S. Gregory R. Wildman
L. Ashkenas K. Wildman P. Haggerty

## Fish Assemblages – Willamette River Basin

Fish assemblages are an important component of aquatic ecosystems of the Willamette River Basin. Fish assemblages are recognized as sensitive indicators of habitat degradation, environmental contamination, and overall ecosystem productivity. Recent listings of fish species in the Willamette River Basin under the federal Endangered Species Act (Oregon chub, spring Chinook salmon, steelhead trout) and consideration of several species for listing (coho salmon, cutthroat trout, bull trout) have caused the state to evaluate the status of fish species and begin development of recovery plans under the Oregon Plan for Salmon and Watersheds in 1997. Most management programs, both current and historical, have focused on particular species of interest. We assembled information on the distribution of all fish species to provide a spatial context for understanding the fish assemblages of the Willamette Basin.

## Sources of Information

We assembled data on locations of fish species from museum records, agency reports, research databases, and field collections. These records were limited to surveys in which there was a high likelihood that the species are accurately identified (e.g., voucher specimens, taxonomic quality controls, collections in the Oregon State University Fish Museum). Known locations were entered into a GIS database for the WRB stream network (1:100,000). The records were reviewed to determine whether it was probable that the species would be distributed between known points of occurrence. Maps of the potential distributions of each species were constructed. Projected distributions were combined to identify the potential number of species present within a reach or subbasin of the Willamette River Basin. Note that this is not a direct measure of the richness of fish species at any point in a stream or river. This projection represents potential distributions and is likely to underestimate the richness of fish species.

## Assemblages of Fish

The Willamette River Basin contains 31 native fish species and 29 exotic or introduced species (Table 22). Almost half the total richness of 60 fish species in the Willamette River Basin is made up of introduced species. Of the 31 native species, more than one-fifth (7 species) are listed by either the federal or state government as threatened, endangered, or sensitive. This proportion (22%) is lower than the proportion of fish species listed across the state of Oregon, which is 45% of the native species and subspecies.[56] Oregon ranks fifth in the United States in terms of total numbers of listed fish species and stocks. The higher proportion across the state reflects the large number of species at risk in more arid regions of the state. The native fish fauna (Table 22; adapted from Ian Waite, USGS) are more sensitive to the impacts of pollution than introduced species. Of the native species in the Willamette Basin, only 13% are considered tolerant of pollution. Introduced species in the Willamette system are characterized by fish that are tolerant of pollution and habitat degradation, with 69% classified as pollution tolerant, such as carp, bullhead and bass.

## Patterns of Richness

Management of fish assemblages within the Willamette River Basin requires an understanding of the distribution of fish throughout the stream and river networks and the factors that are responsible for those distributions. The Upland regions of the Willamette Basin are characterized by fewer fish species than the Lowlands (Figs. 57, 58). Headwater streams typically contain less than 10 fish species, and rivers that are major tributaries to the mainstem Willamette generally support 15-25 species. The mainstem Willamette River supports the highest local fish richness, with more than 35 species found in selected reaches. This overall pattern of greater richness in lowland rivers is exhibited by the native fish species, and the tendency of introduced species to occupy warmer, low gradient streams and rivers accentuates this pattern.

The importance of lowland streams and rivers for fish assemblages is also reflected at the watershed or subbasin scale (Fig. 57). Subbasins of the Willamette in the Lowland region exhibit greater number of species than Upland subbasins. Landscape frameworks for managing fish communities in the Willamette River Basin require incorporation of basin-level patterns in species richness and abundance of particular species. The lowland systems present many challenges because of the high proportion of private land ownership and the wide array of land use practices.

Fish assemblages in the Willamette River network are influenced by both local habitats and larger landscape patterns and water management. Major local factors are 1) availability of different types of habitats, 2) availability of different types of food resources, and 3) interactions with other species (e.g., predation, competitive interactions). Major landscape factors that shape fish assemblages are 1) availability of groups of species from major types of streams and rivers (e.g., large river systems, floodplains, headwater streams, access to estuaries and ocean), 2) evolutionary and geological history of the landscape, and 3) introduction of exotic taxa. These larger scale factors increase the rate of longitudinal addition of species and

