

History of Alaska Red King Crab, *Paralithodes camtschaticus*, Bottom Trawl Surveys, 1940–61

From 1940 through 1961, a series of bottom-trawl surveys was conducted to determine the biology, distribution, and means of commercially exploiting the red king crab population in Alaska waters. The first surveys (1940–49, 1957) were wide-ranging explorations, as well as cooperative arrangements between government research agencies and the private fishing industry, with the intent of identifying crab concentrations and harvest methods needed to create a self-sustaining U.S. red king crab canning industry. The later surveys (1955–61) were conducted on a predetermined grid station pattern in the eastern Bering Sea and run by researchers at the Seattle Biological Laboratory, or “Montlake Lab,” to monitor the effect of the red king crab fishery on crab populations. Due to large-scale program changes over many years, knowledge of these surveys has been lost to the research community.

Exploratory Bottom Trawl Surveys, 1940–49, 1957

The primary motivation for launching the Alaska red king crab investigations was to determine the information needed (areas of abundance, crab capture methods, and canning techniques) to develop a domestic crab fishing industry, as it was noted that Americans were purchasing millions of pounds of canned Alaska crab meat taken by Japanese and Russian vessels operating in Alaska waters (FWS, 1942). The first red king crab exploration was undertaken in the fall of 1940 aboard the *Tondeleyo* and *Dorothy* (Schmitt, 1940), and it was completed aboard the *Dorothy*, *Champion*, and *Locks* in 1941 (FWS, 1942).

Alaska red king crab exploratory cruises were discontinued during World War II, 1942–45, but at the end of the war the potential for harvesting underutilized marine resources reported from the 1940–41 explorations resulted in the government-financed conversion (via the Reconstruction Finance Corporation or RFC) of the *Pacific Explorer* into a factory processor and the construction of four smaller fishing vessels; the *Alaska*, *Washington*, *Oregon*, and *California* (Greenwood, 1982). Part of the vessel lease agreement from the RFC to the Pacific Exploration Corporation (PEC) included allowing government researchers to participate in the cruises (Greenwood, 1982). To complement this vessel construction effort, a North Pacific Exploratory Fishing and Gear Research (EF&GR) program was established at the FWS’s Montlake Lab in Seattle in 1948 (Greenwood, 1982). During this era, EF&GR staff participated in three individual vessel cruises in 1947, 1948, and 1949; a ten-vessel fishing cruise with the *Pacific Explorer* factory processor in 1948; and a 1957 exploratory cruise aboard the *Tordenskjold*.

The 1947 cruise was a private venture to catch, process, and freeze Bering Sea red king crab, operated by the PEC using the RFC-purchased vessel *Alaska* (King, 1949).

In early 1948, a fleet of 10 catcher vessels which included the *Bear*, *Borris*, *Dorothy*, *Foremost*, *Jeanette F.*, *Kiska*, *Mars*, *Pearl Harbor*, *Sunbeam*, and *Tordenskjold*, in support of the factory vessel *Pacific Explorer*, went to the Bering Sea to catch, process, freeze, and can seafood (Wigutoff and Carlson, 1950).

Ownership of the *Washington* was transferred from the PEC to the Montlake Lab in July 1948 (Greenwood, 1982) through special Congressional funding, which also supported vessel operations (Ellson et al., 1949). That fall the BCF used the vessel to explore the Norton Sound

and St. Lawrence Island area of the northern Bering Sea, complementing previous research farther to the south.

The 1949 cruise was conducted aboard the chartered vessel *Deep Sea*, another RFC venture operated by Lowell Wakefield's Deep Sea Trawlers (later called Wakefield Seafoods) (Greenwood, 1982). The northern Bering Sea and Norton Sound area were finally explored on this cruise in the relatively good weather of summer, but found only 115 red and blue king crab in 51 tows (Ellson et al., 1950).

The *Tordenskjold* was chartered with Saltonstall–Kennedy Act funds in 1957 to explore for commercial quantities of red king crab in the region from Davidson Bank to the Shumagin Islands because of large red king crab catches in Pavlof and Canoe Bays taken during the 1940–41 exploration (Johnson, 1959), during the spring of 1948 by the Pacific Explorer fleet (Wigutoff and Carlson, 1950), and during the fall of 1948 by the *Washington* (Ellson et al., 1949). Despite prospecting with a bottom trawl, a shrimp trawl, and king crab pots, no large quantities of red king crab were found.

