



Workshop 2005
Leading the Way

How do they find their way about? Migration, Orientation, and Navigation of Pacific Salmon

Pacific salmon perform a number of incredible migrations during their life cycle. They can travel downstream or upstream for large distances after emerging from the gravel, move hundreds of kilometers through large lakes and then downstream to the ocean as one-year olds or smolts. Their migrations in the ocean can encompass thousands of kilometers as they move between feeding and over wintering grounds, and then when the time for spawning arrives, they find their home river again and unerringly return through estuaries, rivers, lakes, and creeks to the ancestral spawning sites.

Thus, during their life cycle Pacific salmon make a number of habitat changes or migrations; about 5 for pink salmon and about 10 for sockeye salmon. The migrations are performed, within certain narrow time windows, to move from habitat to habitat. To maintain healthy and productive salmon populations it is important that the string of habitats is in good shape. Any weak link in the string or chain can break the cycle.

The interesting question I will be discussing in some detail is how do these fish find their way about during their long distance migrations. That is, how do they orient and navigate in space and time? In my presentation I will use some information from bird migration studies to illustrate the techniques that have been used to study orientation in the laboratory and also to identify the difference between orientation and navigation. It will become apparent that fishes, birds, and many other animal groups, have a number orientation mechanisms available using cues such as the sun, the polarized light pattern of the sky, the earth magnetic field, star patterns, and odour of the home stream, to move about in the world. The question of how they navigate, that is to return to place on earth where they have been once before, is still open.

Creek Habitat and Spawning of Pacific Salmon

Pacific salmon have complicated life cycles. In this presentation I will discuss the intricate relationship between the behaviour of Pacific salmon and their habitats. Specifically, I will concentrate on the spawning phase of Pacific salmon and illustrate with movies and diagrams the delicate interplay between fish and creek environment and the interactions between males and females during courtship behaviour leading up to egg deposition.

Biography of Dr. Kees Groot

Kees Groot was born in Modjokerto, on Java, Indonesia, in 1928. After spending 3 years in a concentration camp during the Second World War, he went to Holland in 1946 and studied biology at the Universities of Amsterdam and Leyden. He immigrated to Canada in 1956 and a year later joined the Fisheries Research Board of Canada (now the Department of Fisheries and Oceans) as a fish behaviourist (ethologist) at the Pacific Biological Station in Nanaimo, British Columbia. There, under the guidance of Dr. J.R. (Roly) Brett, he worked on problems related to a major threat to Fraser River salmon because of a proposal to build multiple dams on the main stem of this river for the generation of hydroelectric power. After this multiple dam construction plan was rejected because of the high likelihood that migrating salmon stocks would be destroyed, he concentrated his studies on long distance migration, orientation, and navigation of Pacific salmon and used the data of these studies to obtain his Ph. D. degree (cum laude) at the University of Leyden in Holland in 1965.

In 1966, soon after receiving his doctorate degree, Kees Groot was appointed Biological Director of the Netherlands Institute of Sea Research in Holland. In 1968 he was invited to return to Canada and again join the staff of the Pacific Biological Station at Nanaimo. His studies then have centered on 1) problems of Pacific salmon migration, specifically on how these fish find their way during long distance journeys, 2) on problems related to salmonid enhancement, and 3) on the potential effects of global climate change on Canada's west coast fisheries resources.

Kees Groot has acted as research supervisor for a number of M.Sc. and Ph.D. candidates of Canadian and Dutch universities and has taught as visiting professor at Simon Fraser University and, several times, at the Bamfield Marine Station. He has also given Animal Behaviour Workshops at the Pacific Biological Station and Malaspina University College, both in Nanaimo, British Columbia, and at the Rajamangala University in Trang, Thailand.

In 1993 he retired from the Department of Fisheries and Oceans, became scientist emeritus at the Pacific Biological Station and started his own biological consulting business - Yellow Point Bio-Research. He has done a number of fisheries and fish farm related studies under contract with both government and private industry. He lives on Gabriola Island with his wife Donny with whom he is involved in a number of artistic ventures, such as watercolour and silk panting, pottery, and woodcarving and as a hobby he grows tropical orchids