

## Delta Ecosystem Quality

The Delta Ecosystem does not support high quality habitats for diverse and valuable plant and animal species. Many plant and animal species that use the Delta have experienced moderate to severe declines. The major problems for the aquatic and wetland habitats are outlined below:

- A. **Important Aquatic Habitats** are inadequate to support production and survival of native and other desirable estuarine and anadromous fish in the estuary. Examples of fishes that have experienced declines related to changes in Delta habitat include delta smelt, longfin smelt, Sacramento splittail, Chinook salmon, striped bass, and American shad. The problems for specific aquatic habitats include:
1. **Lack of Shallow Riverine Habitat** limits spawning success and early survival of many estuarine and anadromous fish in the estuary. Examples of affected species include Sacramento splittail and Chinook salmon.
    - a) **Lack of Riverine Edge Habitats** limits spawning success and survival of juveniles of many native fish species that use such habitats for spawning and rearing.
    - b) **Lack of Shallow Shoal Habitat** within the main river channels of the Delta limits shallow foraging habitat for juveniles of many native estuarine fish.
    - c) **Lack of Intertidal Mudflat Habitat** within the main river channels of the Delta limits spawning and nursery habitat of some native estuarine fish.
  2. **Lack of Shaded Riverine Aquatic Habitat** limits growth and survival of estuarine resident and anadromous fish in the estuary (e.g., Sacramento splittail, Chinook salmon).
    - a) **Lack of Riparian Woodland** limits cover and terrestrial food production for Delta fish.
    - b) **Lack of Large, Woody Debris** along Delta levees limits feeding and refuge habitat for juvenile and adult fish in the Delta.
  3. **Lack of Tidal Slough Habitat** limits the fish productive capacity of the Delta (e.g., delta smelt, Chinook salmon).
    - a) **Lack of and Degradation of Dead-End Sloughs** reduces areas available for spawning and rearing of some native fish species.
    - b) **Lack of Open-Ended Sloughs** reduces areas available for spawning and rearing of some native fish species.
    - c) **Abundant Water Hyacinth** limits productivity of tidal slough habitats.
    - d) **Energetic Exchange** during tidal cycling is limited by lack of tidal slough habitat.
  4. **Reduction of Estuary Entrapment/Null Zone Habitat** by low Delta outflow limits fish production in the estuary (e.g., delta smelt, longfin smelt).
    - a) **Saltwater Intrusion into Suisun Bay** may reduce the bay's value as a low-salinity nursery area for estuarine plants and animals.

- b) **Brackish Water Habitat** is confined to deeper channels in the Western Delta where it is of limited value as compared to Suisun Bay.
  - c) **Brackish Water Habitat** occurs less frequently in San Pablo Bay with reductions in Delta outflow during the winter and spring.
5. **Lack of and Alterations to Transport Flows** hinder successful movement of juvenile fish from spawning habitats to nursery habitats in the Delta and Bay (e.g., delta smelt, longfin smelt).
- a) **Reduced Transport of Young Fish from the Delta to Suisun Bay** because of low Delta outflow reduces growth, survival, and production of important estuarine fish.
  - b) **Reduced Transport of Young Fish through the Delta** limits survival and production of estuarine and anadromous fish.
  - c) **Increased Transport of Young Fish from north to south across the Delta** and direct entrainment of fish because of higher export-to-inflow ratios reduces survival and production of estuarine and anadromous fish.
  - d) **Local Structures** block and alter transport flows and increase predation rates.
6. **Altered Migratory Cues** disrupt upstream and downstream movement of anadromous and estuarine fish (e.g., Chinook salmon).
- a) **Migration of Adult Salmon through the Delta is Disrupted** by lack of olfactory cues caused by export of spawning-river water in the Delta.
  - b) **Outmigration of Juvenile Salmon through the Delta is Hindered** by net downstream flow cues toward South Delta export pumps.
  - c) **Upstream Migration of Adult Estuarine Fish into Delta and River Spawning Areas is Hindered** by altered net flow of water across the Delta.
  - d) **Downstream Migration of Juvenile Estuarine Fish from the Delta and Rivers to the Lower Delta and Bay** is hindered by disruption of subtle changes in net flow cues across the Delta.
7. **Lack of Food Chain Productivity** in aquatic habitats limits forage availability for desirable fish species (e.g., delta smelt, longfin smelt, Sacramento splittail, chinook salmon).
- a) **Entrainment of Food Chain Productivity** limits habitat suitability for desirable fish species.
  - b) **Disconnection of Supporting Habitats** such as brackish marshes and riparian woodlands limits productivity in aquatic habitats.
  - c) **High Concentrations of Toxicants** in the water column and in sediments reduce production and survival of aquatic plants and invertebrates.
  - d) **Introduced Species** consume energy and occupy habitat space for important food chain organisms.