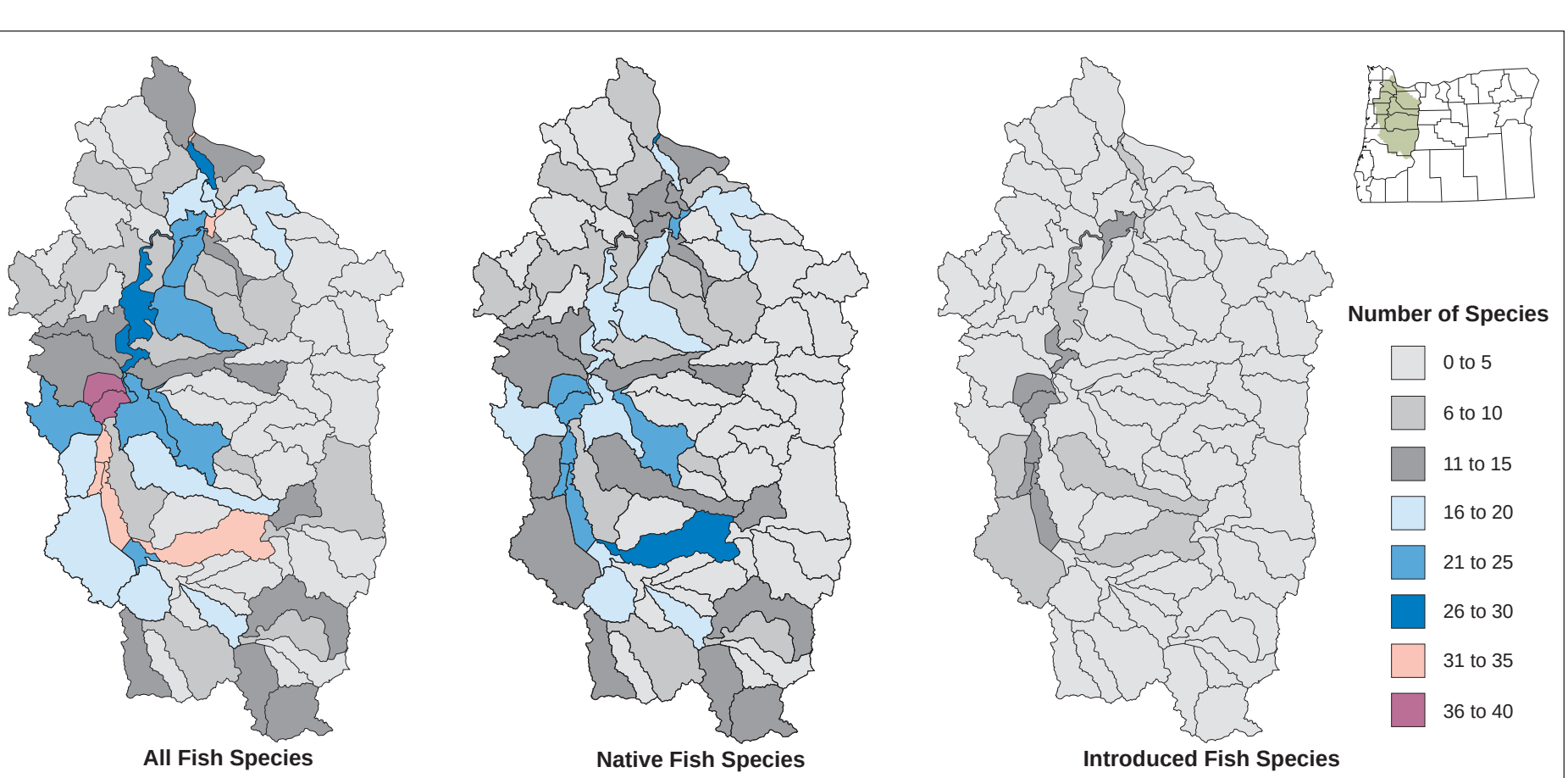


Figure 57. *Numbers of fish species known to occur within subbasins of the Willamette River Basin. Fish species presence is based on projected distributions between points of known species occurrence.*

