



**CENTRAL
OKANAGAN LAKE
FORESHORE INVENTORY
AND MAPPING**

PART II

**CASE STUDY: KOKANEE
SHORE SPAWNING IN
CENTRAL OKANAGAN LAKE**

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Since the 1970s, the Okanagan Lake kokanee population has been in decline, eventually leading to the closure of the kokanee fishery in 1996 (Ashley and Shepherd, 1996). The Okanagan Lake Action Plan (OLAP), sponsored by MoE, is attempting to gain a better understanding of whole-lake biological relationships as well as defining limiting factors and remedial measures to recover the lake's kokanee populations (Andrusak et al., 2004). As part of this plan, both historical and recent spawning locations were collected for kokanee along the shores of Okanagan Lake. This information was combined with the foreshore data found in this report to examine the relationship between spawning locations and attributes such as foreshore type, dominant substrate materials, and disturbance level.



Typical kokanee shore spawning occurs on cliff/bluff and low rocky shore types such as this one seen adjacent to Knox Mountain in the City of Kelowna.
Photo: T. Cashin



Kokanee spawning information was provided by the Ministry of Environment. The data include Okanagan Lake shore-spawning locations compiled from 2001 to 2004 as well as historical shore-spawning locations from 1972. Current spawning locations are identified by annual spawning counts. All data were delineated by reach breaks defined by MoE; these reach breaks do not correspond with the segments identified for the foreshore inventory and mapping in this report.

To understand the applicability and limitations of the analysis in this report, the reader must be aware of several points about the kokanee spawning data (Andrew Wilson, MOE, pers. comm.):

- Detailed GPS data for kokanee spawning locations are limited to the past four years (2001–2004). Historic spawning data are available beginning in 1972, but these are less detailed than the current data.
- The data represent only a portion of the kokanee spawning information required to make many resource management decisions. More detailed information should be gathered to accompany this data when making decisions that have the potential to affect spawning areas.
- Not all suitable kokanee spawning habitat is used in a given year. The total amount of kokanee spawning habitat available on Okanagan Lake is unknown, and with kokanee numbers at an all-time low, spawning occurs in only a percentage of the available habitat. As the population rebounds to its historic level, re-colonization of spawning habitat will likely occur.
- The overall kokanee population is currently at 10% of what it was in the early 1970s. Any spawning habitat used by these fish needs to be flagged as being critical for the population to persist.
- Kokanee are mobile; an area that shows high spawning use one year may have low use the following year.
- The effort being expended by MoE in observing spawning numbers and location is limited. Spawning locations are only visited three times over the spawning period; therefore, it is likely that not all spawning occurrences are being recorded.

Based on these caveats, it becomes increasingly apparent that kokanee spawning areas are not easily prioritized. The current low kokanee population and the preference these fish have for spawning in a variety of locations makes it difficult to determine critical habitat areas. Therefore, all kokanee spawning habitat needs to be considered critical to ensure the viability and long-term recovery of the population.

Notes to the Data User



Recent kokanee spawning locations were compared to the foreshore data to determine spawning usage based on foreshore type, disturbance level, and substrate composition described in Part I of this report. The foreshore types included cliff/bluff, low rocky shore, vegetated shore, gravel beach, sand beach, and wetland; disturbance levels were classified as low, medium, and high; and substrate composition was based on visual observations of standard substrate sizes as defined in the SHIM methodology (sand, gravel, boulder, and bedrock) (Mason and Knight, 2001).

Occurrences of shore spawning were most often associated with cliff/bluff and low rocky shore types (Figure 26). These shore types are defined by foreshore substrates that are coarse and considered well suited to spawning in Okanagan Lake. As Figure 27 indicates, boulder and bedrock substrates were commonly associated with spawning activities.

Most of the recent kokanee spawning occurrences (2001–2004) were also found in association with areas that have a low disturbance level, with fewer spawning occurrences in the moderate and high disturbance levels (Figure 28). Historical data are not easily analyzed in this way because of how the information was collected. A summary map of current and historical kokanee spawning information relative to shoreline segment disturbance level is included in Appendix G.

As an example of the usability of the database, segments with the highest potential for restoration of kokanee spawning habitat were identified. This was done by selecting segments that fit the shore type and substrate criteria most suited to kokanee spawning (outlined above), as well as those segments with high disturbance levels. The result is a list of segment numbers that have potential to exhibit kokanee spawning activity, but have been extensively disturbed.

