**1.2. Methodology used to complete the review:**

This review was prepared by staff of the Ventura Fish and Wildlife Office in cooperation with staff from the Arcata, Sacramento, and Carlsbad Fish and Wildlife Offices. All information pertinent to the status of the tidewater goby that has become available since its listing in 1994 was reviewed as part of this analysis. The information on threats to the tidewater goby in this review was compiled and analyzed by Entrix Environmental Consultants under a contract with the U.S. Fish and Wildlife Service (Service). Sources of information used for this review included peer-reviewed scientific literature, government reports, documents pertaining to section 7 consultations, and the Recovery Plan for the Tidewater Goby (Service 2005). Much of the information on the biology of the tidewater goby was based on the research of Camm Swift, David Jacobs, and Kevin Lafferty as reported in the scientific literature (for a review of their research, see the Recovery Plan for the Tidewater Goby). We incorporated all comments and information from our files into our review, as appropriate.

To quantify presence and absence of tidewater gobies within localities across their range, a

summary of all known tidewater goby literature was reviewed (Toline et al. 2006). The term locality, is used here to refer only to an area documented as occupied by tidewater goby during at least one sampling event. From this, presence or absence was established for any localities where data were available from the time of listing (1994) to the present (Toline et al. 2006). Much of the latest assessment is based on the status as of 2005 as defined in the recovery plan (Service 2005). The status defined in the recovery plan is based on both published data and expert opinion. To be consistent with the recovery plan, status of localities is discussed in terms of being extirpated (defined as no detection at a locality for 3 or more consecutive years of survey effort), intermittent (irregular detection at a locality), or regular (currently occupied and have been consistently occupied for three or more consecutive years).

### **1.3. Background:**

#### **1.3.1. Federal Register Notice citation announcing initiation of this review:**

The *Federal Register* (FR) notice initiating this review was published on July 7, 2005 (70 FR 39327). This notice opened a 60-day request for information period, which closed on September 6, 2005. A second FR notice was published on November 3, 2005 (70 FR 66842), which extended the request for information period for an additional 60 days until January 3, 2006.

#### **1.3.2. Listing history**

##### Original Listing

FR notice: 59 FR 5494

Date listed: February 4, 1994

Entity listed: *Eucyclogobius newberryi*, a species of fish

Classification: Endangered

##### Revised Listing, if applicable

Not applicable

#### **1.3.3. Associated rulemakings (see Appendix A for details)**

June 24, 1999: Proposal to (1) delist populations of the tidewater goby in areas north of Orange and San Diego counties, and (2) retain the tidewater goby populations in Orange and San Diego counties as an endangered distinct population segment (64 FR 33816).

August 3, 1999: Proposal to designate critical habitat in Orange and San Diego counties (64 FR 42250) only, which reflected the June 1999 proposed delisting north of Orange County.

November 20, 2000: Final designation of critical habitat in Orange and San Diego counties (65 FR 69693).

November 7, 2002: Proposed delisting of northern populations withdrawn (67 FR 67803). The decision to withdraw the proposal was based in large part on comments from the public, the scientific community, industry, and other concerned government agencies and new information, received after the publication of the proposed rule that indicated one of the reasons for delisting may have been in error.

February 27, 2003: U.S. District Court for the Southern District of California ordered the Service to promulgate a revised critical habitat rule that considers the entire geographic range of the tidewater goby and any currently unoccupied tidewater goby habitat (Natural Resources Defense Council, Inc. V. U.S. Department of Interior et al. CV98-7596, C.D. Cal.).

November 28, 2006: Proposal to designate critical habitat throughout the range of the tidewater goby (71 FR 68914). A final critical habitat rule is due to the Federal Register no later than November 1, 2007.

#### **1.3.4. Review History**

This is the first status review of the tidewater goby since it was listed in 1994.

#### **1.3.5. Species' Recovery Priority Number at start of 5-year review**

7C (on a scale of 1 to 18). This number indicates a full species of a monotypic genus with moderate degree of threat and a high potential for recovery. The letter C indicates that there is some degree of conflict from construction or other development projects.

#### **1.3.6. Recovery Plan or Outline**

**Name of plan or outline:** Recovery Plan for the Tidewater Goby (*Eucyclogobius newberryi*)

**Date issued:** December 7, 2005

**Dates of previous revisions, if applicable:** N/A

## **2. REVIEW ANALYSIS**

### **2.1. Application of the 1996 Distinct Population Segment (DPS) policy**

#### **2.1.1. Is the species under review a vertebrate?**

Yes.

**2.1.2. Is the species under review listed as a DPS?**

No.

**2.1.3. Is there relevant new information for this species regarding the application of the DPS policy?**

Yes. Research conducted by Dawson et al. (2001), Ahnelt et al. (2004) , and Jacobs (*in litt.* 2007) indicates that the tidewater goby populations remaining in San Diego County are genetically and morphologically discrete from populations located to the north. See Section 2.3.1, Biology and Habitat, sub-heading “Genetic Studies” for additional information relevant to the application of the DPS policy.

**2.2. Recovery Criteria**

**Does the species have a final, approved recovery plan containing objective, measurable criteria?**

Yes.

**2.2.1. Adequacy of recovery criteria.**

**2.2.1.1. Do the recovery criteria reflect the best available and most up-to date information on the biology of the species and its habitat?**

The recovery plan is relatively recent, and does reflect up-to-date information. However, we have now reconsidered the downlisting and delisting criteria in the recovery plan. The downlisting and delisting criteria require that a metapopulation viability analysis be conducted for each subunit (see below for details). We now believe that other, currently available information on the species may also be used to determine the appropriate listing of the species under the Act. These include the current number of occupied localities, current laws and regulations that act to protect the species, and our current understanding of threats and their impact on the tidewater goby.

**2.2.1.2. Are all of the 5 listing factors that are relevant to the species addressed in the recovery criteria (and is there no new information to consider regarding existing or new threats)?**

Yes.

**2.2.2. List the recovery criteria as they appear in the recovery plan, and discuss how each criterion has or has not been met, citing information (for threats-related recovery criteria, please note which of the 5 listing factors are addressed by that criterion. If any of the 5 listing factors are not relevant to this species, please note that here):**

1. Reclassification to Threatened

*“The tidewater goby may be considered for downlisting when:*

*a) A metapopulation viability analysis (see Recovery Action 2.11) based on scientifically credible monitoring over a 10-year period indicates that each Recovery Unit is viable. To be considered viable for downlisting, individual Sub-Units within each Recovery Unit must be projected to have a 75 percent or better chance of persistence for a minimum of 100 years. Specifically, at least 5 Sub-Units in the North Coast Unit, 8 Sub-Units in the Greater Bay Unit, 3 Sub-Units in the Central Coast Unit, 3 Sub-Units in the Conception Unit, 1 Sub-Unit in the Los Angeles/Ventura Unit, and 2 Sub-Units in the South Coast Unit must be individually projected to have a 75 percent chance of persisting for 100 years.*

*b) Individual management plans have been developed and implemented that cumulatively cover the full range of the species and effectively address the specific threats, such as habitat destruction and alteration (e.g., coastal development, upstream diversion, channelization of rivers and streams, discharge of agriculture and sewage effluents), introduced predators (e.g., centrarchid fishes), and competition with introduced species (e.g., yellowfin and chameleon gobies), to each metapopulation.*

*For the species to be downlisted, each of the six recovery units must meet these criteria. For example, if the Sub-Units in the Central Coast Recovery Unit were determined to have probabilities of 86 percent, 79 percent, and 95 percent that they would persist for 100 years, and a management plan was in place for all three, that recovery unit would meet the downlisting criteria. The five other recovery units would also need to similarly meet their criteria in order for downlisting to be considered.”*

Although the final recovery plan does not define specific parameters for the metapopulation viability analysis (MVA) or specific management actions for the individual management plans, the developed MVAs and the management plans would address specific threats associated with each of the metapopulations in each of the six Recovery Units listed in Criterion 1; therefore, this criterion appears to explicitly address listing factors A, C and E, and implicitly addresses listing factor D. Listing factor B is not relevant for this species. See section 2.3.2 Five-Factor Analysis for definitions.

The 10-year period of monitoring needed to conduct the MVA has not been initiated. Other than those metapopulations covered in the Integrated Natural Resource Management Plan (INRMP) for Marine Corps Base Camp Pendleton (Pendleton), no individual management plans have been developed that effectively address the specific

threats for any of the metapopulations. However, at least two populations, Mission Creek in Santa Barbara County, Santa Clara River estuary in Ventura County, and Malibu Lagoon in Los Angeles County, have management plans under development. Therefore, Downlisting Criterion 1 has not been met.

## 2. Delisting

*“The tidewater goby may be considered for delisting when downlisting criteria have been met and:*

*a) A metapopulation viability analysis projects that all recovery units are viable, as in downlisting criterion 1(a) except that Sub-Units must meet a 95 percent probability of persistence for 100 years.*

*For the species to be delisted, each recovery unit must meet this criterion in addition to those required for downlisting.”*

Like Downlisting Criterion 1 (Reclassification to Threatened), Delisting Criterion 2 appears to explicitly address listing factors A, C and E, and implicitly addresses listing factor D; however, Criterion 2 cannot be met without first meeting Criterion 1.

## **2.3. Updated Information and Current Species Status**

### **2.3.1. Biology and Habitat**

#### **Spatial Distribution**

The tidewater goby is a small fish that inhabits discrete locations of brackish water along the California coast. It is found from Tillas Slough (mouth of the Smith River, Del Norte County) near the Oregon border south to Cockleburr Canyon (northern San Diego County). The tidewater goby is known to have formerly inhabited at least 135 localities within this range (Service 2005). The northern limit of the species' range has not changed; however, the southern limit is now 9.2 miles (mi) (14.8 kilometers (km)) farther north from its historically known southern location, Agua Hedionda Lagoon (San Diego County) (Swift et al. 1989).

Tidewater gobies appear to be naturally absent (now and historically) from three large (50 to 135 mi (80 to 217 km)) stretches of coastline where lagoons or estuaries are absent and steep topography or swift currents may prevent tidewater gobies from dispersing between adjacent localities (Swift et al. 1989). From north to south, the first gap is between the Eel River in Humboldt County and the Ten Mile River in Mendocino County. The second gap is between Lagoon Creek in Mendocino County and Salmon Creek in Sonoma County. The southernmost large, natural gap occurs between the Salinas River in Monterey County and Arroyo del Oso in San Luis Obispo County. Habitat loss and other anthropogenic-related factors have resulted in the tidewater goby

now being absent from several locations where it historically occurred, which has created non-natural gaps in the species' geographic distribution (Capelli 1997); the largest of these extends at least 70 mi (113 km) from northern Los Angeles County to northern San Diego County.

Lafferty et al. (1999a, 1999b) believe that tidewater goby populations (i.e., localities) along the California coast occur as metapopulations. A metapopulation is defined as a group of distinct populations that are genetically interconnected through occasional exchange of animals. While individual populations may be periodically extirpated under natural conditions, a metapopulation is likely to persist through colonization or recolonization events that establish new populations (Levins 1970, Hanski and Gilpin 1991, Wells and Richmond 1995, Hanski and Simberloff 1997).

The basis for Lafferty et al. (1999a, 1999b) defining the tidewater goby as a metapopulation is that local populations are frequently isolated from other local populations by extensive areas of unsuitable habitat and tidewater gobies occupy coastal lagoons and estuaries that in most cases are separated from each other by the open ocean. Very few tidewater gobies have ever been captured in the marine environment (Swift et al. 1989), which suggests this species rarely occurs in the open ocean. Lafferty et al. (1999a, 1999b) suggest that some tidewater goby populations persist on a consistent basis (potential sources of individuals for recolonization), while other tidewater goby populations appear to experience intermittent extirpations. These extirpations may result from one or a series of factors, such as the drying up of some small streams during prolonged droughts, water diversions, and estuarine habitat modifications (Lafferty et al. 1999a, Service 2005). Some localities where tidewater gobies have been extirpated apparently have been recolonized when extant populations were present within a relatively short distance of the extirpated population (i.e., less than 6 mi (10 km). More recently, another tidewater goby researcher has suggested that recolonizations have typically been between populations separated by no more than 10 mi (16 km) (Swift, *in litt.* 2007). An example of a locality that has gone through intermittent extirpations and recolonizations is Hidden Lagoon in San Diego County. This lagoon periodically dries and then is recolonized from localities to the north, probably Las Flores Creek located about 1 mi (1.6 km) to the north. For additional examples, see Appendix E in the recovery plan (Service 2005). Lafferty et al. (1999a) suggest that flooding during winter rains can contribute to recolonization of estuarine habitats where tidewater goby populations have previously been extirpated. They also suggest that the failure of tidewater gobies to recolonize habitats after local extirpation is a result of habitat degradation of the extirpated locality, rather than an inability to recolonize. As the number of extirpations increases and the likelihood of recolonization decreases, additional loss of habitat would increase the chance of extinction for an entire metapopulation. At a minimum, this process decreases genetic diversity within a metapopulation, which may affect its ability to adapt to changing environmental conditions (Meffe and Carroll 1994). In some cases, metapopulations have been reduced to a single locality, examples of which include Lagunitas Creek and Rodeo Lagoon in the Greater Bay Recovery Unit (Service 2005). The nearest occupied locality to Lagunitas Creek is 15.5 mi (25 km) north and that to Rodeo Lagoon is 23.6 mi (38 km) north.

