

Distribution and Nomenclature of North American Kokanee, *Oncorhynchus nerka*

Kokanee, freshwater populations of *Oncorhynchus nerka* (Walbaum), are indigenous to lakes of the Pacific drainages in North America and north-eastern Asia. In North America, kokanee occur naturally in Alaska, Yukon Territory, British Columbia, Washington, Idaho, and Oregon, and their distribution is overlapped by that of sockeye salmon, anadromous *O. nerka*.

This note assembles the available locality records for indigenous North American kokanee populations. An examination of the distribution of kokanee supports Ricker's (1940) hypothesis that most kokanee populations have been independently derived from sockeye. Conflicting ideas concerning the nomenclature of kokanee are reviewed.

Distribution.— Locality records for kokanee are given by Suckley (1861), Dawson (1879), Bendire (1878), Bean (1891), Green (1893), Jordan (1893), Evermann (1896), Evermann and Meek (1897), Babcock (1903), Chamberlain (1907), Dymond (1936), and Nelson (MS, 1960). Data from these papers, museum records (Nelson, 1968), and information from government agencies were evaluated and kokanee populations believed to be indigenous and the present distribution of sockeye are indicated in Fig. 1 and 2. In their southern range kokanee occur in most lakes where sockeye are present (Owikeno, Cultus, Chilko, Taseko, and Harrison lakes, B.C., may not contain self-sustaining kokanee), but in Bristol Bay, Cook Inlet, Prince William Sound, and Kodiak Island drainages, Alaska, where sockeye are numerous, kokanee are rare or absent.

It seems probable that sockeye once occurred in all localities where allopatric kokanee populations are definitely indigenous. Sockeye have presumably become extinct in many lakes, which now have kokanee, due to the formation of falls resulting from landform changes and the rising coastal area. For example, in the last 80 years sockeye have been barred from the Upper Columbia (i.e. Okanagan and Arrow lakes and Snake River) and some smaller river systems. Evidence exists of their extinction 150–300 years ago by natural means in three lakes which presently contain kokanee. Sockeye probably at one time migrated into Kathleen Lake, Yukon Territory (Wynne-Edwards, 1947), but were later blocked by Lowell Glacier on the Alsek River (Kindle, 1953). Sand and Lava lakes in the Nass River system, B.C., had runs of sockeye (Aiyansh Indians, personal communication) which were blocked by a lava flow. Hanson (1923) believed a lake existed at the present site of Lava Lake.

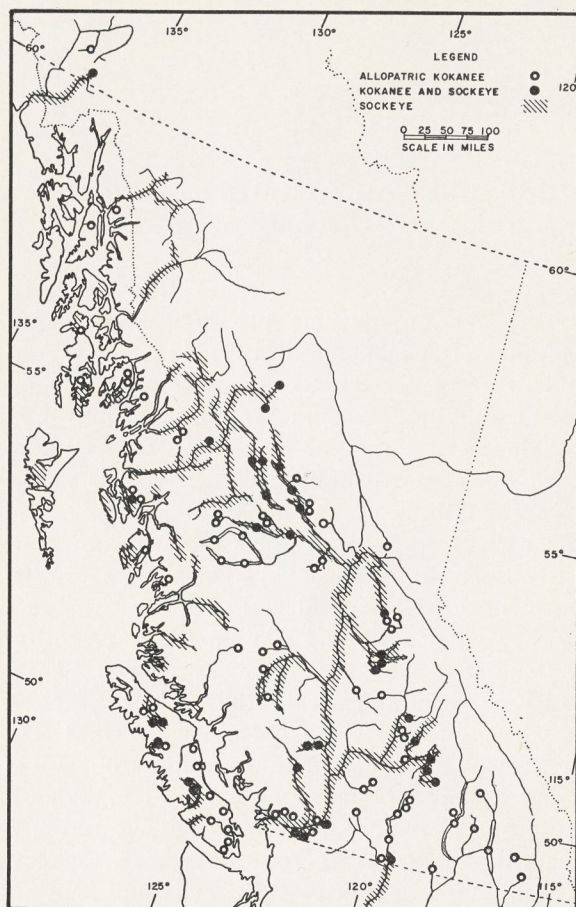


FIG. 1. Locality records of indigenous kokanee in Alaska, Yukon Territory, and British Columbia, and present distribution of sockeye in above area. Kokanee are also indigenous in Big Kitoi Lake, Alaska — $58^{\circ}11'$, $152^{\circ}21'$; and Skilak Lake, Alaska — $60^{\circ}20'$, $150^{\circ}30'$.

There is little evidence in favor of a general origin of kokanee from other kokanee populations rather than from sockeye. River piracy (natural diversion of a tributary from one river system to another) may explain the origin of some kokanee such as those in Arctic Lake (Peace River drainage) and in lakes of southeastern British Columbia. However, kokanee occur on coastal islands and in coastal mainland areas where river piracy is unlikely. Their distribution is unlike that of any other freshwater fish which lacks a diadromous form. Large *O. nerka* attempt to surmount impassable falls below several lakes with kokanee. Even if these individuals were the offspring of kokanee it seems improbable that they could have originated most other kokanee populations.

