Deschutes Whirling Disease Issue

November 5, 2010

A research paper from Oregon State University was published in 2010. It is:

"Detection of Myxobolus cerebralis in the Lower Deschutes River Basin, Oregon
*C. M. ZIELINSKI, H. V. LORZ, AND J. L. BARTHOLOMEW**
Department of Microbiology, Oregon State University, Nash Hall 220, Corvallis, Oregon 97331"

The paper was circulated for comments to three of the speakers at a November 17, 2009, Mini-Workshop on the threat of whirling disease being introduced to the upper Deschutes and the responses are below. **It seems clear that hatchery stray steelhead from the upper Columbia are the source of whatever problem emerges.**

The speakers are:

Rick Stocking is the ODFW - Fish Health Services Biologist, Pelton Round Butte Hydro
Don Ratliff is the PGE Fisheries Biologist at the Pelton Round Butte Complex, and
Brett Hodgson is the ODFW District Fisheries Biologist for the High Desert Region.

From Rick Stocking, October 28, 2010

Tom,

It's really hard to argue with the results. The myxospore stage of Myxobolus cerebralis was identified and confirmed in sentinel fish that were exposed in Trout Creek. These fish were specific parasite free prior to exposure. This means that the fish picked up the parasite from Trout Creek waters which, in turn, means that some portion of Tubifex tubifex (the invertebrate host) populations in Trout Creek are also infected. I agree with the assertion that stray steelhead most likely brought the parasite into Trout Creek.

What I argue with is the language of the conclusions. The assertion that the parasite is "established" probably means something different to the study authors than to myself. To me, the parasite is "established" if it is able to maintain itself through the resident fish populations, not solely through out-of-basin strays reintroductions. In other words, if out of basin strays stopped entering the Deschutes River basin, would the parasite disappear from the basin altogether? It's interesting to me that the parasite could be detected in some years but not others. Was it simply a low dose factor, or is the parasite sometimes there and sometimes not? Will future changes to the lower Deschutes River temperature regime alter the stray rate into the Deschutes River and thus the movement of the parasite? It should be noted that, so far I have not been able to detect the parasite in resident age-0 and age-1 O. mykiss in lower Trout Creek.

A previous detection of the parasite in Clear Creek (Clackamas River tributary) at various sentinel sites was transitory and the parasite was no longer detected a few years after a point source of the infectious stage was eliminated. In this case, the parasite, though detected for a period of time, was not "established" in the system. Nevertheless, Clear Creek continues to show up as a Mc positive system in papers and maps which deal with the parasite. Unfortunately, the study conclusions attaches a "**RED DOT**" on the lower Deschutes River and it will be just short of impossible to ever remove that dot, even if the parasite does disappear. This red dot has management implications, not only for in basin aquatic resources but for others as well. Hopefully, we will never have to put a red dot on the upper Deschutes River.

Rick

From Don Ratliff, October 28, 2010

Hi Tom,
This work is part of the larger study that we, the licensees, funded from 1999 through 2007 that we reviewed at the workshop you all sponsored, and was summarized in the final report (attached). This is the scientific paper documenting the establishment, at very, very, very, low levels of *Myxobolus cerebralis*, in lower Trout Creek, and apparently sporadically in other locations in the lower Deschutes Basin. *M. cerebralis* is the parasite that causes whirling disease in salmonids where it occurs at very high levels. What wasn't emphasized in this paper was all the worm distribution and abundance studies that were done for *Tubifex tubifex*, the alternate host for *M.cerebralis,* in both the lower and upper Deschutes subbasins. The relatively low numbers of this specific worm in the Deschutes basin should continue to control the numbers of parasites to where this organism will continue to be simply one of many background parasites some of the salmonids will carry. However, we are taking all reasonable precautions to prevent its transmission with the passage of adult salmonids into the upper Deschutes when adults return and we can pass them. ODFW and OSU fish pathologists have looked a hundreds of adult salmon and steelhead returning to the Deschutes - after initially rearing in the Deschutes - and have not yet documented one carrying *M. cerebralis* although up to 35% of samples from stray steelhead in the Deschutes carry *M. cerebralis* myxospores. Some adult steelhead that stray into the Deschutes apparently became infected after rearing as juveniles in the Grand Rhonde or Imnaha rivers, or elsewhere in the Snake River Basin where *M. cerebralis* is established. However, even there, where it is readily observed as a parasite of both resident and anadromous salmonids, there is no evidence that it has caused any disease or increase in mortality.

Thanks for the question,

Cheers, Don

From Brett Hodgson, November 3, 2010

Tom,

The results of this study are consistent with ODFW position on the whirling disease issue in the Deschutes. Currently, the pathogen that causes Whirling Disease does not appear to be established in native Deschutes River fish. Presently, the only fish that have tested positive have been adult hatchery strays presumably which picked up the parasite as juveniles in the upper Columbia.