Currently, the majority of the most stable and largest tidewater goby populations consist of lagoons and estuaries of intermediate sizes (5 to 125 ac (2 to 50 ha)) that have remained relatively unaffected by human activities (Service 2005). Many of the localities where tidewater gobies are regularly present may be “source” populations for localities that intermittently lose their tidewater goby populations.

Lafferty et al. (1999b) used historical presence-absence data and their own surveys to estimate annual rates of extirpation and recolonization for several populations of the tidewater goby in southern California. In their study, large wetlands had lower rates of extirpation than small wetlands, and there was a negative but statistically nonsignificant correlation between recolonization rate and distance to the nearest northerly source population. In addition, populations at small sites were sensitive to drought, presumably because droughts can eliminate suitable habitat at small wetlands.

The present sets of populations that act as metapopulations may now be a relatively small subset of the 106 extant populations (Smith, *in litt.* 2007). For example, Smith, (*in litt.* 2007), believes only two likely metapopulations continue to exist in Santa Cruz County, a cluster of six populations from Baldwin Creek south to Moore Creek (including Lombardi, Dairy, Wilder, and Younger creeks) and Corcoran and Moran Lagoons (and Soquel Creek). A small population of tidewater gobies was found in the San Lorenzo River Lagoon on May 11, 2004. Surveys for the species were conducted here by Smith in the 1980s, but produced negative results. Smith believes that the small tidewater goby population discovered at the San Lorenzo River Lagoon was likely the result of a colonization event from Moore Creek; however, genetic testing has not been conducted to test this theory. Furthermore, Smith believes that tidewater gobies are likely to be lost from the San Lorenzo system during a high flow event due to the lower San Lorenzo River's channelized hydromorphology and lack of refugia from storm flows. Smith goes on to report that elsewhere in Santa Cruz County and in San Mateo and Monterey counties, there is little evidence of metapopulation structures, stating that extirpated populations at Salinas River and Waddell Creek have been vacant for 25 to 40 years.

## **Ecology**

Tidewater gobies generally live for only 1 year, with few individuals living longer than a year (Moyle 2002). Reproduction occurs at all times of the year, as indicated by female tidewater gobies in various stages of ovarian development (Swenson 1999). The peak of spawning activity occurs during the spring and then again in the late-summer. Fluctuations in reproduction are probably due to death of breeding adults in early summer and colder temperatures or hydrological disruptions in winter (Swift et al. 1989). Reproduction takes place in water between 9 to 25 degrees Celsius (48 to 77 degrees Fahrenheit) and at salinities of 2 to 27 parts per thousand (Swenson 1999). Male tidewater gobies begin digging breeding burrows in relatively unconsolidated, clean, coarse sand (averaging 0.5 millimeter [0.02 inch] in diameter), in April or May after lagoons close to the ocean (Swift et al. 1989; Swenson 1995). Swenson (1995) has

shown that tidewater gobies also prefer this substrate in the laboratory. Burrows are at least 70 to 100 millimeters (3 to 4 inches) from each other.

Tidewater goby localities closely correspond to major stream drainages. Sediments provided by major drainages produce sandy beaches with low-lying coastal areas conducive to formation of coastal lagoons (Swift et al. 1989; Habel and Armstrong 1977). Tidewater gobies generally select habitat in the upper estuary, usually within the fresh-saltwater interface. Tidewater gobies range upstream a short distance into fresh water, and downstream into water of up to about 75 percent sea water (28 parts per thousand). The species is typically found in salinities of less than 12 parts per thousand (Swift et al. 1989). These conditions occur in two relatively distinct situations: 1) the upper edge of tidal bays, such as Tomales, Bolinas, and San Francisco Bays near the entrance of freshwater tributaries and 2) the coastal lagoons formed at the mouths of coastal rivers, streams, or seasonally wet canyons.

Tidewater gobies held at the Granite Canyon Fish Culture Facility were subject to a salinity tolerance test in hypersaline water (45 to 54 parts per thousand) for 6 months, with no mortality (Worcester and Lea 1996). Holding temperatures (fresh water) varied annually from 4.0 to 21.5 degrees Celsius (39.2 to 70.7 degrees Fahrenheit). During the late 1980's and early 1990's, Karen Worcester (Morro Bay Estuary Program) conducted an investigation of habitat use in Pico Creek lagoon, and observed large numbers of tidewater gobies using the lower portion of the lagoon where highest salinities (up to 27 parts per thousand) were observed. In general, abundance did not appear to be associated with oxygen levels, which at times were quite low. Based on these studies it appears that the tidewater goby is adapted to a broad range of environmental conditions (Worcester and Lea 1996).

The estuaries or lagoons at the mouths of many California streams have been highly modified by adjacent agricultural and urban development. In addition, they receive the accumulated impacts of water diversion, sedimentation and pollution discharges within the watersheds. Despite historical impacts, these estuaries can provide potentially valuable habitat for aquatic invertebrates and the fishes dependent on them, including tidewater gobies. The relative value of individual estuaries varies with size, tidal action, depth, salinity and water quality. These features not only vary between estuaries, but also vary within estuaries on a seasonal and year-to-year basis.

The lagoons, estuaries, backwater marshes, and freshwater tributaries that tidewater gobies occupy are dynamic environments that are subject to considerable fluctuations on a seasonal and annual basis. A lagoon cycle that creates the fluctuating environment for lagoon-inhabiting species can be generalized as follows. Late spring and summer beach development builds a full or partial sandbar across a stream mouth, thereby producing a summer lagoon. In wetter years, the extensive loss of beach sand through high stream discharge (lagoon inflows) results in later development of the bar; in some wet years, high summer discharge results in periodic over-topping and breaching of the sandbars of some lagoons. In drier years, sandbar formation is usually earlier, but may be delayed at some stream mouths due to a scarcity of tidal sand. After sandbar formation, freshwater

inflows raise lagoon levels and greatly increase lagoon size and habitat variety (especially by flooding vegetation adjacent to lagoons). Inflows also convert the lagoon towards fresh water, with the surface freshwater layer thickening and the heavier, bottom saltwater layer percolating through the bar. Larger lagoons, or lagoons with substantial amounts of salt water present at the time of sandbar formation, require more inflow and/or a longer time to convert to fresh water. Lagoons that are fully converted to fresh water are generally relatively cool and well-mixed. Brackish lagoons, with insufficient inflows after sandbar formation, remain stratified unless mixed by strong winds; water temperatures are generally high and dissolved oxygen levels often low in the bottom saltwater layer.

Plankton blooms, filamentous algae and rooted aquatic vegetation can support abundant invertebrates as food for lagoon fish. However, the plants can also produce poor dissolved oxygen conditions overnight or during prolonged foggy periods (i.e., periods when photosynthesis stops and plants respire, using oxygen rather than producing it). These problems are relatively minor in well-mixed (freshwater or windy) lagoons, even when nutrient levels and vegetation abundance are high. Destratifying (mixing) lagoons is more important for improving water quality than is nutrient or vegetation control. Shallow, productive lagoons converted to freshwater can produce numerous, fast-growing lagoon fish, despite dense algal and rooted vegetation growth.

Tidewater gobies tolerate a wide range of salinity and water quality conditions, but generally require sandbar closure to produce the calm lagoon conditions that promote their summer population explosion. Smith (*in litt.* 2007) reports that repeated sampling has shown sandbar formation is important to produce the calm conditions that bring about the very abundant late summer populations. Periodic natural or artificial breaching of sandbars in summer reverses the freshening process, and sandbar re-formation produces salinity stratified conditions, with resultant warm and hypoxic bottom conditions unsuitable for benthic invertebrates and for lagoon fish. As a result, artificial breaching or lack of sandbar formation may result in smaller populations that are restricted to areas upstream of tidal action (where salinity is lower and dissolved oxygen is higher). Open lagoons can sometimes provide some marginal habitat for fish near the tidally mixed mouth, but the substantially reduced remainder of the lagoon tends to be stratified, warm and relatively unproductive. Partially closed lagoons tend to have warm, stratified conditions except every 2 weeks when very high tides cool and mix the lagoon.

Tidewater gobies also depend upon calm backwaters as refuges against storm flows and/or draining of small lagoons when the sandbar is opened in winter. Tidewater gobies are still present in many relatively natural lagoon systems (e.g., Corcoran, Moore, Wilder, Baldwin, and Laguna creek lagoons in Santa Cruz County). They are apparently periodically lost and then recolonize lagoon systems that provide poor winter refuges in flood years (e.g., Aptos, Soquel, and Moran lagoons in Santa Cruz County). At several locations, tidewater gobies have been apparently extirpated from lagoons that lack winter refuges (e.g., Waddell lagoon in northern Santa Cruz County).

Another important aspect of lagoons to the tidewater goby is the availability of sediments for burrow construction and spawning. Winter rains and subsequently increased stream flows may bring in considerable sediment and dramatically affect the bottom profile and substrate composition of a lagoon or estuary. Fine mud and clay either moves through the lagoon or estuary or settles out in backwater marshes, while heavier sand is left in the lagoon or estuary. High flows associated with winter rains can scour out the lagoon bottom to lower levels, with sand building up again after flows decline.

## **Genetic Studies**

To measure genetic differences that infer reproductive isolation and evolutionary independence, genetic systematists generally rely on indirect information in the form of some character systems, such as variation in size and shape of morphologic characters, cytogenetics, allozymes, or DNA sequences (Bradley and Baker 2001). Dawson et al. (2001) analyzed mitochondrial DNA and cytochrome-*b* sequences of individual tidewater gobies collected from 31 locations between 1990 and 1999 (cytochrome-*b* analysis determines the magnitude of genetic variation required to distinguish between two separate species (Bradley and Baker 2001)).

The results of Dawson et al.'s (2001) study found that tidewater gobies vary genetically in four clusters that are distributed in six major phylogeographic groups. The phylogeographic groups, in this case, were based on geologic, climatic and ecologic conditions that have influenced the current distribution of species. Dawson et al.'s (2001) four clusters are as follows: 1) the San Diego clades south of Los Angeles, 2) a lone Estero Bay group from central California, 3) the San Francisco group; and 4) the Cape Mendocino group. Dawson et al. (2001) concluded that the modern geographic and genetic structure of the tidewater goby has been influenced by patterns of expansion and contraction, colonization, extirpation, and gene flow linked to Quaternary climate change that affected coastal geography and hydrography. Plate tectonics along the North American coast and historical human activities are probably also factors. The deepest phylogenetic gap in tidewater goby coincides with phylogeographic breaks in several other coastal California taxa in the vicinity of Los Angeles, suggesting common extrinsic factors have had similar effects on different species in this region (Dawson et al. 2001).

Dr. David Jacobs, with the Department of Ecology and Evolutionary Biology at the University of California, Los Angeles, has been working extensively on the population structure, differentiation and metapopulation dynamics of the tidewater goby. His work in the lab has been primarily molecular and is ongoing at this time. Jacobs (*in litt.* 2007) states that all available evidence suggests the tidewater goby in Orange and San Diego counties is a distinct taxon of, or equivalent to, species rank. Mitochondrial analysis indicates that the tidewater goby in Orange and San Diego counties, i.e., *E. newberryi* populations to the south of the Palos Verdes Peninsula that now are found only at Camp Pendleton, differentiated from tidewater goby populations to the north about two million years ago, or well before the Pleistocene. Dr. Jacobs has indicated that he and his co-researchers plan to publish his current research in the near future, which would likely describe the tidewater goby populations south of the Palos Verdes Peninsula as a distinct

taxon or new species (David Jacobs, University of California Los Angeles, pers. comm. 2007). The type specimens (syntypes) for tidewater gobies are from northern California (Girard 1857, 1858), thus if the species were split, the new, southern California population would no longer be listed under the Act. (However, removal of a species from the list for taxonomic changes would require the Service to publish a notice in the Federal Register and analyze the status and threats of the new species to determine whether the new species requires the protection of the Act, and if so whether it should be listed as endangered or threatened).