- e) **Reduced Residence Time of Water in Delta** channels may limit plankton blooms and favor undesirable algal-mat growth in the Delta.
  - f) **Reduction in Organic Nutrient Inputs** from wetland and riparian habitats limits aquatic productivity.
  - g) **High Salinity Levels** in Delta aquatic habitats limit seasonal productivity patterns of estuarine food-chain organisms.
  - h) **Lack of Freshwater Inflow to Estuary** directly limits primary and secondary productivity of the estuary.
  - i) **Lack of Shallow Water Habitats in the Estuary** directly limits primary and secondary productivity .
8. **Excessive Concentrations of Toxic Constituents and their Bioaccumulation** directly limits survival and growth of desirable fish species (e.g., delta smelt, longfin smelt, Sacramento splittail, Chinook salmon).
- a) **Excessive Pesticide Residues** directly affect some fish species.
  - b) **Excessive Hydrocarbons, Heavy Metals, and other Pollutants** directly harm some desirable fish species.
- B. **Important Wetland Habitats** are inadequate to support production and survival of native wildlife species in the Delta. The problems for the specific wetland habitats include:
- 1. **Lack of Brackish Marsh Habitats** of high quality limits supportable populations of native wildlife species that inhabit them (e.g., California clapper rail, salt marsh harvest mouse).
    - a) **Altered Vegetation Composition** in brackish marshes caused by changes in salinity levels limits habitat suitability for some native species.
    - b) **Reduced Areal Extent** of brackish marsh limits native wildlife populations.
    - c) **Inappropriate Salinity Levels** reduces forage production and habitat suitability for some native species.
    - d) **Disconnection of Supporting Habitats** such as aquatic habitats and riparian woodlands limits productivity in brackish marshes.
  - 2. **Lack of Freshwater Habitats** of high quality limits supportable populations of native wildlife species (e.g., giant garter snake, tri-colored blackbird, Mason's lilaeopsis).
    - a) **Inappropriate Salinity Levels** do not support desirable vegetation composition and thereby limits habitat suitability for some native species.
    - b) **Reduced Areal Extent** of high quality habitats does not support sustainable population sizes of some native wildlife species.
    - c) **Inappropriate Juxtaposition** of freshwater marsh habitats does not provide corridors for population movement and genetic exchange.

- d) **Lack of freshwater wetlands** that do not require intensive management limits sustainability.
  - e) **Vulnerability of Levee Failure** on Delta islands threatens sustainability of existing freshwater marshes.
3. **Limited Riparian Woodland Habitats** of high quality in the Delta reduces diversity and sizes of supportable native wildlife populations (e.g., Swainson's hawk, riparian brush rabbit, western yellow-billed cuckoo, neotropical migrant songbirds, northern California black walnut).
- a) **Lack of Riparian Habitat Structure** near foraging areas limits nesting opportunities for some native bird species.
  - b) **Inappropriate Juxtaposition** of riparian habitat patches does not provide corridors for population movement and genetic exchange.
  - c) **Limited Areal Extent** of riparian habitats prevents use by some native bird species.
  - d) **Disconnection of Supporting Habitats** such as aquatic habitats and brackish marshes limits productivity in riparian woodlands.
4. **Reduced Breeding Waterfowl Habitats** limits production of desired populations of dabbling ducks (e.g., mallard, cinnamon teal, wood duck).
- a) **Lack of Brood Habitat** of high quality near nesting habitat limits dabbling duck production.
  - b) **Lack of Nesting Habitat** of high quality near brood habitat limits dabbling duck production.
5. **Reduction in Wintering Waterfowl Habitats** for foraging and resting limits desired populations of wintering waterfowl (e.g., Aleutian Canada goose, mallard, tundra swan, white-fronted goose).
- a) **Decreasing Waste Grain** on agricultural lands limits availability of waterfowl forage.
  - b) **Lack of Resting Areas** near foraging areas limits wintering waterfowl populations that can be supported in the Delta.
  - c) **Reduction in Historical Foraging Habitats** (e.g. freshwater marsh) limits availability of high quality foraging areas for wintering waterfowl.
  - d) **Vulnerability of Levee Failure on Delta islands** threatens sustainability of wintering waterfowl habitats.
6. **Lack of Wintering Habitat for Greater Sandhill Cranes** limits wintering crane populations (e.g., lesser sandhill crane, greater sandhill crane).
- a) **Lack of Foraging Habitats** of high quality for cranes in proximity to roosting habitats limits supportable wintering populations.

- b) **Lack of Roosting Habitats** of high quality for cranes in proximity to foraging habitats limits supportable wintering populations.
7. **Lack of Connectivity among Wetland Habitats** does not provide corridors for population movement and genetic exchange.