Conservation Genetics and Fisheries Management

By Chris O'Bara

The science of genetics has far-reaching implications in many aspects of our lives. Medical research, health management, criminal investigations and natural resources management, including fisheries management. Recreational fisheries management and species restoration efforts can be enhanced through application of conservation genetics analysis techniques.

So why are fisheries biologists of the West Virginia Division of Natural Resources (DNR) concerned with genetics in managing our fish populations? To answer that question, let's explore a few basic concepts of genetics and how these apply to us, as well as our fishery resources. As most of us have been taught in grade school, part of who we are is dependent on our parents. Some of these traits are presented in physical attributes such as the color of our hair, eyes and our height. Also, our tolerance to cold or warm weather may be the same as one of our parents. Well, fish are no different. Any angler knows that you seek trout in cold water and channel catfish in warm water. We often find more largemouth bass in lakes and more smallmouth bass in rivers, or paddlefish in large rivers and brook trout in small streams.

Applying knowledge of genetic traits will help biologists restore the native strain of walleye to the scenic New River.

Photo by David Fattaleh

Native strain of walleye netted during a nighttime electrofishing survey.

DNR photo

We can now see a link between fisheries management and genetics. For fishery biologists of the DNR Wildlife Resources Section (WRS) this became more apparent when new opportunities and techniques allowed for the restoration of important sport fish in our state's waters. Since the late 1990s, species such as muskellunge, walleye and paddlefish have been re-introduced into rivers such as the New, Cheat, Ohio, Kanawha and Coal. These re-introductions were based on improving water quality and habitat, and the ability to spawn and rear these fish in our hatchery system.

So, our biologists asked what genetic strain of these species should be used for introductions into our state waters and how they could determine these best stocks. Several approaches can be used and WRS fisheries biologists are currently employing these techniques to match the best genetic strain to the available aquatic environment.

Logic suggests that fish from a given geographic region are best suited for that region. Consequently, it is rational to collect broodstock from adjacent water bodies and use these fish in restoration efforts. This was the initial approach WRS fisheries biologists used in the restoration of muskellunge and paddlefish. Adults were collected from the upper Ohio River watershed and returned to DNR hatcheries to be spawned, their young reared, and finally stocked into Ohio River water bodies. For muskellunge, this meant collecting and using broodstock from Middle Island Creek in west-central West Virginia to restore populations in "sister" rivers. For paddlefish, this meant collecting and using broodstock from the Ohio River to restore populations in the upper Ohio and Kanawha rivers.

The more technical approach is to use biochemical and molecular genetic techniques to identify differences based on gene complexes of fish populations. That may be CSI stuff, but similar approaches are currently used by DNR fisheries biologists to manage our riverine walleye populations. In the late 1990s, researchers from both Ohio University and Virginia Tech identified molecular, genetic-based differences between our native walleye of the New, Kanawha and Ohio rivers, and walleye from the Great Lakes. Over time, the techniques used to identify these differences were simplified and allowed a quick evaluation without sacrificing the fish. Wildlife Resources Section fisheries biologists collect adult fish from "native" waters, take a small clip of the fin, and use DNA testing to identify if the fish is a "native" or a "Great Lake" strain. Fish from like strains can then be spawned and their young reintroduced into the appropriate waters.

DNR fisheries biologist Katie Zipfel prepares tissue sample for genetic analysis.

DNR photo

So why is genetics important in providing angling opportunities and more importantly, quality opportunities to anglers? As we discussed earlier, part of who we are is dependent on our parents. The same holds for fish – their suitability to a given river or lake is dependent on their genes acquired from their parents. Old-time anglers often told stories of the large walleye caught in the New River. We now know that these growth traits were at least partially based on genetics. Wildlife Resources Section fisheries biologists are using the understanding of these genetic traits to restore this strain of walleye into the New River. Similarly, new highly technical approaches have confirmed that genetic based differences do exist between paddlefish populations and fisheries biologists have been using the appropriate strain for restoration. Only time will tell when this program will result in a restored population and perhaps, a new fishery. Also, new approaches in muskellunge genetics have been recently developed. In time these will be used by fisheries biologists to further differentiate populations and improve both the efficiency and effectiveness of rearing this important game fish.

So why use genetics in fisheries management? It enables our WRS staff to wisely and effectively manage our prized fisheries and angling opportunities.

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