

Chapter 6 Cumulative Effects

Cumulative effects, as defined by rule, are those effects of future State, tribal, local or private activities, not involving Federal activities, that are reasonably certain to occur within the Action Area of the Federal action subject to consultation (50 CFR 402.02) that USFWS and NMFS use in conducting a jeopardy analysis. For this biological assessment, these include unscreened water diversions, state or local levee maintenance, oil and gas production and powerplants, and the point and non-point source chemical contaminant discharges related to agricultural and urban land use. These actions typically result in habitat fragmentation and degradation of habitats that incrementally reduces the carrying capacity of the rearing and migratory corridors found within the action area. Cumulative effects also include the implementation of changes in state law. Several related and reasonably foreseeable future State or private projects and actions could result in impacts on Federally-listed aquatic and terrestrial biological resources considered in this biological assessment. The projects that are most likely to affect those resources are generally described below.

6.1 Unscreened Water Diversions

Water diversions for irrigated agriculture, municipal and industrial use, and managed wetlands are found throughout the California Central Valley. Thousands of small and medium-size water diversions exist along the Sacramento River, San Joaquin River, their tributaries, and the Delta, and many of them remain unscreened. Depending on the size, location, and season of operation, these unscreened diversions entrain and kill many life stages of aquatic species, including juvenile listed anadromous or osmeridae (smelt) species (Mussen et al. 2013, Mussen et al. 2014). For example, as of 1997, 98.5 percent of the 3,356 diversions included in a Central Valley database were either unscreened or screened insufficiently to prevent fish entrainment (Herren and Kawasaki 2001). This has improved due to the Anadromous Fish Screen Program (AFSP), part of CVPIA, as well as DWR's fish screening program. While private irrigation diversions in the Delta are mostly unscreened, the total amount of water diverted onto Delta farms has remained stable for decades (Culberson et al. 2008).

6.2 Agricultural Practices

Agricultural practices may negatively affect riparian and wetland habitats through upland modifications that lead to increased siltation or reductions in water flow in stream channels flowing into the action area, including the Sacramento River, Stanislaus River, San Joaquin River, and Delta. Grazing activities from dairy and cattle operations can degrade or reduce suitable critical habitat for listed fish species by increasing erosion and sedimentation, as well as introducing nitrogen, ammonia, and other nutrients into the watershed, which then flow into receiving waters. Delta Smelt's exposure to contaminants are inherent in the Delta, ranging in the degree of effects. Sources of introduction vary from agricultural use pesticide runoff to urban wastewater treatment discharge, and other potential sources. Stormwater and irrigation discharges related to both agricultural and urban activities contain numerous pesticides and herbicides that may disrupt various physiological mechanisms and may negatively affect reproductive success and survival rates of listed anadromous fish (Scott and Sloman 2004). However, the State of California issues Waste Discharge Requirements (WDRs) to dischargers, including irrigators, dairy operations, and cattle operations, that require implementation of Best Management Practices (BMPs) designed to be protective

of surface water quality, with benefits for listed fish species. Monitoring and reporting requirements associated with those WDRs ensure compliance with BMPs.

Agricultural practices introduce nitrogen, ammonium, and other nutrients into the watershed, which then flow into receiving waters, adding to other inputs such as wastewater treatment (Lehman et al. 2014). Stormwater and irrigation discharges related to both agricultural and urban activities contain numerous pesticides and herbicides that may negatively affect fish reproductive success and survival rates (Dubrovsky et al. 1998; Kuivila et al. 2004; Scholz et al. 2012). Discharges occurring outside the action area that flow into the action area also contribute to cumulative effects of contaminant exposure.

6.3 Wastewater Treatment Plants

The Sacramento Regional Wastewater Treatment Plan (SRWTP), in order to comply with Order no. R5-2013-0124, has begun implementing compliance measures to reduce ammonia discharges. Construction of treatment facilities for three of the major projects required for ammonia and nitrate reduction was initiated in March 2015 (Sacramento Regional County Sanitation District 2015). Order no. R5-2013-0124, which was modified on October 4, 2013, by the Central Valley Regional Water Quality Control Board imposed new interim and final effluent limitations, which must be met by May 11, 2021 (Central Valley Regional Water Quality Control Board 2013). By May 11, 2021, the SRWTP must meet effluent limits EPA published revised national recommended ambient water quality criteria for the protection of aquatic life from the toxic effects of ammonia in 2013. Few studies have been conducted to assess the effects of ammonia on listed fish species, although studies have been performed on surrogate non-listed fish species. Studies of ammonia effects on various fish species have shown numerous effects including membrane transport deficiencies, increases in energy consumption, immune system impairments, gill lamellae fusions deformities, liver hydropic degenerations, glomerular nephritis, and nervous and muscular system effects leading to mortality (Connon et al. 2011). Additionally, a study of coho salmon and rainbow trout exposed to ammonia showed a decrease in swimming performance due to metabolic challenges and depolarization of white muscle (Wickset al. 2002).