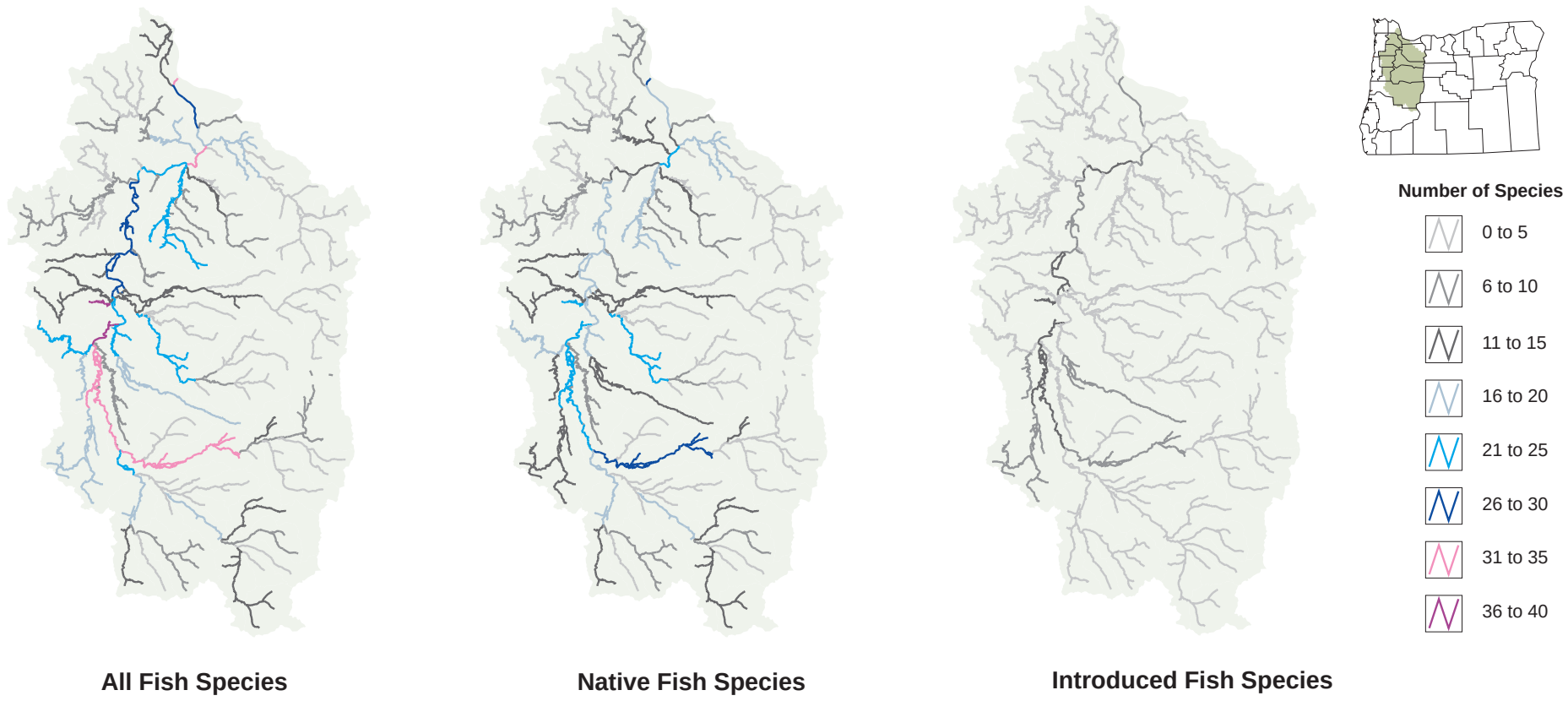


Figure 58. *Numbers of fish species within major stream reaches in the Willamette River Basin. Distributions are based on the same database illustrated in Figure 57.*

the maximum number of species observed. These influences are reflected in the longitudinal pattern of cumulative numbers of potential fish species from the headwaters of the Middle Fork of the Willamette River to the mouth in Portland (Fig. 59). In this analysis, the cumulative number of species is determined by increasing the cumulative number of species as each species is encountered in a trajectory from small headwater streams to the mouth of the Willamette River. The cumulative number of species increases steadily until it reaches the mainstem Willamette River, at which point the number of species is high and the rate of increase in species is not as rapid. Along the mainstem, local numbers of fish species within 1 kilometer range from 8 to 24. Local numbers decrease in the Portland area because of habitat loss and lower aquatic environmental quality. Introduced species increase markedly when the river network enters the Lowland region.