The genetic differentiation of tidewater gobies in Orange and San Diego counties from the northern populations is also supported by a morphological study (Ahnelt et al. 2004). The study focused on the morphologic variation in the amount of closure of the cephalic canal system (lateral line system in the head) among different populations of tidewater goby. The primary feature of this cephalic canal system is above the eyes of the tidewater gobies from northern portion of the species range but is much reduced in specimens south of Palos Verdes. There is some variation in this feature in populations from the northern portion of the tidewater goby's range but there are no populations that exhibit such a consistent pattern of reduction as in the tidewater goby populations south of Palos Verdes (Jacobs, *in litt.* 2007).

### **Abundance and Population Trends**

No range-wide, long-term monitoring program is currently being conducted for the tidewater goby, and data on population dynamics are limited. Estimates of population size are generally lacking due to the constant variability in local abundance. Seasonal changes in distribution and abundance further hamper efforts to estimate population size for this short-lived species. For example, when lagoons are breached due to flood events during the rainy season, tidewater goby populations will decrease and then recover during the following summer (Lafferty et al. 1999a).

Tidewater goby populations can also vary with between-year changes in environmental conditions such as drought. Nonetheless, assessments of locality presence and absence have been made and are summarized below.

When the species was listed in 1994, tidewater gobies occurred, or had been known to occur, at 87 localities (Swift et al. 1989). At the time of listing, only 48 of the 87 were known to be occupied. Additional tidewater goby localities have been identified since the time of listing, and for our analysis for the recovery plan we determined that tidewater gobies were known from 135 localities within the historical geographic range of the species (Service 2005). Of these 135 localities, 29 (21 percent) are believed to be extinct; therefore, 106 localities are presumed to be currently occupied (Smith, *in litt.* 2007).

Many lagoon habitats have been channelized or permanently opened with jetties and dredging so they no longer support the seasonally closed habitat of tidewater gobies. However, it should also be noted that tidewater gobies have been re-discovered in localities such as Devereux and Goleta sloughs in Santa Barbara County, and Arroyo

Grande in San Luis Obispo County, in the last couple of years after multi-decadal absences (Jacobs, *in litt.* 2007). Thus, absence does not mean that the habitat is not or could not be viable.

Drought and/or low water years have likely affected the presence of tidewater gobies at various localities throughout their range. Periodic droughts are a historical feature of California, which has been repeatedly subject to prolonged droughts ([www.drought.unl.edu/whatis/palmer/calif.gif](http://www.drought.unl.edu/whatis/palmer/calif.gif)). California experienced 5 years of severe drought in the late 1980s and early 1990s. California may now be experiencing another major drought. The 2006-2007 winter precipitation period for California was the driest since 1924 (O'Driscoll 2007). This was the driest period for Los Angeles since records were first kept in the 1880s with only 3.2 in. (8.1 cm) of rain.

To facilitate the discussion of the status of the tidewater goby, the range of which encompasses most of the 1,000-mile (1,600 km) coast of California, we analyzed its status within the six tidewater goby recovery units delineated in the Recovery Plan for the Tidewater Goby (Service 2005). From north to south, these units are: North Coast, Greater Bay, Central Coast, Conception, LA/Ventura, and South Coast. The six recovery units are based on morphological (Ahnelt et al. 2004) and molecular (Dawson et al. 2001) data or on geomorphology where other data are lacking. Recovery units are further subdivided into 26 sub-units, which are considered different from each other genetically. The recovery plan lists 151 sites, which includes potential introduction sites. However, new data (Toline et al. 2006) and data in the recovery plan indicate 134 localities (135 as of the date of this 5-year review) having been occupied by tidewater goby at least since the 1940s when better records of species occurrence were made. The term locality is used here to refer only to an area documented as occupied by tidewater goby during at least one sampling event, i.e., the 134 localities identified in the recovery plan.

### *Status of Recovery Units*

As noted above, data on abundance are generally lacking for tidewater goby localities. To assess the status of the tidewater goby for each recovery unit we looked at presence/absence of tidewater gobies at each locality over time and classified the abundance at each locality as being extirpated, intermittent, or regular where possible. Based on consistent occupancy, we believe regular localities are source populations, and thus are important to the conservation of the species. We also identify localities that are within or at least partially within a national park, state park, or wildlife refuge because we believe the natural resources in these, including the tidewater goby and its habitat, are generally afforded greater protection than other areas.

### North Coast

The North Coast recovery unit is divided into six sub-units, each containing one to six localities (Service 2005). In most cases we consider sub-units to be genetically different metapopulations. At the time of listing there were 10 occupied localities in this unit. Subsequently, more localities were discovered to have tidewater gobies bringing the total

to 22 overall. Sampling across sub-units has been comparatively evenly distributed. Of the 22 localities, 3 (16.7 percent) are presumed to be extirpated (Service 2005), 8 are considered intermittent, 4 regular, and 7 are unknown. Land ownership may be a factor in evaluating the status of the species because it could indicate a level of stewardship for the tidewater goby and its habitat. Federal and State ownership may indicate a higher level of protections than others. This unit has several localities that are protected to at least some degree by the Service, National parks and the California Department of Fish and Game; seven localities consist partially or entirely of California State Park lands and are protected accordingly. Five localities are partially or completely in private ownership. The rest are owned or managed by city, State, or Federal entities.

### Greater Bay

The Greater Bay recovery unit is one of the largest recovery units and is composed of 11 sub-units, each containing 1 to 7 localities. At the time of listing there were nine occupied localities in this unit. Subsequently, more localities were discovered to have tidewater gobies bringing the total to 34 overall. Sampling of localities has been fairly frequent since the time of listing except for the area between Horseshoe Cove and San Pedro Creek, where relatively few tidewater gobies remain. Of the 34 localities, 11 (32.4 percent) are presumed to be extirpated (Service 2005), 15 are considered intermittent, 7 are regular, and 1 is unknown. Several areas that include tidewater goby localities are managed as State parks or beaches. California State lands occur across 15 localities. Sixteen localities are partially or entirely in private ownership. The remaining localities are owned or managed by city, county, university, or Federal entities. City municipalities own land across nine localities, and two localities are controlled in part or entirely by the National Park Service.

### Central Coast

The Central Coast recovery unit is divided into three sub-units, each containing from 3 to 10 localities per sub-unit. At the time of listing, there were nine occupied localities in this unit. Subsequently, more localities were discovered bringing the total to 21 overall. Sampling across sub-units is fairly evenly distributed. Of the 21 localities, 5 (23.8 percent) are presumed to be extirpated (Service 2005), 10 are considered intermittent, 5 are regular, and 1 is unknown. Land is in both public and private ownership, with several localities near or within protected areas. In the northern portion of this recovery unit, eight of the localities are partially owned by a single private owner, the Hearst Corporation. Of the other 15 localities in the southern portion of the unit, at least 12 are partially or completely surrounded by State parks, State beaches, or natural preserves. Three localities are partially protected by conservation easements.

### Conception

The Conception recovery unit is one of the two largest and consists of three sub-units. At the time of listing, there were 15 occupied localities in this unit. Subsequently, more localities were discovered bringing the total to 36, most of which are located in the

southernmost sub-unit. Of the 36 localities, 2 (5.6 percent) are presumed to be extirpated (Service 2005), 17 are considered intermittent, and 17 are regular. Of 36 localities in the Conception recovery unit, 5 occur on Vandenburg Air Force Base (VAFB), and 8 are surrounded by ranches. Four localities occur partially or completely within State parks or beaches and two occur within a national wildlife refuge. The remaining localities are bounded partially or completely by city, county, or private land.

### LA/Ventura

The LA/Ventura recovery unit consists of a single sub-unit. At the time of listing, there were two occupied localities in this unit. Subsequently, more localities were discovered bringing the total to eight overall, all of which have been sampled for the presence of tidewater gobies since the time of listing. Of the 8 localities, 2 (25 percent) are presumed to be extirpated (Service 2005). Four are considered intermittent and the other six are regular. The majority of localities in this recovery unit are owned and managed by State parks and beaches. Three localities are under private, city or Federal (Navy – one locality) ownership.

### South Coast

The South Coast recovery unit is divided into two sub-units. At the time of listing, three localities were in this unit. Subsequently, more localities were discovered bringing the total to 14 overall. Of the 14 localities, 6 (42.9 percent) are presumed to be extirpated (Service 2005), 7 are intermittent, and 1 is regular. Of the 14 localities in this unit, 8 occur on Camp Pendleton Marine Corps Base. The other 6 localities, which are believed to be extirpated, are under private or public ownership including cities, State beaches and county parks. Private land also borders some localities not within Camp Pendleton.

## **2.3.2. Five-Factor Analysis (threats, conservation measures, and regulatory mechanisms)**

The history of the tidewater goby under the Act, including the original listing of the species, designation of critical habitat, and recovery planning, extends over a period of 25 years (see Appendix A). The main reasons for listing the tidewater goby in 1994 were the decline in the number of tidewater goby populations (i.e., occupied tidewater goby localities) and the threat of coastal development. Other factors that may threaten the tidewater goby identified in the final listing rule included agricultural and sewage effluents, cattle grazing and feral pig activity, introduced fish predators, drought combined with human induced water reductions, isolation of populations, and competition with introduced fish species.

Actions that have been taken that are important to the conservation of the tidewater goby since it was listed in 1994 include: ongoing surveys have found 58 additional occupied localities, additional laws and regulations have been enacted that may help protect the tidewater goby and its habitat, and additional research on the genetics of the species has

been conducted (see Service 2005 and the section on genetics above). More recently, we published a recovery plan for the tidewater goby in December 2005 (Service 2005). Also of importance to the conservation of the tidewater goby, Pendleton has an approved INRMP that provides a degree of protection to the eight remaining occupied tidewater goby localities south of Los Angeles. VAFB in Santa Barbara County also prepared an INRMP in 1997 and an updated draft in 2003 that provide some protection for the tidewater goby.

### **2.3.2.1. Present or threatened destruction, modification or curtailment of its habitat or range:**

Threats identified in the final listing of the tidewater goby (59 FR 5494), with respect to present or threatened destruction, modification or curtailment of its habitat or range, included loss of wetland and associated habitat due to development along the coast (e.g., wetland draining and filling for industrial and residential development; dredging to develop navigation channels, harbors, and marinas) and hydrologic changes (e.g., water diversion and related changes in salinity, groundwater overdrafting, channelization, sand bar breaching). Pollution and cattle grazing have also been discussed as potential threats to tidewater gobies throughout the various listing rules and the recovery plan for the species. However, we are not aware of any comprehensive information that indicates that these are having an impact on tidewater goby occupancy, abundance, and productivity, and/or adult and juvenile survival. Therefore, pollution and grazing are not considered further in this review.

#### **Development and Habitat Loss**

Historically, tidewater gobies likely occurred in far more localities than at present. An estimated 75 to 90 percent of estuarine wetlands have been lost in California (Capelli 1997). The habitat at many of these historic localities was probably entirely lost to development (e.g., harbors, channels, agriculture, industrial and business uses, residential development, road construction) before surveys for tidewater gobies were being conducted. For example, over 95 percent of the wetlands that existed prior to 1850 in the San Francisco Bay have been lost (<http://pubs.usgs.gov/fs/coastal-wetlands/index.html>). Most of these wetlands were filled in entirely and are now covered by development. Given that tidewater gobies may be able to disperse along sandy shores to some degree, it seems likely that tidewater gobies in the southern portion of their range occupied estuaries and lagoons along the shores from Palos Verdes to the headlands at La Jolla when and where the appropriate, intermittently closed habitat occurred (Jacobs, *in litt.* 2007). Nearly all this habitat has been opened for marinas and harbors (or closed to create freshwater impoundments). This has produced a human-caused gap between those occupied localities in Los Angeles and San Diego counties of at least 70 miles (113 kilometers).

The dramatic destruction of estuarine and coastal wetland habitat that occurred in the past has largely or entirely been eliminated as a result of current laws and regulations protecting coastal habitats (see below and section 2.3.2.4. Inadequacy of Existing

Regulatory Mechanisms). Section 30233 of the Coastal Act has been particularly important in protecting the remaining coastal wetlands (California Coastal Commission 2006). Although major habitat loss is now unlikely, a limited amount of habitat will continue to be altered, which in turn will result in limited impacts on tidewater goby. Examples of ongoing or imminent activities within tidewater goby habitat include annual dredging (e.g., Goleta Slough, Santa Barbara County), habitat restoration projects (e.g., Malibu Lagoon, Los Angeles County; Mission Creek, Santa Barbara County), and bridge widening projects (Mission Creek). Although we expect the impact of these activities to be limited, even small projects can potentially have significant effects. For example, on February 24, 1998, repair work began on railroad trestles crossing San Mateo Creek Lagoon, San Diego County. This work included dredging portions of the creek and lagoon, and filling freshwater marshes which function as tidewater goby refugia. Previous surveys had found tidewater gobies to be abundant, but no tidewater gobies were found after the construction was completed (Swift and Holland 1998).