Monitoring/Gridded Surveys 1955–61

The era of long-term monitoring and grid-patterned red king crab bottom trawl surveys, designed for abundance estimates and stock monitoring, began with strong international cooperation. The International North Pacific Fisheries Commission (INPFC) was established in 1952 and initiated a cooperative U.S.–Japan red king crab monitoring program in 1954 (INPFC, 1954a) out of concern that the stock was already being fully exploited in the Bering Sea (INPFC, 1954b).

The first trawl survey with preplanned stations was conducted aboard the *Tordenskjold* in the summer of 1955 working on a 26-station (INPFC, 1956) diagonal grid (14' latitude by 25' longitude intervals) covering the southeast Bering Sea between Amak and Port Moller.

With the addition of a 27th station placed near Amak Island, the same stations were trawled by the *Tordenskjold* in 1956 in two rounds, 9–20 July and 20 Aug.–1 Sept. (INPFC, 1957).

The *Mitkof* was chartered for the 1957 survey, which initiated a new, square-gridded station pattern (INPFC, 1958) with stations at intervals of 37 km (20 nmi). This station pattern, with rows designated by letters and columns designated by two-digit numbers, is still used today (Acuna and Lauth, 2008), but the reason this new station pattern supplanted the 1955–56 station pattern is not documented.

The *Tordenskjold* 1958 survey essentially replicated the 1957 survey, except that tows were increased to 60 min duration and there were two rounds of trawling, 29 April–3 June and 8 June–11 July (INPFC, 1959).

In 1959, the *Tordenskjold* was chartered again for the red king crab survey (INPFC, 1960). Round 1 of trawling, 2–19 May, which occupied only the western two-thirds of stations due to rough weather, consisted of 60-min tows. Round 2, 2–20 Aug., was a dedicated tagging cruise, in which repeated tows for 30 or 60 min were made in a few locations, such as off Unimak Island, to meet a tagging quota.

The *Paragon* was chartered for the 1960 (Miyahara, 1961) and 1961 (Shippen and Miyahara, 1962) surveys, each of which conducted 60- min tows in a single round. The surveys in both years were intended to cover a greater geographic extent so that the western, northern, and eastern red king crab distribution limits in the Bering Sea would be defined, but, in retrospect, this effort failed to completely encompass the bounds of the red king crab distribution.

Epilogue

Large-scale changes in the 1960's and 1970's in the fisheries research organizations involved in the Alaska red king crab program led to disruptions in the Bering Sea bottom trawl survey. Following Alaska statehood in 1959, an EF&GR base was established at Juneau, Alaska, in 1960 (Greenwood, 1982) and the responsibilities of the Seattle EF&GR base concerning Alaska commercial fisheries, including the Alaska Crab Investigation Program, were transferred to Juneau, although only two of the Seattle staff made the move north (Simpson, 1982). The 1961 red king crab survey was the last conducted by staff at Montlake, and the 1966 *Sonny Boy* king crab survey was the first by the staff at Auke Bay (Kirkwood and Hebard, 1967), but these data sheets have not yet been located. The Juneau EF&GR lab was moved again, to Kodiak in 1970 along with the *Oregon* (Greenwood, 1982). Annual Bering Sea bottom trawl surveys were conducted by Kodiak staff aboard the *Oregon* from 1971–80 (available in RACEBASE at the AFSC).

In 1975, the Seattle-based Marine Monitoring, Assessment and Prediction program (MARMAP), in coordination with the Bureau of Land Management's Outer Continental Shelf Environmental Assessment Program (OCSEAP), conducted the largest Bering Sea bottom trawl survey in terms of areal extent to date (Pereyra et al. 1976). A follow-up survey in the spring of 1976 also covered a vast area (Smith and Bakkala, 1982). Together these surveys became recognized as the beginning of a new research program rather than the continuation and expansion of the earlier red king crab surveys, perhaps because the Kodiak Laboratory was still conducting Bering Sea red king crab bottom trawl surveys on the *Oregon*. Thus, the official start of the current Bering Sea trawl survey time series is 1975, and the title of that trawl survey report includes the phrase "In the baseline year of 1975," even though the gridded trawl surveys of 1955–61 are briefly mentioned in the text (Pereyra et al. 1976). Knowledge of the 1940–61 surveys and the findings of the biological sampling programs have been lost to the research community and largely forgotten.