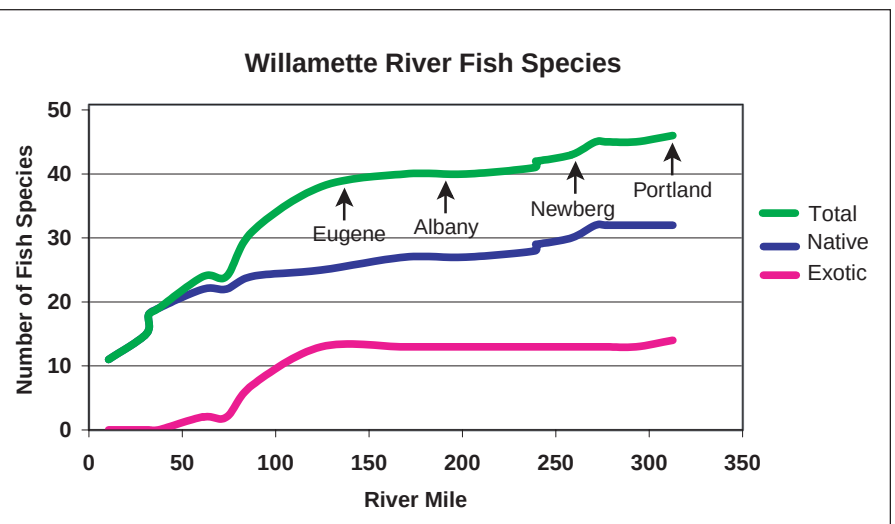


Figure 59. *Longitudinal pattern of cumulative number of fish species (native, introduced, total) from the headwaters of the Middle Fork of the Willamette River to the mouth in Portland. Fish species presence is projected between points of known species occurrence.*

## Conclusions

- Lowland stream and river systems support greater numbers of fish species than headwater streams and rivers.
- Management of lowland systems, as well as the publicly owned uplands, is critical for maintaining and restoring the fish fauna of the Willamette River Basin.
- Introduced species now make up almost half the fish assemblage of the Willamette Basin and present potentially detrimental influences on native fish communities.