### Hydrologic Changes

Habitat may also be degraded as a result of hydrological changes. Hydrological changes include actions such as channelization, water diversions and groundwater pumping, and in some cases restoration projects. Channelization can diminish downstream marsh habitat, and lead to loss of populations by flushing them out to sea during high flow events; by scouring of stream channels which may eliminate or reduce the substrate needed for burrows; and by changes in salinity regimes which may affect tidewater goby abundance, survival, and productivity (Service 2005). Although channelization and habitat removal is continuing throughout the State within the coastal zone, the degree of impact of these activities on habitat are less severe than prior to the listing of the species. In addition, improvements in technology (e.g., use of weirs and biostabilization techniques) has further reduced impacts.

Water diversions and groundwater pumping can change flow rate, which can cause a reduction in freshwater input into lagoons and estuaries. For example, Penasquitos Creek lagoon in San Diego County and Aliso Creek lagoon in Orange County are drained monthly in the summer preventing tidewater goby habitation. They can also change the timing of water availability (i.e., sufficient water needs to be available during peak breeding periods to cover burrows and eggs) and alter downstream salinity regimes. Dredging has been attributed to both direct habitat loss and salinity changes. Road construction along coastlines has severed tidal influx altering both salinity and temperature profiles. Although these impacts are ongoing, we have no information on the degree of impact they may be having on tidewater gobies.

Another potential threat that was raised in the proposed delisting rule is human-caused sandbar breaching. Breaching can result in rapid decreases in water level, exposure of tidewater goby breeding burrows and bottom habitat, and increased

salinity. Although information is presently lacking on the significance of this threat to the long-term survival of the species, an example of the local severity of breaching on tidewater gobies that occurred at the San Onofre Creek lagoon in San Diego County is provided in the proposed delisting rule for the tidewater goby (64 FR 33816). In 1996, the lagoon was artificially breached and water immediately began draining from the lagoon into the ocean. The water level dropped 16 to 20 in (40 to 50 cm) and the surface area of the lagoon decreased approximately 60 to 75 percent during the next 12 hours. This event was estimated to have resulted in a 56 percent decline in tidewater goby abundance (Swift and Holland 1998). It is important to note, however, that the tidewater goby was not extirpated from this locality as a result of this event and still occurs there. Other examples of localities where artificial breaching occurs on a regular basis include Lake Earl in Del Norte County, Santa Clara River in Ventura County, and Malibu Lagoon in Los Angeles County. Again, these localities are still occupied and so this threat may not be as severe as previously thought.

Urban and commercial development adjacent to or upstream from coastal lagoons can lead to increased sedimentation (California Coastal Commission 2006). This may raise the elevation of the lagoon bottom and subsequently decrease lagoon depth. The shallower water may allow water temperatures to fluctuate between higher and lower extremes, which may affect tidewater gobies. Breeding tidewater gobies are usually found in temperatures ranging from 44 to 77 degrees F (8 – 25 degrees C) (Moyle 2002). Although tidewater gobies may be adapted to a wide range in temperature, the abundance of other fish including predators and competitors may increase as a result of temperature changes (Moyle 2002). Shallower lagoons of finite width also have reduced storage capacity and thus the same amount of fresh water flowing into the estuary may breach the sandbar more quickly, which could be at times outside the natural, historic norms. This change in breach timing may impact tidewater gobies by reducing habitat for breeding, foraging, and cover; exposing nest burrows; and flushing adults and juveniles out to sea (Swift et al. 1989). Conversely, reduced storage capacity may allow lagoons with limited inflows to dry out. Tidewater gobies are not known to have any defenses against desiccation. In addition, the trend in estuary restoration has been to create more open tidal settings via jetties and dredging (e.g., Bolsa Chica Lagoon in Orange County and Batiquitos Lagoon in San Diego County), thus eliminating the potential for the seasonally closed habitat on which tidewater gobies depend. Further north, Pescadero Marsh/Butano Creek in San Mateo County has been altered by a Highway 1 bridge replacement and by restoration activities, which included removing levees. Since that time the sandbar, which normally formed in early to mid-summer in the 1980's, has generally formed in late summer or early fall. In addition, habitat conversion has eliminated the extensive tidewater goby habitat in the North Marsh. Despite the loss of tidewater goby habitat from these activities, the population is still considered reasonably secure (Smith, *in litt.* 2007). The impacts listed above may potentially have an effect on tidewater gobies; however, information on the occurrence and magnitude of these threats is not available.

In conclusion, development activities along the coast of California prior to the listing of the tidewater goby eliminated or severely altered numerous tidewater goby localities. However, this large-scale destruction of habitat has been largely or entirely eliminated as a result of current laws and regulations. Although many other potential threats to the habitat of tidewater goby have been discussed in the listing rule and other documents, little information is available to determine the extent of these threats or the degree to which they may affect tidewater gobies. Information on how these potential threats may affect tidewater goby abundance, productivity, and/or adult and juvenile survival is especially lacking. We do know that the number of known occupied localities has more than doubled since the time of listing. Although survey efforts have also increased since listing, this alone would not explain the magnitude of the increase that has occurred. As a result of the survey efforts detecting more occupied localities and because habitat destruction and alteration have been reduced, we believe that the tidewater goby is not currently in imminent danger of becoming extinct. Therefore, we recommend that it be downlisted to threatened.

#### **2.3.2.2. Overutilization for commercial, recreational, scientific, or educational purposes:**

This was not considered a factor at the time of listing and is not currently a factor.

#### **2.3.2.3. Disease or predation:**

##### **Exotic and Native Predators**

Introduced aquatic species have a negative impact on most of California's native coastal species and are a predation threat to tidewater gobies. Introduced species may threaten tidewater gobies by preying on adults, larvae, or eggs. Threat of predation by exotic or native predators in each recovery unit was assessed based on information provided in the Recovery Plan for the Tidewater Goby (Service 2005) and a complete review of tidewater goby literature (Toline et al. 2006).

Native species, such as some salmonids, are suspected to prey on tidewater gobies (Moyle 2002). This is a natural condition, but when tidewater goby numbers and habitat are reduced through human-induced threats, these native predators may have a greater effect on the tidewater goby population. Predation by introduced or native species can be particularly damaging to species such as tidewater goby that are generally distributed across small, isolated populations and are prone to fluctuation in population size (Pimm et al. 1988, Lafferty et al. 1999b). The degree of impact as a result of predation to tidewater goby abundance has not been determined.

A major source of introduced species is the spread from ballast water from ocean-going ships. It is estimated that more than 10,000 marine species are transported each day (California Department of Fish and Game 2002). Additionally, the high volume of shipping to California and the associated increase in ballast water in addition to decreases in ship transit times are leading to higher rates of marine invasive species.

Cohen and Carlton (1998) estimate that the average rate of new species was as much as one every 55 weeks between 1851 and 1960, whereas the rate had increased to one every 14 weeks between 1961 and 1995. Fish surveys along the California coast have confirmed the presence of numerous non-native predatory species.

The Ballast Water Management Act of 1999, California Government Code 71211, stipulates that the California Department of Fish and Game conduct appropriate studies necessary to develop a list of non-indigenous species occurring in the marine and estuarine waters of the State. To this end, the California Department of Fish and Game's Office of Spill Prevention and Response was assigned the task of conducting the non-indigenous species investigations. Results of these surveys identified the presence of numerous introduced predatory species such as striped bass (*Morone chrysops*), white catfish (*Ameiurus catus*), largemouth bass (*Micropterus notius*), common carp (*Cyprinus carpio*), threadfin shad (*Dorosoma petenense*), redear sunfish (*Lepomis microlophus*), black crappie (*Pomoxis nigromaculatus*), bluegill (*Lepomis macrochirus*), and inland silverside (*Menidia beryllina*). These fish have been introduced historically in California waters as sportfish or forage. Cohen and Carlton (1995) estimate that approximately 30 species of introduced marine, brackish, and freshwater fish species are important carnivores throughout the San Francisco Bay and Delta. Those species that they consider to pose the greatest threats from predation include species such as largemouth and smallmouth bass (*Micropterus dolomieu*), which have been identified in the California Department of Fish and Game surveys. Centrarchids (fish in the sunfish family) are known predators of tidewater gobies and are documented as having led to the extirpation of tidewater gobies in several localities (Swift et al. 1989).

Although direct evidence that introductions of nonnatives led to extirpations of tidewater gobies is lacking, tidewater gobies were no longer detected at several localities soon after centrarchid fish were introduced (Swift et al. 1989, 1994; Rathbun et al. 1991). Specific examples of situations where predation by nonnatives may have negatively affected tidewater goby populations can be found in M. Capelli, *in litt.* (1999), D. Holland, *in litt.* (1999), and C. Swift *in litt.* (1999). In the Santa Ynez River system, tidewater gobies accounted for 61 percent of the prey volume of 55 percent (10 of 18) of the juvenile largemouth bass sampled (Swift et al. 1997, M. Capelli, *in litt.* 1999). The decline and subsequent recovery of the tidewater goby population in Las Pulgas Creek closely tracked the absence of green sunfish from the lagoon in this system (Swift and Holland 1998). The elimination of tidewater gobies from the Santa Margarita River, San Diego County, may have been due to the combined influence of nonnative species and decreasing habitat available for the tidewater goby (Swift and Holland 1998). Largemouth bass in Old Creek of San Luis Obispo County are likely responsible for the elimination and prevention of re-establishment of tidewater gobies there (D. Holland, *in litt.* 1999). The evidence suggests that nonnative fish are often introduced to tidewater goby habitats, prey on tidewater gobies, and in some documented cases, may lead to the extirpation of tidewater gobies. This evidence, though indirect, suggests that some nonnative predators can have negative impacts on tidewater gobies, including extirpation (K.

Lafferty, *in litt.* 1999). In addition, predation by nonnatives may have negative effects short of extirpation, reducing tidewater goby population sizes and, thereby, rendering populations more vulnerable over the long-term to extirpation as a result of natural perturbations of habitat conditions at the site (M. Capelli, *in litt.* 1999). Tidewater gobies may have limited ability to repopulate from adjacent streams. Furthermore, dispersal ability of tidewater gobies may be very limited, making repopulation of extirpated sites problematic (D. Holland, *in litt.* 1999).

Amphibians are also known predators of native fish species (Swift and Holland 1998). Bullfrogs (*Rana catesbeiana*) have been introduced to California either accidentally through the aquarium trade and during trout stocking, and deliberately for pest control or sport (National Invasive Species Information Center, U.S. Department of Agriculture, National Agriculture Library 2006). Bullfrogs are known predators on a wide variety of species, including many fish and are suspected to have significant negative impacts on tidewater goby populations (Swift and Holland 1998, Holland et al. 2001). Furthermore, bullfrogs have been implicated in the demise of the Old Creek, San Luis Obispo County, tidewater goby population (Rathbun 1991).

Introduced African clawed frogs (*Xenopus laevis*) will also prey on tidewater gobies (Lafferty and Page 1997), although they are probably not a significant source of mortality due to the limited distribution of this species in tidewater goby habitat. Lafferty and Page (1997) conducted their research in the Santa Clara River estuary, Ventura County. The Santa Clara River estuary undergoes periodic breaching providing higher saline conditions, which is suspected to be not suitable to the African clawed frogs. However, many of the species known or thought to prey on tidewater goby have a wide range of salinity tolerance, including striped bass, chameleon gobies, yellowfin gobies (*Acanthogobius flavimanus*) and shimofuri gobies (D. Holland, *in litt.* 1999). Additionally, the habitat of the tidewater goby may be essentially freshwater for part, or even much, of the year (Swift and Holland 1998), making tidewater gobies vulnerable even to nonnative species with limited salinity tolerance, including largemouth bass, green sunfish, African clawed frogs, and others (M. Capelli, *in litt.* 1999; D. Holland, *in litt.* 1999).

Finally, there is speculation that ranges of current nonnative species may expand (e.g., African clawed frog, yellowfin goby), and new nonnative species (e.g., Chinese mitten crabs (*Eriocheir sinensis*)) may become a problem in the future. Some establishment and movement of nonnatives may be facilitated by water redistribution plans (D. Holland, *in litt.* 1999).

