

Adaptive Whale Management in the California Dungeness Crab Fishery

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Along the California coast, humpback whales and Dungeness crab fisheries are competing to occupy the same ocean space. In recent years, interactions between humpback whales and crab fishery gear have led to a dramatic increase in reported humpback whale entanglements. Dungeness crab managers have responded by implementing entanglement strategies such as season delays, closures, and gear restrictions. Climate change has intensified this conflict by altering ocean temperatures, prey availability, and migration patterns, forcing whales near the coastline during the crab fishery season. Management approaches aimed at protecting whales have reduced fishing opportunities, resulting in unexpected socio-economic challenges. This field report discusses how climate change has driven the current conflict between humpback whales and the Dungeness crab fishery, evaluates the limitations of current management approaches, and proposes strategies for developing ecologically and economically balanced management practices.

The California Dungeness crab fishery is an economically and culturally important commercial and recreational sector. The crab fishery is typically open from mid-November to mid-July. (Monterey Bay Fisheries Trust). As seen in Figure 1, the commercial fishery is divided into Northern and Central management areas by the Sonoma/Mendocino County line (California Department of Fish and Wildlife 2023). The fishery uses circular pots, three feet in diameter, with wire mesh and two iron weight bars on the bottom. The pots are attached to surface buoys to allow for easy identification and retrieval. Crab fishing practices increasingly overlap with the seasonal migration of humpback whales to the California coast.



Figure 1. Management Zones. Note: The commercial Dungeness crab fishery is split into Northern and Central California management areas (California Department of Fish and Wildlife 2023).

Many whales, including humpback whales, migrate seasonally to the California coast to feed on anchovies, sardines, and krill (Monterey Bay Whale Watch 2026). The whales arrive on the coastline from late March to early December, often overlapping with the Dungeness crab fisheries. It is becoming more common for the whales to get entangled in California Dungeness crab gear, often dragging it for thousands of miles, leading to exhaustion, starvation, injuries, and even drowning (Hanson-Ahumada 2020). Figure 2 depicts how the number of reported whale entanglements on the West Coast has increased since 2005, with humpback whales making up the majority

(NOAA Fisheries 2025). In 2024, there were 21 confirmed humpback whale entanglements in California, 11 of which were caused by Dungeness crab pots. The increase in reports of humpback whale entanglement has caused great concern and discussion from conservation groups, fishery managers, and stakeholders.

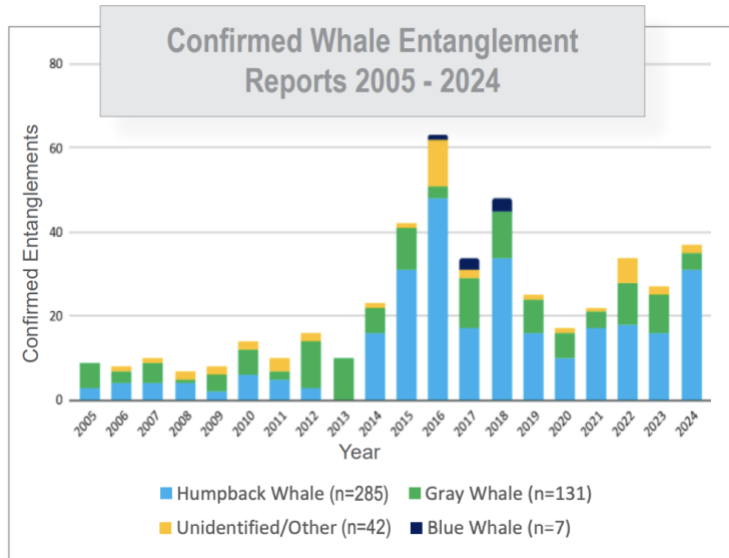


Figure 2. West Coast Whale Entanglements. Note: The number of reported whale entanglements on the West Coast from 2005 to 2024, organized by species (NOAA Fisheries 2025).

Under instructions from the California Department of Fish and Wildlife (CDFW), Dungeness crab fishery managers have implemented strategies to mitigate entanglement risks. The CDFW created a working group composed of fishermen, environmental organizations, and governmental agencies to develop and recommend strategies (Cieri 2024).

These strategies include reducing the amount of gear used, using alternative gear, implementing stricter trap regulations, closures, or adjusting the fishing season (Bonham 2025). Alongside gear and season regulations, managers should monitor periods of high whale presence along the coast to more appropriately adjust management strategies. Depending on the season, managers will use a combination of these management strategies.

What’s likely causing the increase in overlap between humpback whales and the California Dungeness crab fishery is the changing marine environment due to climate change. Ocean water temperatures are increasing worldwide, and marine heatwaves are becoming more common. As a result, mass mortality events and ocean acidification are shifting the marine food web and diminishing food sources for marine mammals. (Monterey Bay National Marine Sanctuary 2020). Humpback whales, in particular, have lost their preferred prey due to climate change. In addition, the environmental cues humpback whales rely on for migration and feeding are being impacted by changes in water temperature and currents (NOAA Fisheries 2025b). Without migration cues and a food source, humpback whales are swimming closer to California’s shoreline in search of alternatives. This is problematic because whales are reaching the coast during the Dungeness crab fishery season, increasing their risk of entanglement in gear.

While the protection of humpback whales is important, the current fisheries management approaches have caused economic uncertainty for coastal communities that have long relied on the fishery for financial support and food. Management methods that focus on closures and season shifts reduce fishing opportunities and do not consider socio-economic impacts. Using a retrospective economic model, Seary et al. (2022) estimated that in 2019, revenues in California's central management area would have been \$9.4 million higher without recommended closures and season shifts. The lack of economic risk analysis of management practices is a key limitation of current Dungeness crab management. If economic losses and impacts on communities are not properly taken into consideration, closures will function as a barrier to fishing opportunities and revenue. This does not mean that economic profit from California Dungeness crab fisheries outweighs whale protection, but rather that management practices need to balance preventing entanglements and supporting fishing communities.

An emphasis on developing and implementing alternative gear, rather than just closures and seasonal shifts, is one way to address economic and ecological priorities. Creating gear that whales are less likely to get entangled in will lessen the need for closures or allow certain fishing practices to continue during closures. For example, the CDFW recently approved the use of the innovative pop-up gear (Karnik 2026). Pop-up gear is made of strings with multiple crab traps that stay on the seafloor until a fishing vessel signals to release the lines and buoys to the surface for retrieval. As seen in Figure 3, the lines and buoy are stored with the crab pot until the fisherman signals to bring the gear up to the surface (Chadwick & Mullins 2025). This is a great alternative and example of minimizing entanglement while maximizing fishing opportunities.



Figure 3. Pop-up Gear. Note: Pop-up gear being tested on a fishing vessel during the Spring 2025 fishing trials. The line and buoy are stored with the crab pot (Chadwick & Mullins 2025).

As climate change continues to impact our oceans, creative management practices that both protect marine organisms and the economic well-being of coastal communities will be essential. The entanglement of humpback whales in Dungeness crab fishing gear is just one example of the many climate-driven conflicts that are already and will continue to emerge in our oceans. The best course of action is to increase collaboration between conservationists, scientists, and fisheries stakeholders to create innovative gear and adaptive management strategies. By prioritizing adaptive, science-based management and technology, California can reduce humpback whale entanglement and support the livelihoods of fishing communities in a changing climate.

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