*Steelhead trout*

*Common carp*

Table 22. *Contemporary fish fauna of the Willamette River Basin.*

| Family | Common Name | Mainstem Abundance | Mainstem Location | Scientific Name | Origin * | Adult Trophic Group |
|---|---|---|---|---|---|---|
| Acipenseridae | White sturgeon | rare | low | Acipenser transmontanus | N | Omnivore |
| Catostomidae | Largescale sucker | common | all | Catostomus macrocheilus | N | Omnivore |
| Catostomidae | Mountain sucker | common | all | Catostomus platyrhynchus | N | Herbivore |
| Cottidae | Mottled sculpin | absent | tribs | Cottus bairdi | N | Insectivore |
| Cottidae | Paiute sculpin | medium | all | Cottus beldingi | N | Insectivore |
| Cottidae | Prickly sculpin | common | all | Cottus asper | N | Insectivore |
| Cottidae | Reticulate sculpin | common | all | Cottus perplexus | N | Insectivore |
| Cottidae | Riffle sculpin | rare | tribs | Cottus gulosus | N | Insectivore |
| Cottidae | Shorthead sculpin | absent | tribs | Cottus confusus | N | Insectivore |
| Cottidae | Torrent sculpin | common | all | Cottus rhotheus | N | Insectivore |
| Cyprinidae | Chiselmouth | common | all | Acrocheilus alutaceus | N | Herbivore |
| Cyprinidae | Leopard dace | medium | all | Rhinichthys falcatus | N | Insectivore |
| Cyprinidae | Longnose dace | common | all | Rhinichthys cataractae | N | Insectivore |
| Cyprinidae | Northern pike minnow | common | all | Ptychocheilus oregonensis | N | Piscivore |
| Cyprinidae | Oregon chub | absent | tribs | Oregonichthys crameri | N | Insectivore |
| Cyprinidae | Peamouth | common | all | Mylocheilus caurinus | N | Insectivore |
| Cyprinidae | Redside shiner | common | all | Richardsonius balteatus | N | Insectivore |
| Cyprinidae | Speckled dace | common | all | Rhinichthys osculus | N | Insectivore |
| Gasterosteidae | Threespine stickleback | common | all | Gasterosteus aculeatus | N | Insectivore |
| Osmeridae | Eulachon | rare | low | Thaleichthys pacificus | N | |
| Percopsidae | Sand roller | medium | all | Percopsis transmontana | N | Insectivore |
| Petromyzontidae | Pacific lamprey | common | all | Lampetra tridentata | N | Omnivore |
| Petromyzontidae | Western brook lamprey | medium | all | Lampetra richardsoni | N | Omnivore |
| Petromyzontidae | River lamprey | rare | all | Lampetra ayresi | N | Omnivore |
| Pleuronectidae | Starry flounder | rare | low | Platichthys stellatus | N | Piscivore |
| Salmonidae | Bull trout | absent | tribs | Salvelinus confluentus | N | Insectivore |
| Salmonidae | Chinook salmon | common | all | Oncorhynchus tshawytscha | N | Insectivore |
| Salmonidae | Coho salmon | rare | low | Oncorhynchus kisutch | N | Insectivore |
| Salmonidae | Cutthroat trout | common | all | Oncorhynchus clarki | N | Insectivore |
| Salmonidae | Mountain whitefish | common | all | Prosopium williamsoni | N | Insectivore |
| Salmonidae | Rainbow trout | common | all | Oncorhynchus mykiss | N | Insectivore |
| Salmonidae | Sockeye salmon | rare | low | Oncorhynchus nerka | N | Insectivore |
| Centrarchidae | Black crappie | common | all | Pomoxis nigromaculatus | I | Insectivore |
| Centrarchidae | Bluegill | common | all | Lepomis macrochirus | I | Insectivore |
| Centrarchidae | Green sunfish | absent | lakes | Lepomis cyanellus | I | Insectivore |
| Centrarchidae | Largemouth bass | common | all | Micropterus salmoides | I | Piscivore |
| Centrarchidae | Pumpkinseed | common | all | Lepomis gibbosus | I | Piscivore |
| Centrarchidae | Redear sunfish | absent | lakes | Lepomis microlophus | I | Insectivore |
| Centrarchidae | Smallmouth bass | common | all | Micropterus dolomieui | I | Carnivore |
| Centrarchidae | Warmouth | medium | all | Lepomis gulosus | I | Insectivore |
| Centrarchidae | White crappie | common | all | Pomoxis annularis | I | Insectivore |
| Clupeidae | American shad | medium | low | Alosa sapidissima | I | Omnivore |
| Cobitidae | Oriental weatherfish | absent | tribs | Misgurnus anguillicaudatus | I | Omnivore |
| Cyprinidae | Common carp | common | all | Cyprinus carpio | I | Omnivore |
| Cyprinidae | Fathead minnow | absent | lakes | Pimephales promelas | I | Omnivore |
| Cyprindae | Golden shiner | rare | low | Notemigonus chrysoleucas | I | Insectivore |
| Cyprinidae | Goldfish | rare | low | Carassius auratus | I | Omnivore |
| Cyprinidae | Tench | rare | low | Tinca tinca | I | Insectivore |
| Cyprinidae | Grass carp | rare | low | Ctenopharyngodon idella | I | Omnivore/ Herbivore |
| Cyprinodontidae | Banded killifish | common | low | Fundulus diaphanus | I | Insectivore |
| Ictaluridae | Black bullhead | rare | low | Ameiurus melas | I | Omnivore |
| Ictaluridae | Brown bullhead | common | all | Ameiurus nebulosus | I | Omnivore |
| Ictaluridae | Channel catfish | rare | all | Ictalurus punctatus | I | Omnivore |
| Ictaluridae | White catfish | rare | low | Ameiurus catus | I | Omnivore |
| Ictaluridae | Yellow bullhead | common | all | Ameiurus natalis | I | Omnivore |
| Percidae | Walleye | rare | all | Stizostedion vitreum | I | Piscivore |
| Percidae | Yellow perch | common | all | Perca flavescens | I | Insectivore |
| Poeciliidae | Western mosquitofish | common | all | Gambusia affinis | I | Insectivore |
| Salmonidae | Brook trout | absent | tribs | Salvelinus fontinalis | I | Insectivore |
| Salmonidae | Brown trout | absent | tribs | Salmo trutta | I | Insectivore |
| Salmonidae | Kokanee | absent | lakes | Oncorhynchus nerka | I | Insectivore |
| Salmonidae | Lake trout | absent | lakes | Salvelinus namaycush | I | Insectivore |

* N - Native
I - Introduced