### **Parasitic Infestation**

Little study of the parasites of the tidewater goby has been conducted; however, *Cryptocotyle lingua* is one parasite that has been documented in the tidewater goby (Swift et al. 1989, Swenson 1999). *Cryptocotyle lingua* is an introduced fluke native to the eastern Atlantic Ocean that infects marine fish as an intermediate host (Sindermann and Farrin 1962). Swenson (1999) suggests that this parasite may kill

hosts, facilitate secondary bacterial infection, or increase predation vulnerability. Although all localities may potentially support this parasite, it has only been documented to infest tidewater gobies at Gannon Slough, Humboldt County, Pescadero Creek, San Mateo County, and possibly Corcoran Lagoon, Santa Cruz County (Swenson 1999).

McGourty et al. (2007) report that a newly recognized species of protozoan parasite, *Kabatana newberryi*, may be specific to the tidewater goby. Their data suggest that *Kabatana newberryi* occurs sympatrically (overlaps geographically) with the tidewater goby throughout northern California. McGourty et al. (2007) found that presence-absence surveys for tidewater gobies conducted during the summers of 2003 and 2004 discovered individuals throughout the northern range of the tidewater goby infected with the microsporidian provisionally identified as *Kabatana newberryi*, as shown by the presence of opaque white muscle tissue. Voucher specimens of tidewater gobies taken from Rodeo Lagoon, Marin County, California in 2005 exhibited similar microsporidian infections (D. Fong, pers. comm. as cited in McGourty et al. 2007). No specific identification of the parasites could be made because the voucher specimens were preserved in formalin. However, the parasite from the Rodeo Lagoon specimens appears very similar to *Kabatana newberryi* in that it infects muscle cells. *Kabatana newberryi* has not been reported in the southern portion of the tidewater goby's range, and the dispersal mechanism of *Kabatana newberryi* is not well understood (McGourty et al. 2007). Surveys evaluating the presence and potential effects of *Kabatana newberryi* on tidewater gobies are needed to assess whether this parasite represents a significant threat to its host and could contribute to its decline. Because this parasite was discovered in tidewater goby specimens captured in Big Lagoon, Humboldt County, an otherwise large and reasonably secure population (State Parks ownership at the site), this suggests that even populations at otherwise low risk from habitat loss or destruction may be at risk from disease/parasites.

Numerous native and introduced predators exist within the habitat of the tidewater goby throughout its range. Introduced species are likely to increase over time as a result of increasing shipping to California and associated ballast discharges (California Department of Fish and Game 2002). There are cases where tidewater gobies appear to have been extirpated as a result of the introduction of nonnative predators. However, the number of occupied tidewater gobies has more than doubled since the time of listing, and we do not believe predation is an imminent threat to the survival of the species at this time.

Eighty-four localities (64 percent) are affected by risk of predation. Relative to the other units, the Central Coast recovery unit is experiencing the greatest threat from predation, where 15 of 21 localities (71 percent) are considered at risk; however, this is a threat across all units. Most predatory species include non-native fish such as smallmouth bass and introduced amphibians such as bullfrogs. Species such as these are expected to remain in the system permanently and will be a continuing challenge to recovery. If nonnative species are not responsible for tidewater goby declines by

themselves, they may be important in concert with factors such as drought, habitat loss or alteration, and natural or anthropogenically induced fluctuations in population size (M. Capelli, *in litt.* 1999; D. Holland, *in litt.* 1999).

Diseases and parasites and how they affect tidewater goby populations are not well understood at this time. Only recently has research begun to analyze the relationship between tidewater gobies and parasites, and how the tidewater goby populations are affected.

In conclusion, there are numerous native and non-native predators on tidewater gobies, and the number of non-native species is likely to increase. However, information on the impacts of predation on the long-term survival of tidewater gobies is generally lacking, and the number of occupied tidewater goby localities has increased since the time of listing. Therefore, we do not believe that the tidewater goby is in imminent danger of extinction as a result of predation.

#### **2.3.2.4. Inadequacy of existing regulatory mechanisms:**

There are several State and Federal laws and regulations that are pertinent to tidewater gobies, each of which currently contributes to the conservation of the tidewater goby, although in varying degrees. These laws, most of which have been enacted in the past 30 to 40 years, have greatly reduced or eliminated the threat of wholesale habitat destruction.

#### **State Protections**

California Environmental Quality Act (CEQA): CEQA requires review of any project that is undertaken, funded, or permitted by the State or a local governmental agency. If significant effects are identified, the lead agency has the option of requiring mitigation through changes in the project or to decide that overriding considerations make mitigation infeasible (CEQA section 21002). Protection of listed species through CEQA is, therefore, dependent upon the discretion of the lead agency involved.

California Lake and Streambed Alteration Program: The Lake and Streambed Alteration Program (California Fish and Game Code sections 1600-1616) may promote the recovery of listed species in some cases. This program provides a permitting process to reduce impacts to fish and wildlife from projects affecting important water resources of the State, including lakes, streams, and rivers. This program also recognizes the importance of riparian habitats to sustaining California's fish and wildlife resources, including listed species, and helps prevent the loss and degradation of riparian habitats.

California Coastal Act: The California Coastal Commission considers the presence of listed species in determining environmentally sensitive habitat lands subject to section 30240 of the California Coastal Act of 1976, which requires their protection.

Certain local jurisdictions have developed their own Local Coastal Programs or Land Use Plans that have been approved by the Coastal Commission. Some of the major accomplishments of this act include: reduction in overall development, the acquisition of prime habitat along the coast, restoration of coastal streams and rivers, and a reduction in the rate of wetland loss (Faber 1997).

Ballast Water Management Act of 1999: This Act established a multi-agency program to prevent the introduction and spread of non-indigenous aquatic species from the ballast of ships into the State waters of California. This program was designed to control ballast introductions and determine the current level of species invasions while researching alternatives to the present control strategies. Under this program, the California Department of Fish and Game was required to study the extent of non-native species introductions into the coastal waters of the State. To fulfill this requirement, the California Department of Fish and Game's Office of Spill Prevention and Response initiated several baseline field surveys of ports and bays along the California coast and a literature survey of records of non-indigenous species.

In 2002, Governor Gray Davis signed into law SB 1573, a bill that established an Interagency Aquatic Invasive Species Council and provided for the development of a State Aquatic Invasive Species Plan. The plan, prepared by California Department of Fish and Game's Habitat Conservation Planning Branch, will follow Federal guidance and fall under the direction of the State invasive species coordinator.

### **Federal Protections**

National Environmental Policy Act (NEPA): NEPA (42 U.S.C. 4371 *et seq.*) provides some protection for listed species that may be affected by activities undertaken, authorized, or funded by Federal agencies. Prior to implementation of such projects with a Federal nexus, NEPA requires the agency to analyze the project for potential impacts to the human environment, including natural resources. In cases where that analysis reveals significant environmental effects, the Federal agency must propose mitigations that could offset those effects (40 C.F.R. 1502.16). These mitigations usually provide some protection for listed species. However, NEPA does not require that adverse impacts be fully mitigated, only that impacts be assessed and the analysis disclosed to the public.

Clean Water Act: Under section 404, the U.S. Army Corps of Engineers (Corps) regulates the discharge of fill material into waters of the United States, which include navigable and isolated waters, headwaters, and adjacent wetlands (33 U.S.C. 1344). In general, the term "wetland" refers to areas meeting the Corps' criteria of hydric soils, hydrology (either sufficient annual flooding or water on the soil surface), and hydrophytic vegetation (plants specifically adapted for growing in wetlands). Any action with the potential to impact waters of the United States must be reviewed under the Clean Water Act, NEPA, and the Endangered Species Act. These reviews

require consideration of impacts to listed species and their habitats, and recommendations for mitigation of significant impacts.

Endangered Species Act of 1973, as amended (Act): The Act is the primary Federal law providing protection for this species. Since its listing, the Service has analyzed the potential effects of Federal projects under section 7(a)(2), which requires Federal agencies to consult with the Service prior to authorizing, funding, or carrying out activities that may affect listed species. A jeopardy determination is made for a project that is reasonably expected, either directly or indirectly, to appreciably reduce the likelihood of both the survival and recovery of a listed species in the wild by reducing its reproduction, numbers, or distribution (50 C.F.R. § 402.02). A non-jeopardy opinion may include reasonable and prudent measures that minimize the amount or extent of incidental take of listed species associated with a project. The Service's responsibilities include administering the Act, including sections 7, 9, and 10. Section 9 of the Act prohibits the taking of any federally listed endangered or threatened species. Section 3(18) of the Act defines "take" to mean "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct." Service regulations (50 CFR 17.3) define "harm" to include significant habitat modification or degradation which actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding or sheltering. Harassment is defined by the Service as an intentional or negligent action that creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering. The Act provides for civil and criminal penalties for the unlawful taking of listed species. Incidental take refers to taking of listed species that results from, but is not the purpose of, carrying out an otherwise lawful activity by a Federal agency or applicant (50 C.F.R. § 402.02). For projects without a Federal nexus that would likely result in incidental take of listed species, the Service may issue incidental take permits pursuant to section 10(a)(1)(B). To qualify for an incidental take permit, applicants must develop, fund, and implement a Service-approved habitat conservation plan (HCP) that details measures to minimize and mitigate the project's adverse impacts to listed species. Regional HCPs in some areas now provide an additional layer of regulatory protection for covered species, and these HCPs are coordinated with the related NCCP-State program.

Since the time of its listing, over 100 biological opinions have been issued to address the potential threats to the tidewater goby from a variety of actions (Toline et al. 2006). Actions for which the Service has issued biological opinions for effects to tidewater gobies include but are not limited to: grazing, flood control projects, removal of gas lines, bridge repair, pipeline replacement, channel maintenance, water diversions, sand and gravel mining extraction, and road resurfacing. Some biological opinions have been issued for actions that are considered overall benefit to tidewater gobies but were likely to include some adverse affects, such as restoration in estuaries and along streambanks.

Sikes Act: The Sikes Act (16 U.S.C. 670) authorizes the Secretary of Defense to develop cooperative plans with the Secretaries of Agriculture and the Interior for natural resources on public lands. The Sikes Act Improvement Act of 1997 requires Department of Defense installations to prepare Integrated Natural Resource Management Plans (INRMP) that provide for the conservation and rehabilitation of natural resources on military lands consistent with the use of military installations to ensure the readiness of the Armed Forces. While the Sikes Act of 1960 was in effect at the time of the tidewater goby listing, it was not until the amendment of 1997 (Sikes Act Improvement Act) that the Department of Defense installations were required to prepare INRMPs. INRMPs incorporate, to the maximum extent practicable, ecosystem management principles and provide the landscape necessary to sustain military land uses. While INRMPs are not technically a regulatory mechanism because their implementation is subject to funding availability, they can be an added conservation tool in promoting the recovery of endangered and threatened species on military lands.

In 2001, the Marine Corps completed an INRMP per the Sikes Act, as amended for Pendleton in northwest San Diego County. All currently occupied tidewater goby locations in San Diego County are on Pendleton. Additionally, in 1995, the Marine Corps and the Service completed a large-scale programmatic consultation under section 7 of the Act addressing, among other species, the tidewater goby and its habitat. All conservation measures, including the Pendleton's Estuarine/Beach Ecosystem Conservation Plan and the terms and conditions from that consultation, have been incorporated into the INRMP. The objective of the Estuarine/Beach Ecosystem Conservation Plan is to "manage and protect the natural resources along the Base's coastline emphasizing coastal lagoons and the Santa Margarita River Estuary," which includes tidewater goby habitat. Specific measures in the INRMP that benefit the tidewater goby include: (1) general avoidance of estuarine wetlands by all military activities, (2) maintenance of currently and historically occupied tidewater goby habitat, (3) compensation for unavoidable impacts, (4) regular monitoring of tidewater goby populations, and (5) controlling and removing exotic plants and fish. Additionally, the Base is exploring the potential for habitat enhancement to benefit the tidewater goby, including deepening smaller lagoons. Further, the Base's environmental security staff reviews Base projects and enforces existing regulations and Base orders that, through their implementation, avoid and minimize impacts to natural resources, including tidewater gobies and their habitat.

VAFB in Santa Barbara County completed an INRMP in 1997. In 2003, VAFB drafted a revised INRMP, which we commented on in a letter dated August 2, 2004. The older plan and the draft revised INRMP provide conservation measures for the five localities occupied by tidewater gobies on VAFB, as well as for the management of important wetland habitats on VAFB.

VAFB's INRMP benefits tidewater gobies through: (1) avoidance of tidewater gobies and their habitat, whenever possible, in project planning; (2) scheduling of activities that may affect tidewater gobies outside of the peak breeding period

(March–July); (3) coordination with VAFB water quality staff to prevent degradation and contamination of aquatic habitats; and (4) prohibiting the introduction of nonnative fishes into streams on-base. Further, VAFB’s environmental staff reviews projects and enforces existing regulations and orders that, through their implementation, avoid and minimize impacts to natural resources, including tidewater gobies and their habitat. In addition, VAFB’s INRMP provides protection to aquatic habitats for the tidewater goby by excluding cattle from wetlands and riparian areas through the installation and maintenance of fencing. VAFB’s INRMP specifies periodic monitoring of the distribution and abundance of tidewater goby populations on the base.