The results include segments 42, 56, 58, 83, 88, 59, 92, 101, 114, 122, 124, 135, 139, 142, and 153 (see Part III for segment descriptions). These segments occur throughout the study area, and most of them are partially composed of low rocky shore or cliff/bluff shore types that have been extensively disturbed. Queries similar to this can be performed on a variety of fields and attributes within the foreshore database to fulfill objectives outlined in, or in development of, a foreshore plan.



Coarse substrate materials such as this angular cobble are considered well suited for kokanee shore spawning in Okanagan Lake.

Photo: A Wilson, Ministry of Environment

Results cont'd

Figure 26

Summary of dominant shore type and recent kokanee spawning activity (since 2001) in the Central Okanagan.

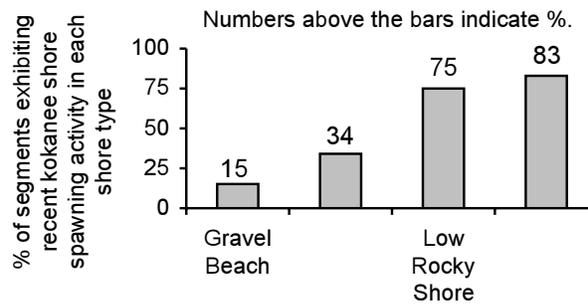


Figure 27

Summary of dominant substrate and recent kokanee spawning activity (2001-2004) in the Central Okanagan.

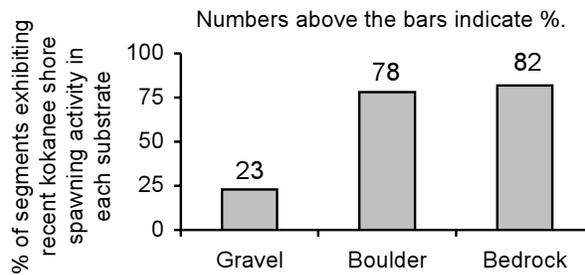
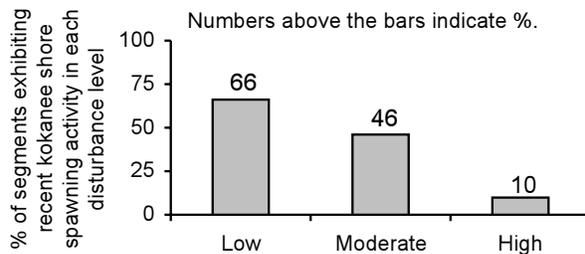


Figure 28

Summary of disturbance level and recent kokanee spawning activity (2001-2004) in the Central Okanagan.





As the results indicate, kokanee shore-spawning activities on central Okanagan Lake are commonly associated with cliff/bluff and low rocky shore types that have either boulder- or bedrock-dominated substrates. Low rocky shore types provide suitable spawning substrates throughout, while cliff/bluff habitats often provide suitable substrates in small subsurface benches and littoral shelves. Areas that are not as highly used for spawning include gravel beaches and vegetated shorelines, although limited spawning does occur in these areas. Spawning was not found to be associated with the sand beach shore type.

Most of the recorded spawning locations were associated with areas characterized as low or moderate disturbance level. Few areas with a high disturbance level were found to have spawning occurrences. This could be attributed to several factors including anthropogenic alteration of the foreshore in settled areas (e.g., beach grooming, lake infilling) and disturbance in littoral drift (sediment transported by waves and currents) due to foreshore structures such as groynes, docks, or retaining walls.

These structures have the capacity to change both habitat quality and quantity. However, reduced spawning on developed foreshore areas could also be because the locations traditionally deemed suitable for development may be inherently less suitable for kokanee spawning. For example, easily developed sites such as low-lying alluvial fans are less suitable for kokanee spawning because of substrate composition, depth, and proximity to escape cover.

Therefore, historical spawning locations may not coincide with favoured development locations. A more detailed study of this scenario would be required to determine the relationship between kokanee spawning and foreshore development, but ultimately, this would likely have a greater influence on future restoration efforts than on protection efforts.



Most of the recorded kokanee spawning locations are associated with areas not previously disturbed.

Photo: B. Magnan

Chapter 5 REFERENCES



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