Executive Summary

● Catch and release (C/R) is a practice used in recreational fisheries resulting from regulations for conserving particular species, populations, or sizes of fish, or as a practice to meet personal values. C/R enables increased fishing opportunities and is critical for implementing mark-selective fisheries.

● C/R will be a major component of future recreational salmon fisheries, but its broad usage has been limited by two major issues which this research directly addressed: identifying the magnitude of post-release mortality (the main component of Fisheries Related Incidental Mortality, FRIM) which we determined with telemetered freely migrating fish, and, understanding the mechanisms of post-release mortality so that fishing practices can be modified to enhance survival of released fish.

● We worked with sport fishing groups and other partners to capture, tag and release Chinook and coho salmon in different locales of coastal British Columbia, utilizing a broad spatial scale acoustic receiver network that is in place throughout the Salish Sea. We experimentally assessed the effects of air exposure duration, landing time and approach, hook size and other gear, and release approach on fish impairment and injuries, and on subsequent survival at different time scales post-release.

● We conducted C/R studies on: 616 Chinook salmon tagged on East Coast Vancouver Island (ECVI) and tracked through the Discovery Island region, 430 Chinook salmon tagged in Barkley Sound and tracked to spawning areas, and, 549 coho salmon tagged and tracked in Juan de Fuca Strait.

● ECVI Chinook salmon that were released with various (and some times minor) types of injuries to fins, scales, and/or eyes had on average 15-20% poorer survival within the first 10 days of release compared to fish that were in good physical condition when released, with the latter group having very little mortality during this time period.

● ECVI Chinook with any type of eye injuries, caused by hooks piercing the ocular cavity from the mouth, demonstrated an additional 15-20% mortality on average after 40 days post-release compared with fish in good physical condition or with other non-eye injuries.

● We estimate FRIM for adult Chinook (52–99 cm FL) to range up 40% depending on fishing practice, gear type, and subsequent injuries caused by the C/R encounter. Modifying fishing practice and gear as we determined can result in minimal FRIM.

● Experimental manipulations to air exposure duration led to environmentally specific results. ECVI Chinook exposed to air ranging up to 300 seconds exhibited only modest (~10%) post-release mortality compared to non-air exposed fish over 10 days. Yet Barkley Sound Chinook bound for Robertson Creek Hatchery exposed to 300 seconds of air exhibited 50% mortality to the entrance of Alberni Inlet, only a ~ 5-day migration.

● We identified carry-over effects to freshwater environments resulting from marine C/R. Robertson Creek Chinook typically encounter sub-lethal or lethal temperatures (> 20°C) during their freshwater spawning migrations through the Somass River which is a significant additional migratory stressor. No

fish reached the hatchery if they were air exposed in the marine environment > 90 seconds, and of the few that did, all were males which are known to be more resilient to C/R stressors than females.

● There is a strong size effect on survival of C/R fish. In most years, ECVI Chinook that were tracked for at least 10 days and that were smaller than 62 cm FL had ~ 36% mortality while those larger than 80 cm FL had ~4-12% mortality – these two size groups are often ones that regulations require release. Robertson Creek Chinook that we tracked into freshwater and were larger than 70 cm FL had 12% mortality while those smaller than 70 cm FL had 19% mortality. Every decrease of 1 cm FL was associated with 6% increase in the odds of mortality in coho ~3.3 days post-release.

● As with Chinook, post-release mortality levels of coho salmon increased with scale loss, bleeding, and eye damage – eye injuries were associated with 2.8 times greater odds of mortality within the first ~3.3 days after release than coho salmon without an eye injury.

● Coho seemed to be less resilient than Chinook to C/R practices. Unlike Chinook, coho in good condition when released still suffered on average 17% short-term (~3.3 days post-release) mortality. Short-term FRIM (which we defined as the difference between post-release mortality of good condition and poor condition fish) was on average 31% which is nearly twice that observed for ECVI Chinook. Based on coho tracked into Puget Sound, the difference in mortality levels between good and poor condition fish after a median migration time of 9 days continued to be ~ 30% suggesting most of the FRIM for coho occurred in the first few days after release.

● Landing nets are not fish friendly. There was a direct relationship between the use of nets and fin injuries which led to high mortality in our companion holding study. In the tagging studies, 90% of Chinook salmon landed without nets had no visible fin damage.

● We identified the presence of 12 pathogens in ECVI Chinook and 11 in coho, but infection rates for Chinook salmon were half that of coho (average 1.1 vs 2.3 pathogens per fish, respectively). No relationships among pathogen loads and mortality were observed for either species.

● Anglers were surveyed using a phone app (3612 responses, 1503 different anglers) revealing they generally employed fishing behaviours and had capture outcomes similar to what we used and found, thus our field experimental approaches reflected behaviours of typical anglers.

● We also interviewed anglers in person (n = 26) gathering opinions of C/R as a conservation tool. They were generally open to new information on best practices to improve survival of C/R fish. Many were already using some of the practices we recommended. Anglers were supportive of creating more educational resources using our study results.

● We made 15 recommendations that DFO can adopt as regulations, and should adopt as ‘best fishing practices’ involving: landing, handling and releasing approaches, gear choices, and fishing tactics that will minimize FRIM for marine migrating Chinook and coho.