National Park Service (NPS) Organic Act: The NPS Organic Act of 1916 (39 Stat. 535, 16 U.S.C. 1, as amended), states that the NPS “shall promote and regulate the use of the Federal areas known as national parks, monuments, and reservations ... to conserve the scenery and the national and historic objects and the wildlife therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations.” The NPS Management Policies (NPS 2006) indicate that NPS will “meet its obligations under the NPS Organic Act and the Endangered Species Act to both pro-actively conserve listed species and prevent detrimental effects on these species.” This includes working with the Service and undertaking active management programs to inventory, monitor, restore, and maintain listed species habitats, among other actions.

National Forest Management Act (NFMA): The National Forest Management Act (36 C.F.R. 219.20(b)(i)) has required the Forest Service to incorporate standards and guidelines into Land and Resource Management Plans, including provisions to support and manage plant and animal communities for diversity and for the long-term, range-wide viability of native species. Recent changes to NFMA may affect future management of listed species, particularly rare plant occurrences, on National Forests. On January 5, 2005, the Forest Service revised National Forest land management planning under NFMA (70 FR 1023). The new planning rule changes the nature of Land Management Plans so that plans generally are strategic in nature and may be categorically excluded from NEPA analysis, and thus not subject to public review. Under the new planning rule, the primary means of sustaining ecological systems, including listed species, will be through guidance for ecosystem diversity. If needed, additional provisions for threatened and endangered species may be provided within the overall multiple-use objectives required by NFMA. The final rule does not include a requirement to provide for viable populations of plant and animal species, which had previously been included in both the 1982 and 2000 planning rules.

The existence of the above laws and regulations has greatly reduced the likelihood of the wholesale, indiscriminate destruction and alteration of coastal wetland habitat that was so pervasive in California historically. For example, the Sikes Act provides a degree of protection of tidewater gobies on military lands. The California Coastal Act and Clean Water Act have been particularly beneficial to the tidewater goby and

its habitat. Another law that may afford some protection to the tidewater goby in the future is the Ballast Water Management Act of 1999. Based on the protections afforded to the tidewater goby and its habitat, we recommend that the species be downlisted to threatened. Although these laws and regulations have largely eliminated major habitat loss and alteration, they are not as effective at smaller-scale losses that are ongoing. This may be especially true for upstream activities involving channelization, water diversion and groundwater overdrafting. The tidewater goby is not likely to be considered in many of these situations with the exception of the Act. An example of a situation where tidewater gobies were considered some distance upstream was in the biological opinion for the proposed Matilija Dam removal, which is about 16 mi (26 km) from the estuary. The conservation of the tidewater goby may also be in conflict with that of other listed species such as listed salmonids. If the tidewater goby was not listed, the conservation needs of the listed species would likely be considered over those of the goby. As a threatened species, the tidewater goby will continue to be provided the full protection of the Act. The protections afforded by the Act include the review of potential effects of Federal projects on tidewater gobies, the review of potential effects of projects where there is no Federal nexus, and the development of a recovery plan and the periodic review of the plan.

#### **2.3.2.5. Other natural or manmade factors affecting its continued existence:**

Metapopulation dynamics are an important aspect of tidewater goby biology and in turn, conservation. Studies such as Lafferty et al. (1999a, 1999b) and recovery planning efforts (Service 2005) emphasize the need to understand metapopulation dynamics for conserving and recovering tidewater gobies where the unit of conservation and recovery is a local subpopulation. A metapopulation perspective of tidewater goby subpopulations highlights the importance of regional processes in determining local patterns of abundance of tidewater gobies. In addition, it offers a straightforward, estuary-based approach to monitoring and managing tidewater goby populations, and reducing threats at estuaries.

Metapopulation structures that may have existed in the past have been altered by the loss of many stepping-stone populations (Smith, *in litt.* 2007). Connectivity of many populations has been reduced or eliminated by distance and lack of suitable, intermediate habitats. For example: 1) Waddell Creek in Santa Cruz County has been lost as a possible 15 mi stepping stone between those localities to the north in San Mateo County and those to the south (e.g., Scott Creek); 2) Schwans and Woods lagoons have been lost as suitable stepping stones between the Baldwin/Wilder metapopulation north of the Santa Cruz and Corcoran/Moran metapopulation south of Santa Cruz; and 3) San Vicente and Liddell Creeks have been lost between Scott and Laguna Creeks (Smith, *in litt.* 2007).

In central and northern California, Swift (*in litt.* 2007) believes it very unlikely that genetic interchange is possible between several groups of populations naturally separated by 20 or more miles (32 km) of rugged coastline. For example, isolated populations in Mendocino County in the Ten Mile River-Virgin Creek-Pudding Creek

group are unlikely to receive dispersing tidewater gobies from either the north or the south. These populations are too far away from other populations to be recolonized if lost and are unlikely to contribute tidewater gobies in either direction as well.

Farther south, a wide gap exists between Gaviota Creek and Winchester/Bell Canyon in Santa Barbara County (Swift, *in litt.* 2007). Similar long distances exist between Winchester/Bell Canyon and Arroyo Burro and Mission Creek-Laguna Channel and between these latter two and the Ventura River and Santa Clara River pair. These large gaps seem to disrupt or leave relatively unprotected the metapopulations along most of the coast from Point Conception to Rincon Point (Swift, *in litt.* 2007).

By far, the most significant natural factor adversely affecting the tidewater goby is drought and the resultant alteration of coastal and riparian habitats. Periodic droughts are a historical feature of California, which has been repeatedly subject to prolonged droughts ([www.drought.unl.edu/whatis/palmer/calif.gif](http://www.drought.unl.edu/whatis/palmer/calif.gif)). When the tidewater goby was proposed for listing as endangered in 1992 (57 FR 58770), California had just experienced what is considered the most severe drought in the history of the State which lasted for 5 years from 1987 to 1992 (Priest et al., 1993). At the time of listing in 1994 it was believed that only 48 localities remained occupied, although some localities had not yet been discovered and others were so low in abundance because of drought conditions they could not readily be detected. The 2006-2007 winter precipitation period for California was the driest since 1924 (O'Driscoll 2007). This was the driest period for Los Angeles since records were first kept in the 1880s with only 3.2 in (8.1 cm) of rain. However, based on the increase in occupied localities since the previous drought, the tidewater goby appears to be more resilient than previously thought.

Drought conditions, when combined with human induced water reductions (i.e., diversions of water from streams, excessive groundwater withdrawals), have degraded coastal and riparian ecosystems and have created extremely stressful conditions for most aquatic species including the tidewater goby. Drought can have dramatic negative effects on tidewater gobies, at least decreasing their populations to very low levels (perhaps to the point where they are undetectable) and at most extirpating populations. For example, the final listing rule for the tidewater goby (59 FR 5494) stated that formerly large populations of tidewater gobies had declined in numbers because of the reduced availability of suitable lagoon habitats (i.e., San Simeon Creek, Pico Creek), while others disappeared when the lagoons dried ( i.e., Santa Rosa Creek).

The substantial destruction of coastal wetlands, lagoons, and estuaries in the past has resulted in many tidewater goby localities becoming more isolated. An example of where this has occurred is the San Francisco Bay area. We have no way of determining how many tidewater goby localities existed in this area prior to development although, historically, 95 percent of the wetlands in this area have been filled in (Josselyn 1983, <http://pubs.usgs.gov/fs/coastal-wetlands/index.html>). Available records indicate seven localities have been extirpated in this area, and there

are now no occupied localities within the San Francisco Bay (Figure 1). Lagunitas Creek is the only remaining locality within Tomales Bay and is now separated from its nearest neighbor to the north, Estero de San Antonio, by a distance of about 15.5 mi (25 km). If tidewater gobies at Lagunitas Creek were extirpated during a drought, it is unlikely that it would be recolonized naturally. Another isolated locality is Rodeo Lagoon. The closest known existing locations of tidewater goby to Rodeo Lagoon are Lagunitas Creek in Tomales Bay, 23.6 mi (38 km) to the north, and San Gregorio Creek, 36 mi (58 km) to the south. If the population at Rodeo Lagoon were extirpated, the tidewater goby would disappear from about a 60-mile (70 km) portion of the coast. Another complicating factor that may be important to recolonization is the direction of long-shore currents. In the San Francisco Bay area, these currents are likely from north to south. Because tidewater gobies are considered to be weak swimmers, recolonization may be limited to extirpated localities to the south of occupied ones.

Genetic exchange within a metapopulation is also correspondingly limited, which may result in genetic drift and inbreeding (mating between close relatives). Loss of genetic diversity in small populations may decrease the potential for persistence in the face of long-term environmental change (Shaffer 1981, 1987; Primack 1998). Loss of genetic diversity can also result in decline in fitness from expression of deleterious recessive alleles (Meffe and Carroll 1994). Change in the distribution of diversity can destroy local adaptations or break up coadapted gene complexes (outbreeding depression). These problems can lead to a poorer "match" of the organism to its environment, reducing individual fitness and increasing the probability of population or species extinction (Meffe and Carroll 1994).

Flooding following severe storm events also threatens the tidewater goby. Floods can wash tidewater gobies out of the estuary naturally, but effects may be exacerbated when channelization has been implemented upstream. In this case, the effect of flood events can increase in duration and intensity, not only increasing the likelihood of loss of tidewater gobies from the estuary but reducing the likelihood of recolonization. Recolonization could also be limited as the distance between historic localities increases following loss of habitat and populations along the coast. However, periodic floods may also be essential for recolonization (Lafferty et al. 1999a).

Often, closely-related species compete for resources such as food and habitat and may degrade native fish habitat. As noted earlier, additional information is needed on competition with other species before this potential threat the tidewater goby can be fully assessed. Several small, potentially competitive or predatory estuarine fishes have been introduced into tidewater goby habitat. Rainwater killifish, chameleon goby, and yellowfin goby appeared in the 1960's in San Francisco Bay, coincident with the last collections of tidewater gobies there (Hubbs and Miller 1965; Haaker 1979; Swift *et al.* 1989). Rainwater killifish have become widespread in San Francisco Bay, and have recently become established in Upper Newport Bay, but have not become established elsewhere (Moyle 2002; C. Swift, pers. comm. 2004).

Yellowfin gobies have slowly spread to many of the larger, tidal and muddy California estuaries. They have seldom been collected in the smaller brackish, nontidal systems where tidewater gobies are found (Swift et al. 1993). However, in 1992 and 1993 yellowfin gobies were collected in the Santa Clara River and Santa Margarita River lagoons (K. Lafferty, pers. comm. 1994; Swift et al. 1994). The recent appearance of yellowfin gobies in southern California and the coincident disappearance of the tidewater goby in the Santa Margarita River in late 1993 suggest that the species is slowly spreading to brackish habitats and may be eliminating tidewater gobies.

Chameleon gobies have been locally abundant on hard substrates in San Francisco and Los Angeles harbors since the 1960's and 1970's, respectively (Haaker 1979). Recently, shimofuri gobies made an upstream invasion into the San Francisco Bay Delta that allowed them to move down the California Aqueduct into Pyramid Reservoir and Piru Creek in southern California. The shimofuri goby is a more freshwater adapted taxon, as described by Akihito and Sakamoto (1989). Thus, marine invasions from bilge water of marine ships and downstream or inland invasions with imported water are possible now in southern California. California Aqueduct water is soon to be piped into central coastal California, and the potential invasion of exotic gobies with this water poses a potential threat to tidewater gobies in this area (C. Swift, pers. comm. 1995).

Initial experiments by Swenson and Matern (1995) indicated that shimofuri gobies aggressively intimidate, outcompete and prey upon tidewater gobies in the laboratory. However, like the chameleon goby, the shimofuri goby prefers hard substrates. It was found almost exclusively on rocky shores and around boulders of levees and breakwaters in Pyramid Lake (Wade Sinnen and Janice Curl, California Department of Fish and Game, pers. comm. 1992). Thus it might be expected to remain in such habitats in coastal lagoons, and perhaps not interact extensively with tidewater gobies. However, any increase in hard substrate in lagoons inhabited by tidewater gobies should be carefully considered because this substrate would provide the habitat that could result in the establishment of the shimofuri goby. If lagoons were breached or other conditions lowered the water level, the shimofuri gobies could potentially move from the rocky areas and establish themselves in the tidewater goby habitat, to the detriment of tidewater gobies. To date, the possible effects of interactions in the wild between these exotic goby species and tidewater gobies are largely conjectural.