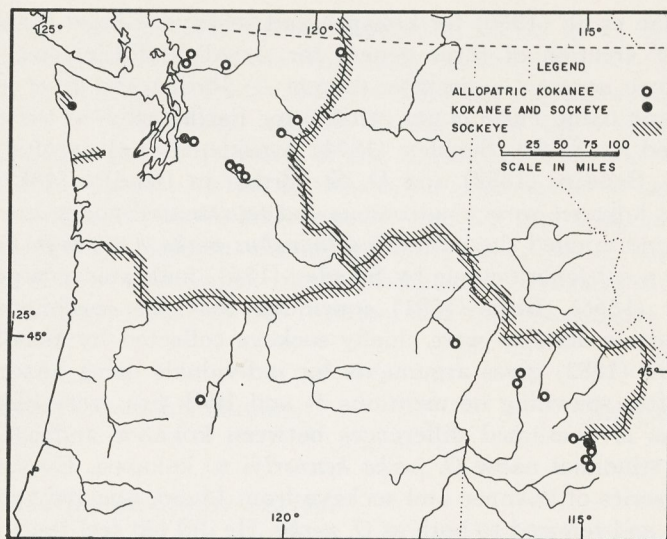


FIG. 2. Locality records of indigenous kokanee in Washington, Idaho, and Oregon, and present distribution of sockeye in above area.

Ricker's (1940) hypothesis that most kokanee populations have been independently derived from various sockeye populations is supported by the following: (1) kokanee are indigenous only in areas which have probably been frequented by sockeye; (2) the total distribution of kokanee is most plausibly explained by the presence of an anadromous form; and (3) offspring of kokanee and sockeye may, contrary to their usual life-history, become anadromous or remain in freshwater, respectively (Fraser, 1918; Ward, 1929, 1932; Foerster, 1947; Rounsefell, 1958; Ricker, 1959).

Nomenclature.— Disagreement has arisen on the nomenclatorial status of kokanee and sockeye. The various names applied to North American kokanee are presented to assist in tracing their history.

- Oncorhynchus nerka* (Walbaum) — Kokanee
Salmo kennerlyi Suckley, 1861
Hypsifario kennerlyi Gill, 1862
Oncorhynchus kennerlyi Jordan, 1878a
Oncorhynchus kennerlyi Jordan, 1878b
Oncorhynchus nerka Bendire, 1882; Jordan and Gilbert, 1883
Oncorhynchus nerka kennerlyi Bean, 1891

Kokanee were first described by Suckley (1861) as *Salmo kennerlyi*. Gill's (1862) genus *Hypsifario* was intended to distinguish kokanee from *Salmo* by the compressed body and projected snout of the former. The name lacks priority at the generic level but was used at the subgeneric level by Jordan (1878a) for kokanee (with sockeye in the subgenus *Oncorhynchus*)

and by Jordan et al. (1930) for kokanee and sockeye. Girard (1856) accepted Valenciennes' erection of three genera for Artedi and Linnaeus' *Salmo*. He described *Fario aurora* (= sockeye salmon — Jordan and Evermann, 1896), but the generic name *Fario* is unavailable for Pacific salmon; the type species is now placed in *Salmo*. Suckley (1874) considered *S. kennerlyi* to be non-anadromous. Bendire (1882) and D. S. Jordan in Bendire (1882), however, believed that kokanee were anadromous and represented young breeding males of sockeye, and applied the name *Oncorhynchus nerka*. *Oncorhynchus* was used originally as a subgeneric name by Suckley (1861) and later as a generic name by Günther (1866). Bean (1891) concluded that the specimens on which Jordan based his decision were chiefly sockeye collected by Bendire. Indeed, when Bendire (1882) gives arguments for individuals being anadromous and not dying after spawning he mentions 5- and 10-lb fish, very likely sockeye. On the basis of presumed differences between kokanee and sockeye, Bean applied the trinomial name *O. nerka kennerlyi* to kokanee. Evermann (1896) examined a series of kokanee and sockeye from Idaho, rejected the differences Bean found, and referred to both as *O. nerka*. He did not feel there was enough evidence to state whether they were anadromous or freshwater. Jordan and Evermann (1896) also applied the name *O. nerka* to both kokanee and sockeye but for different reasons than Evermann (1896). They agreed that there was no structural difference between the two forms but incorrectly felt (presumably Jordan only — see Jordan in Bendire, 1882) that kokanee were just young individuals of sockeye which had returned from the ocean. Jordan (1893) curiously refers to *O. kennerlyi* as landlocked despite later rejecting and having earlier rejected this belief. Subsequent investigators referred to kokanee as: (a) *O. kennerlyi* (e.g. Halkett, 1913; Jordan et al., 1930; Ward, 1932); (b) *O. nerka kennerlyi* (e.g. Chamberlain, 1907; Dymond, 1936; Ricker, 1940; Foerster, 1947); or (c) *O. nerka* (e.g. Schultz et al., 1935; Lindsey, 1956; Bailey, 1960; Vladykov, 1962). Workers studying kokanee in Asia have divided kokanee into different species (Jordan and McGregor, 1925) or different subspecies (Berg, 1948), or have recognized only the binomial name *O. nerka* despite finding differences in certain characters between the two forms (Hikita, 1962).