In addition to concerns about direct toxicity of ammonia to Delta Smelt, another important potential concern is that ammonium inputs have slowed diatom growth in the Delta and Suisun Bay, thereby reducing the productivity in the Delta Smelt food web (Wilkerson et al., 2006, Gilbert et al. 2011, Dugdale et al. 2016), in combination with other factors such as invasive clams.

6.4 Increased Urbanization

With a projected growth rate of 1.2% annually through 2030, California can expect to observe future increases in urbanization and housing developments (California Department of Finance 2012). Increases in urbanization and housing developments can impact habitat by altering watershed characteristics, and changing both water use and stormwater runoff patterns. Increased growth will place additional burdens on resource allocations, including natural gas, electricity, and water, as well as on infrastructure such as wastewater sanitation plants, roads and highways, and public utilities.

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these actions will not require Federal permits and thus will not undergo review through the Section 7 consultation process.

Adverse effects on listed fish species and their critical habitat may result from urbanization-induced point and non-point source chemical contaminant discharges within the action area. These contaminants include, but are not limited to, ammonia and free ammonium ion, numerous pesticides and herbicides, and oil and gasoline product discharges. Increased urbanization also is expected to result in increased recreational activities in the region.

6.5 Recreational Activities in the Region

Recreational boating is expected to increase in volume and frequency. Boating activities typically result in increased wave action and propeller wash in waterways. This potentially will degrade riparian and wetland habitat by eroding channel banks and mid-channel islands, thereby causing an increase in siltation and turbidity. Wakes and propeller wash also churn up benthic sediments thereby potentially resuspending contaminated sediments and degrading areas of submerged vegetation. This, in turn, would reduce habitat quality for the invertebrate forage base required for listed fish species. Increased recreational boat operation is anticipated to result in more contamination from the operation of gasoline and diesel powered engines on watercraft entering the associated water bodies.

6.6 Changes in Location, Volume, Timing, and Method of Delivery for Non-CVP/SWP Diversions

Changes in location, volume, timing, and method of delivery for non-CVP/SWP diversions may be implemented without Federal consultation. While not certain, changes may be expected to occur due to:

- Implementation of the California Sustainable Groundwater Management Act that requires development and implementation of Groundwater Sustainability Plans;
- Implementation of the California Senate Bill X7-7 provisions which require the state to achieve a 20% reduction in urban per capita water use by December 31, 2020;
- Implementation of the California 2009 Delta Reform Act (implementation of portions of the Delta Reform Act also is part of the California Water Action Plan);
- Implementation of the California Water Action Plan released by Governor Jerry Brown in January 2014, specifically, for provisions of the plan that would not necessarily require separate environmental documentation and consultation for related Federal actions.

Reduced reliance on groundwater under SGMA could result in increased surface water diversions in some cases, and associated impacts on listed species. Reduction of urban water use would be expected to have beneficial effects to listed species by reducing diversions.

6.7 Activities within the Nearshore Pacific Ocean

Future tribal, state, and local government actions will likely be in the form of legislation, administrative rules, policy initiatives, or fishing permits. Activities are primarily those conducted under state, and tribal management. These actions may include changes in ocean policy and increases and decreases in the types

of activities that currently occur, including changes in the types of fishing activities, resource extraction, or designation of marine protected areas, any of which could impact listed fish species or their habitat.

6.8 Other Activities

Other future, non-Federal actions within the action area include: the dumping of domestic and industrial garbage that decreases water quality; oil and gas development and production that may affect aquatic habitat and may introduce pollutants into the water; infrastructure including roads, state and local dredging projects; and state or local levee maintenance that may also destroy or adversely affect habitat and interfere with natural, long term habitat-maintaining processes.

Power plant cooling system operations can also affect aquatic habitat. Contra Costa Power Plant, which was owned and operated by NRG Delta, LLC, was retired in 2013 and replaced with the new natural gas power plant, Marsh Landing Generating Station. The Pittsburg Generating Station (PGS) remains in operation and consisted of seven once-through cooling systems, two of which remain in operation. The once-through cooling system intake process can cause the impingement and entrainment of estuarine and marine animals, kill organisms from all levels of the food chain, and disrupt the normal processes of the ecosystem. On May 4, 2010, the SWRCB adopted a Statewide Policy on the Use of Coastal and Estuarine Water for Power Plant Cooling under Resolution No. 2010-0020, which required existing cooling water intake structures to reflect the best technology available for minimizing adverse environmental impacts (SWRCB 2010). The PGS chose to comply by retrofitting two of the existing units and retiring one unit. The retrofit and retirement of these units is underway (GenOn Delta LLC 2011). This is expected to have beneficial effects for listed species.