In conclusion, habitat destruction, drying or diversion of waterways, urbanization, and other human activities can act to isolate populations that normally would experience gene exchange with other populations. If the resultant induced fragmentation and isolation reaches a degree that in turn results in loss of heterozygosity and divergence from other populations where gene exchange

previously occurred (Meffe and Carroll 1994), then the species may eventually decline to the point where extinction risk becomes unacceptable. In some cases, the metapopulation dynamic structure of the tidewater goby has been affected because of past habitat destruction that has produced gaps in the distribution of tidewater gobies. These gaps may be significant because of the tidewater goby's limited dispersal and recolonization abilities. Drought may greatly reduce tidewater goby abundance, productivity, and survival and result in extirpations. However, with the limited information available at this time, it is difficult to determine the impact these factors are having or may have on the long-term survival of the tidewater goby. The species was listed at the end of a severe drought. Based on the increase in occupied localities since that drought, the tidewater goby appears to be more resilient than previously thought. Also, the other factors discussed above have not prevented the doubling of occupied localities that has occurred since listing. Therefore, we believe that the species is not in imminent danger of extinction as a result of these factors, and we recommend that it be downlisted to threatened.

#### **2.4. Synthesis**

Past threats to the tidewater goby were severe and frequently involved the complete destruction of entire wetlands, lagoons, and estuaries. More than 90 percent of wetlands in California have been lost. Along the coast, the wetlands that have been most affected are those in the San Francisco Bay area and in the southern coast (Los Angeles/San Diego area; California Coastal Conservancy 2001). The main reasons for listing the tidewater goby as endangered were habitat destruction and the effects of drought. Current laws and regulations have reduced or eliminated both large- and small-scale habitat loss and alteration. However, some threats to the tidewater goby are still ongoing. These include limited loss and alteration of habitat resulting from development projects, flood control, anthropomorphic breaching of coastal lagoons, and freshwater withdrawal. Also, predation by and competition with native and non-native species continue to be a concern.

Another important factor is the status of the metapopulation dynamics aspect of tidewater goby biology. The recovery plan (Service 2005) emphasizes the need to understand metapopulation dynamics for conserving and recovering tidewater gobies. The metapopulation structure of tidewater gobies depends on the continued availability of suitable habitat and the recolonization ability of the species. In some cases past habitat loss has resulted in artificial gaps within a metapopulation that tend to decrease the likelihood of recolonization. As the subpopulations that make up a metapopulation become isolated, local extirpations may become permanent because they are outside the recolonization ability of the species, and an entire metapopulation can move incrementally toward extinction (Rieman and McIntyre 1993). An example of where this has occurred is at the Petaluma River, Novato Creek, and Corte Madera Creek localities located in the northern portion of the San Francisco Bay (Greater Bay Recovery Unit) where extirpations have resulted in greater and greater isolation of occupied localities, which has severely reduced or eliminated the possibility of natural recolonization. It is difficult to address this concern because needed

information is not yet available. However, the greater numbers of occupied localities that are known to exist now compared with the past improve the probability that more metapopulations are sustainable.

It is difficult to determine the status of the species throughout its range and the overall impacts of the threats to it because information on population size and population trends is lacking. However, based on the more than doubling of the number of occupied localities since it was listed (from 48 localities to 106, Table 1), we now consider the species to be more resilient to perturbations and climatic factors (particularly, drought) than previously believed. Considering that there are now 106 occupied localities, we believe the tidewater goby is more secure than at the time of listing. Under natural conditions, tidewater goby populations are highly dynamic. We expect that tidewater gobies will periodically be extirpated or reach such low numbers that they cannot be detected at some localities. This is a natural occurrence within many species exhibiting a metapopulation dynamic including the tidewater goby. We also expect the rate of loss to be higher during drought conditions. Furthermore, during wetter periods, we expect that these localities will again be occupied assuming that suitable habitat still exists.

In conclusion, we recommend that the tidewater goby be downlisted to threatened because we believe that it is not in imminent danger of extinction. The main reason for this recommendation is that the number of localities known to be occupied has more than doubled since listing. We believe this indicates the tidewater goby is more resilient in the face of severe drought events than believed at the time of listing. Furthermore, we believe threats identified at the time of listing have been reduced or are not as serious as thought. One of the main reasons why the tidewater goby was listed was because of habitat destruction and alteration. Current laws and regulations have largely eliminated the major destruction of habitat that occurred in the past along the coast of California. Although numerous other threats to the tidewater goby have been identified (e.g., non-native predation and competition, pollution, cattle grazing), information on the degree of impact these may have on tidewater gobies is generally lacking. Based on the increase in occupied localities, these threats appear to not be having a major impact on the tidewater goby.

Although we are recommending downlisting, we believe that a proposed downlisting action should be deferred until we determine whether the unpublished taxonomic research referred to in the Genetics section of this report is published. Since there is a high likelihood that taxonomic changes of the listed entity are imminent, we believe we should review those changes prior to publication of a proposed downlisting rule. We also believe careful monitoring of the species should continue and be encouraged, especially during and after drought events. Also, developing a metapopulation viability analysis (MVA) as prescribed in the recovery plan should be conducted to gain a better understanding of tidewater goby metapopulation dynamics (i.e., identifying source and sink populations and the likelihood of recolonization). There is Service-funded research underway that will further detail the genetic makeup of the species (important to identifying source populations), develop the model parameters for MVA's, and collect data to conduct MVA's for localities from San Luis Obispo to San Diego County.

### 3. RESULTS

#### 3.1. Recommended Classification

- Downlist to Threatened
- Uplist to Endangered
- Delist (Indicate reasons for delisting per 50 CFR 424.11):
  - Extinction
  - Recovery
  - Original data for classification in error
- No change needed

#### 3.2. New Recovery Priority Number

The recovery number changes from 7C to 13. This is based on our determination that current threats to the tidewater goby are not as severe as previously thought. There is also less potential for economic conflict than previously thought.

#### 3.3. Listing and Reclassification Priority Number, if reclassification is recommended

6.

### 4.0 RECOMMENDATIONS FOR FUTURE ACTIONS

Based upon review of current information, limitations to tidewater goby recovery include a lack of a directed long-term monitoring program and the need for a better understanding of the effects of incompatible coastal development practices on tidewater goby and habitat protection.

#### Long-term monitoring plan

Assessment of the Federal status of this species is difficult without a well-developed long-term monitoring plan. It is recommended that this plan be developed. Several sites have been monitored for presence and absence over the years. However, this does not allow for statistically-sound quantification of trends in population size across the species' range. This is due to varying degrees of sampling effort across the species range and variation in sampling protocol. To this end, it is recommended that a long-term monitoring plan be developed dictating that: 1) sites are sampled in a common fashion throughout the species' range where possible, or at least sampled in such a way that comparisons can be made among sites based on catch per unit effort; and 2) a hierarchical sampling scheme be developed that dictates sampling in each recovery unit, sub-unit and locality at specific intervals. Standardized reporting forms should be developed to ensure consistency of environmental data and reporting detail.

### Quantification of linkage between reduction in tidewater goby populations or habitat and incompatible coastal development practices

Many threats are identified throughout the literature and within the recovery plan. However, there is limited information on the linkage between specific habitat uses such as development and agriculture and reductions in habitat and number of tidewater goby localities.

### Quantification of effects of drought (or drier years) on presence of tidewater goby

A better understanding of the effect of drought on tidewater goby populations would be of value to the long-term assessment of the status of this species. Data from a well-developed monitoring plan and associated hydrologic data would aid in the development of this understanding.

### Delineation of populations

It is difficult to assess the number of populations due to the frequent loss and re-colonization of sites. Additional molecular data would be useful to quantify among-population genetic structure and the existence of tidewater goby metapopulations.

Furthermore, in the event that the populations located in San Diego County are described as a new taxon, we should evaluate threats to both the tidewater goby and the new taxon. Based on the outcome of this evaluation, we would make a determination as to the listing status of the new taxon and the tidewater goby.

### Water quality monitoring plan

The development of a water quality monitoring plan for tidewater goby would allow better assessment of threats and provide data necessary to understand the link between water quality and tidewater goby population size. This plan could incorporate those data already gathered by State and Federal entities required to assess water quality and recommend areas for partnership.

### High priority recovery actions

Several recovery actions are identified in the Recovery Plan. Many of these focus on the need for increased data. However, there is also a need for habitat protection. It is recommended, as articulated in the Recovery Plan, that the development of management plans for recovery units be developed and subsequent habitat protection be implemented, as needed.

### Provide funding and technical support for development of metapopulation viability analyses

It is recommended, as articulated in the reclassification criteria of the Recovery Plan, that the development of metapopulation viability analyses be developed, which projects that all recovery units are viable. The goal of the metapopulation analysis is to identify particular subpopulations or localities, or links between localities that are critical to maintenance of the overall metapopulations.

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*Personal Communications*

Jacobs, David. 2007. Department of Ecology and Evolutionary Biology, University of California, Los Angeles, California.

## Appendix A.

### Tidewater Goby Listing, Recovery, and Litigation History

The listing and recovery planning process for the tidewater goby has occurred over 25-years. The Service classified the tidewater goby as a category 2 candidate species (47 FR 58454) in 1982. It was reclassified as a category 1 candidate species in 1991 (56 FR 58804) based on status and threats information in Swift et al. (1989). Although the Service no longer uses the category 1 or 2 classification system, category 2 species were those taxa for which information in our possession indicated that proposing to list as threatened or endangered was possibly appropriate, but for which sufficient data on biological vulnerability and threats were not currently available to support a listing proposal. Category 1 species, now referred to as candidate species, were those taxa for which we had on file sufficient information on biological vulnerability and threats to support a proposal to list as threatened or endangered.

The listing process for the tidewater goby began with our receipt of a petition on October 24, 1990, to list it as endangered. On March 22, 1991, we published our finding that the petition presented substantial information that the requested action may be warranted (56 FR 12146). On December 11, 1992, we published a proposal to list the tidewater goby as an endangered species (57 FR 58770). We published the final rule listing the tidewater goby on February 4, 1994 (59 FR 5494).

The main reasons for listing the tidewater goby were a substantial decline in the number of known populations (i.e., occupied goby localities) and the threat of coastal development. The listing rule stated that since 1900, tidewater gobies had been extirpated from 50 percent of formerly occupied lagoons. This loss had been documented by surveys in 1984 that found that the tidewater goby populations at 22 of the 135 historical localities had been extirpated (Swift et al. 1989). Additional surveys in 1989 found that tidewater goby populations had been extirpated from an additional 21 localities (Swift et al. 1989, 1990). In the San Francisco Bay area, 9 of 10 previously identified populations had been extirpated (Swift et al. 1989, 1990). At the time of listing, losses were highest in the southern part of the tidewater goby's range where tidewater gobies had been extirpated from 74 percent of the coastal lagoons south of Morro Bay, San Luis Obispo County; only three populations remained south of Ventura County. Information on actual abundance of tidewater gobies was not available at the time, but the listing rule characterized the 43 remaining populations as being small, vulnerable to a variety of human and natural threats, and isolated from each other so that recolonization was unlikely. Only eight populations were considered large enough to be relatively secure for the immediate future; all eight of these populations were north of the San Francisco Bay.

Coastal development projects considered in the listing rule included the draining of coastal marsh habitats for residential and industrial development, the dredging of waterways for navigation and harbors, road construction, channelization, and upstream water diversions. At the time of listing we thought the tidewater goby was restricted to

salinities less than 10 parts per thousand (ppt). Therefore, water diversion activities that altered salinity levels were considered a threat. Other threats to the tidewater goby identified in the final listing rule included agricultural and sewage effluents, cattle grazing, feral pig activity, introduced fish predators, drought combined with human induced water reductions, isolation of populations, and competition with introduced fish species.

We did not designate critical habitat for the tidewater goby at the time of listing because we believed critical habitat was not then determinable. In addition, a final decision on critical habitat required detailed information on the possible economic effects of designation, which was not available at that time. On September 18, 1998, the Natural Resources Defense Council, Inc., filed a lawsuit against the Service in U.S. District Court for failure to designate critical habitat for the tidewater goby. On April 5, 1999, the court ordered that the "Service publish a proposed critical habitat designation for the tidewater goby in 120 days" (*Natural Resources Defense Council, Inc. v. U. S. Department of the Interior et al.*, CV 98-7596, C.D. Cal.).