The sympatric occurrence of two forms, kokanee and sockeye, each having a distinctive life-history and each able to maintain itself in allopatry, would perhaps suggest that they should be regarded as different species. Or, if full species status does not seem warranted, the desirability of taxonomically recognizing the two forms, thereby avoiding the necessity of using a vernacular name for each form and of using two vernacular names for the same taxonomic unit, would leave open the alternative of lumping all kokanee populations into one subspecies. However, the probable phenotypic basis of the partial isolating mechanisms between kokanee and sockeye, the ability of one form to produce offspring which take up the life-history of the other, and the presumed multiple origins of kokanee from sockeye make it advisable to designate both forms as *Oncorhynchus nerka*.

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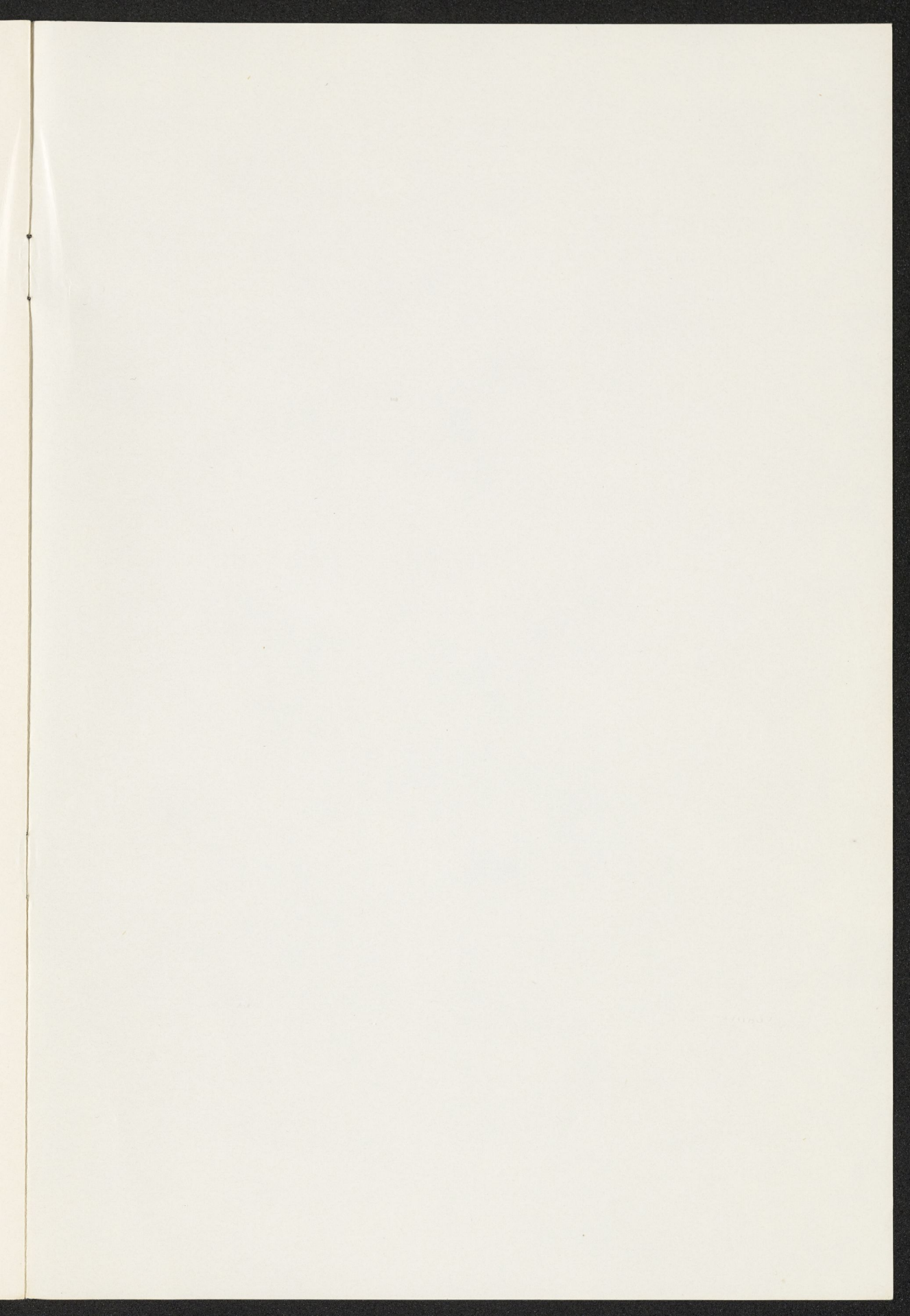
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