What does this mean for reintroduction? The likelihood of transferring the pathogen into the upper watershed from passing adults known to have originated from above the project is minimal, however, there is some risk inherent with adult passage. Therefore, ODFW has advocated for a conservative approach to moving forward with the reintroduction program from the outset. We would like to see clear indicators of success demonstrating that the SWW is properly functioning, moving fish through the reservoir and upstream habitats are capable of producing a sufficient number of smolts. At that time we are willing to pass returning adults upstream (of known origin) and incur the associated minimal risk.

Hope this doesn't murky the water even more.

Brett

The Papers Below Are From the:

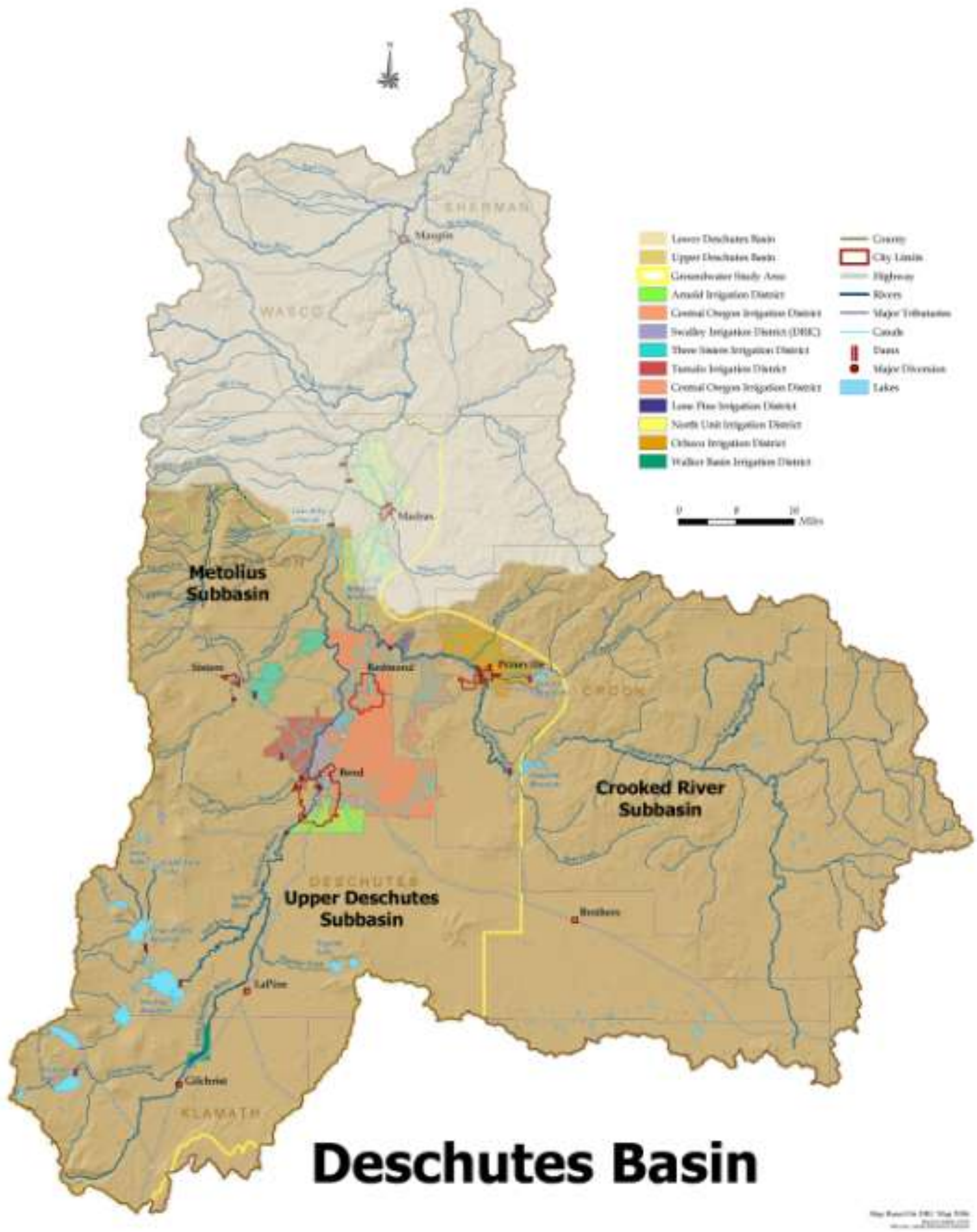
Potential for Whirling Disease Introduction

To the

Upper Deschutes

NFS and TU Workshop – November 17, 2009

Rick Stocking & Brett Hodgson (ODFW), Don Ratliff (PGE) and Clair Kunkel (ODFW ret.)