On June 24, 1999, we published a rule that proposed the tidewater goby in Orange and San Diego counties as a Distinct Population Segment (DPS) (64 FR 33816). The following information is summarized from that proposed rule. The rule proposed to retain this southern DPS as endangered, and to remove the tidewater goby north of Orange and San Diego counties from the list entirely. The proposal found that information available after the species was listed indicated its habitat requirements were less stringent than originally thought (i.e., tidewater gobies can tolerate a wider range of salinity levels) and there was a greater likelihood of dispersal between localities. North of Orange County, more populations were known to exist than were known when the species was listed in 1994. We also believed that threats to the northern populations were less severe than previously thought. The main reason for listing the tidewater goby was the threat of habitat degradation from coastal development. We proposed delisting in part because we believed this threat was responsible for the historical loss of tidewater goby populations, but that the potential for substantial future habitat loss had been greatly reduced. We believed this was due largely to the implementation of key environmental regulations associated with the Clean Water Act, the Coastal Zone Management Act, and related California environmental statutes. Because we believed that tidewater gobies could tolerate more variation in salinity than previously thought, we concluded that changes in salinity resulting from water diversion projects were less likely to affect populations of the species. This proposal also concluded that, based on more recent surveys, the 50 percent decline in occupied localities that was estimated in the final rule was likely less than a 25 percent permanent loss. We proposed to retain the southern DPS as endangered because it continued to be threatened by habitat loss and degradation, predation and competition by non-native species, and extreme weather and streamflow conditions.

On August 3, 1999, we proposed to designate critical habitat for the tidewater goby in Orange and San Diego Counties (64 FR 42250). Critical habitat was not proposed for this species throughout the rest of its geographic range in 1999 because we believed that

it was only threatened with extinction in Orange and San Diego Counties. On November 20, 2000, we designated critical habitat for the tidewater goby in Orange and San Diego counties (65 FR 69693). The critical habitat designation consisted of 10 coastal stream segments that collectively measured 9 miles (mi) (14.5 kilometers (km)) in length.

The Service was also sued on September 7, 1999, by the Environmental Defense Center, the Natural Resources Defense Council, Heal the Bay, and the Friends of the Ventura River (Environmental Defense Center v. United States Department of the Interior, Case No. 01-1034 DOC) over failure to prepare a recovery plan for the tidewater goby. A settlement was reached on April 23, 2003, which required the Service to publish a recovery plan by December 2005. The Service published a draft recovery plan for the tidewater goby in October 2004 and a final recovery plan in December 2005 (Service 2005).

On August 31, 2001, Cabrillo Power L.L.C. (Cabrillo) filed a lawsuit in the U.S. District Court for the Southern District of California challenging a portion of the November 20, 2000, final rule that designated the 10 critical habitat units in Orange and San Diego counties. Specifically, Cabrillo objected to the critical habitat unit involving Agua Hedionda Lagoon and Creek. In a consent decree dated February 27, 2003, the U.S. District Court: (1) agreed to vacate the critical habitat designation involving Agua Hedionda Lagoon and Creek; (2) stated the nine other critical habitat units should remain in effect; (3) stated the final rule designating critical habitat was remanded in its entirety for reconsideration; and (4) directed the Service to promulgate a revised critical habitat rule that considers the entire geographic range of the tidewater goby and any currently unoccupied tidewater goby habitat.

On November 7, 2002, we withdrew the proposal to delist the tidewater goby in areas north of Orange County (67 FR 67803). We also withdrew the proposed designation of the southern tidewater goby as a DPS. The comments we received on the proposed rule were mainly opposed to delisting and included new information that indicated the reasons for delisting may have been in error. The criticisms and concerns that were most influential to the withdrawal of the proposed rule are summarized below (see the withdrawal (67 FR 67803) for a detailed discussion).

One of the main reasons for the proposed delisting (64 FR 33816) was the greater number of localities known to be occupied by the tidewater goby compared to the time of listing, especially in the northern part of its range. Reasons for this increase included a lack of survey information at the time of listing, recolonization, or increased tidewater goby abundance that facilitated detection. We received several comments from peer reviewers and others that noted we should not have considered all tidewater goby populations equally important. Rather, these comments suggested that we should have considered the size, trend, threats, and viability of newly documented populations. In addition, commenters suggested that an increased number of occupied localities was not sufficient to show that the species had recovered. Several commenters believed that many of the recently documented tidewater goby populations were small and vulnerable to extirpation. There was also concern that we had not considered the metapopulation

dynamics of the tidewater goby in our proposal to delist. A number of commenters expressed their opinions that tidewater goby populations likely exhibit “source-sink” dynamics, where not all local populations contribute to the overall persistence of the metapopulation. They suggested that larger populations contribute individuals to smaller sites that are not, by themselves, sustainable. Based on these comments, one of the reasons for our withdrawal of the proposal was that information needed to appropriately evaluate these new localities was not available. We also withdrew the proposal because information was lacking on the importance of metapopulation dynamics in relation to long-term persistence of local populations, and whether or not some local populations might behave as “sinks” for tidewater gobies dispersing from other populations. We believed this information was important in evaluating the likelihood of persistence of the tidewater goby.

Another reason for our proposed delisting (64 FR 33816) was that we believed the tidewater goby had a greater ability than previously thought to recolonize habitat from which it is temporarily absent. Many commenters disagreed with this interpretation, suggesting that we had overestimated the tidewater goby’s potential for recolonization. A number of commenters stated that (1) the tidewater goby’s ability to recolonize habitats is limited, (2) tidewater gobies are not known to occur beyond 6 mi (10 km) from source populations, (3) the tidewater goby has limited ability to swim for long distances and against the currents of an estuarine system, and (4) because of prevailing ocean currents, recolonization is most likely to occur to the south rather than the north. Many commenters noted that recolonization is much less likely to occur in areas where populations are more widely separated, have geographic barriers, or where there is no nearby population to the north (i.e., up current); the latter scenario exists in a number of locations throughout the tidewater goby’s range.

In the proposed delisting rule (64 FR 33816), we also reasoned that the tidewater goby’s tolerance of relatively high salinities indicated their potential for successful marine dispersal and recolonization of unoccupied habitat. However, one peer reviewer noted that demonstrating survival in high salinities in laboratory conditions is not equivalent to a likelihood of successful migration through high salinity natural habitats. The peer reviewer suggested that it is necessary to document movement of tidewater gobies from one estuary to another, either directly through tag and recapture studies, or indirectly through targeted genetic studies, to conclude that recolonization occurs. Commenters noted that tidewater gobies prefer low salinities, that the species is most widespread and abundant in low salinity conditions, and that the species is much more restricted in highly saline systems. In addition, the proposed delisting did not discuss long-term effects of high salinity on tidewater goby reproduction, feeding, or survival.

Based on these comments, we believed that we had overestimated the likelihood of natural recolonization of tidewater goby localities over any substantial distance. We concluded that additional time was needed to assess whether natural recolonization is as frequent as we assumed in the proposed delisting rule (64 FR 33816). We also agreed that tolerance to high salinity does not necessarily indicate that natural recolonization

occurs or is likely. Our proposed delisting relied heavily on our conclusion that recolonization was more frequent than previously thought.

Another reason we had proposed delisting the northern populations of tidewater gobies was our belief that the severity of threats in this area was less than previously thought (64 FR 33816). Several commenters felt that we did not adequately or accurately assess the current and future threats to the tidewater goby, including the threat to tidewater goby populations from coastal and upstream development projects, the threats of predation and competition by nonnative species, and the cumulative effects of combined threats. One of these commenters noted that smaller wetlands, which can be “stepping stones” between larger tidewater goby habitats, are vulnerable to random events such as drought.

In the proposed delisting rule (64 FR 33816), we also concluded that the effects of water diversion and groundwater overdrafting were not a substantial threat because we believed that the higher salinity levels that could result from these activities could be tolerated by gobies to a greater extent than previously thought. We believed these higher salinities would not result in the extirpation of tidewater gobies. However, commenters pointed out that tidewater gobies tend to prefer lower salinity levels, and that high salinity may result in impacts other than extirpation, such as reduced productivity. We also proposed that channelization was not a substantial threat to tidewater gobies because there was a lack of examples indicating otherwise. However, in the withdrawal (67 FR 67803) we acknowledged that channelization could have impacts on tidewater goby habitat in addition to flushing gobies out to sea.

In the proposed delisting rule (64 FR 33816), we also discussed artificial lagoon breaching, which was a threat that was not mentioned in the final listing rule (59 FR 5494). However, we concluded that the complete extirpation of tidewater goby populations where breaching occurs did not appear to be a problem. As with channelization, we did not consider that impacts on tidewater goby abundance, productivity, feeding, and survival could also result from artificial breaching.

We withdrew our delisting proposal in part because we agreed that further analysis of the impacts of coastal and upstream development projects, water diversion, and channelization was needed (67 FR 67803). In addition, the dramatic increase in the human population estimated for California in the near future would greatly increase infrastructure needs that could impact coastal watersheds and drainages occupied by tidewater gobies. Human-induced impacts, combined with the effects of drought, could lead to a situation in which a marginal tidewater goby population may not recover from a drought.

In the delisting proposal, we asserted that tidewater goby populations north of Orange and San Diego Counties were not particularly vulnerable to predation from introduced fish. However, the comments and new information we received suggested that nonnative fish are often introduced to tidewater goby habitats, prey on tidewater gobies and in some documented cases, may lead to their extirpation. Even if nonnative species are not responsible for tidewater goby declines by themselves, they may be important in concert

with factors such as drought, habitat loss or alteration, and natural or anthropogenically-induced fluctuations in population size.

In the final listing rule (59 FR 5494), we stated that the most significant natural factor adversely affecting the tidewater goby was drought and the resultant deterioration of coastal and riparian habitats. At the time, California had recently experienced 5 consecutive years of lower-than-average rainfall. We believed that these drought conditions, when combined with human-induced water reductions, degraded coastal and riparian ecosystems and created extremely stressful conditions for aquatic species. Periodic droughts are a historical feature of California, which has been repeatedly subject to prolonged droughts (<http://www.drought.unl.edu/whatis/palmer/calif.gif>). Such natural population fluctuations assume a different character when considered in conjunction with other threats to the species, such as coastal development projects, freshwater diversions, urban development, and introduced species. When coupled with other human-related modifications to the habitat of the tidewater goby, these droughts increase in significance, and will undoubtedly be repeated in the future. We withdrew our delisting proposal in part because we received comments that, when evaluating the status of a species which fluctuates widely in response to climatic conditions, we should have considered a time period which includes the full range of climatic variation (67 FR 67803). In proposing to delist the tidewater goby, we considered only one drought cycle. Drought can have dramatic negative effects on the tidewater goby, at least decreasing goby populations to very low levels (perhaps to the point where they are undetectable) and at most extirpating populations. We need to consider the potential magnitude and importance of these drought events on the long-term persistence of the tidewater goby prior to delisting any portion of the range of the species.

In summary, we proposed to delist the northern portion of the tidewater goby range because we felt the original listing was in error. Specifically, we believed that new evidence showed that (1) there were more populations in the northern portion of the species' range at the time of the delisting proposal than at the time of the listing, (2) the threats to the northern populations were less severe than previously believed, and (3) the tidewater goby has a greater ability to recolonize than was known at the time of the listing. Some commenters, including a number of scientists with extensive experience with the tidewater goby, disagreed with all three premises. In particular, the commenters suggested that we overemphasized the importance of the discovery of new tidewater goby populations, that we minimized the severity of the threats to the species in the northern portion of its range, and that we overstated the species' recolonization ability. After reviewing the information presented, we found the commenters' arguments with respect to the tidewater goby's ability to recolonize compelling, and believed that it was prudent to withdraw the proposed delisting. We also withdrew our proposal to establish an endangered DPS in Orange and San Diego counties. At the time of withdrawal, we did not evaluate the appropriateness of downlisting the species instead of de-listing, and we did not attempt to provide a more in-depth analysis of the magnitude and imminence of the various threats to the species.

On November 28, 2006, we published a revised proposed critical habitat designation for the tidewater goby in the Federal Register (71 FR 68914). This revised proposal included 44 units totaling approximately 10,003 acres (ac) (4,050 hectares (ha)) within the range of the tidewater goby from Del Norte County in northern California to Los Angeles County in the south. We will publish a final critical habitat rule in November 2007.

**U.S. FISH AND WILDLIFE SERVICE 5-YEAR REVIEW of Tidewater Goby**

**Current Classification:**

**Recommendation resulting from the 5-Year Review:**

- Downlist to Threatened
- Uplist to Endangered
- Delist
- No change needed

**Appropriate Listing/Reclassification Priority Number, if applicable:**

6

**Review Conducted By:**

**FIELD OFFICE APPROVAL:**

Lead Field Supervisor, Fish and Wildlife Service

Approve Diane K. Ueda Date 9/20/07

**REGIONAL OFFICE APPROVAL:**

Lead Regional Director, Fish and Wildlife Service

Approve Michelle Fri Date 9/28/07