Overview of Fish and Wildlife Diseases as a Management Issue
Clair Kunkel

ODFW (retired) Bend District Watershed manager

Dealing with a myriad of fish and wildlife diseases is one of the major challenges facing managers, industry, and the public now and into the future. A growing number of diseases take a heavy toll on fish and wildlife populations, reduce public opportunities, threaten local economies, and require huge budgets and efforts on the part of managing agencies.

Some examples of these devastating diseases include:

- Chronic wasting disease – affects deer and elk populations in several states. Not exhibited in Oregon yet, but considered a major threat. A solution in some locales is to reduce or eliminate captive and domestic herds to control spread of this devastating disease.

- Deer Hair Loss –heavily impacts deer in Western Oregon, associated with an exotic louse that may have been introduced via wildlife ranching. A different "hair loss syndrome", little understood, is affecting deer in certain locales in central Oregon and some other states.

- Adenovirus hemorrhagic disease – deadly to deer, first identified in northern California in the 1980s, has since spread to many areas including Oregon. Transmission is exacerbated in urban/suburban settings when people feed the deer.

- *Pasteurella spp*. – certain strains of Pasteurella bacteria are commonly carried by domestic and exotic sheep, but are deadly to native bighorn sheep throughout the west including in Oregon. Many historic habitats can no longer support bighorn populations due to Pasteurella exposure from domestic and exotic sheep.

- Avian Influenza - thought to have originated in the poultry industry of Hong Kong, "bird flu" has quickly spread throughout the world and impacted numerous species of wild birds. In Oregon and other western states, avian influenza poses great risk to native sage grouse populations that are already suffering from habitat issues.

- Whirling disease – the main topic of this summary, whirling disease in fish is caused by a parasite (*Myxobolus cerebralis*) native to Europe, and first described in Germany in 1903. The parasite is thought to have been transported to the U.S. via frozen fish products, and is now established in at least 25 states, including the Grande Ronde and Imnaha systems in northeast Oregon. This parasite has an intricate life cycle involving certain *Tubifex* worms, and including one life-stage that invades the juvenile cartilage of Salmonids, causing deformities and elevated mortality rates in some species. Steelhead straying into the lower Deschutes River produce an exposure risk for Deschutes River trout, steelhead, and salmon. An ongoing project to reestablish anadromous steelhead and salmon runs above the Pelton-Round Butte hydroelectric dams poses a risk of establishing the parasite into the upper Deschutes subbasin. Considerable cost and effort have been expended to evaluate this risk and develop procedures to minimize the risk.

Following are some characteristics that the above diseases have in common:

- Most are intimately associated with an industry such as agriculture, wildlife ranching, hatchery production, etc.
- The effect of these diseases is often exacerbated by captive breeding, crowding or artificial feeding programs.

- These diseases have been widely spread through the practice of transporting infected animals from one locale to another, sometimes over great distances.
- Many of these diseases are carried by resistant species or stocks, subsequently exposing non-resistant species or stocks to the disease with disastrous consequences.

Who is to blame?
While some might be inclined to place the blame for the proliferation of fish and wildlife diseases on certain industries, or governments, or managing agencies, the truth is that the blame must be shared by all of modern society. All of us, as consumers and users of our natural resources, place huge demands on industry and government to meet all of our needs. We collectively support agricultural industries that strive for maximum production so that we have ready access to inexpensive food products. We expect fish and wildlife agencies to maximize opportunities to view, hunt, angle, and otherwise enjoy a wide variety of native and non-native fish and wildlife species. It may be that we are asking too much, causing managers to push beyond the limits of sustainable fish and wildlife production.

What can we do about it?
- Support much-needed research concerning fish and wildlife disease management.
- Support managers in making informed, effective, and sustainable management decisions.
- As concerned citizens, stay informed and engaged in the political system to help foster effective solutions and decisions.
- Through a process of education, teach the public to have reasonable expectations regarding the abundance, availability, and sustainability of fish and wildlife populations and related opportunities.
- Risks and benefits of proposed actions must be closely weighed; sometimes it may be wise to forego perceived benefits, in light of associated risks.

Here's the conundrum: if we continue relying on artificial breeding programs and transporting potentially infected animals as means to meet our demands, we will continue to run risks of spreading various diseases, and may experience devastating consequences from those diseases. We need to collectively strive towards making better decisions in the future than we have sometimes made in the past. Meanwhile, we will have to live with the dire consequences of certain fish and wildlife related diseases that are the products of past decisions.

The PGE steelhead and salmon reintroduction project
This project is a good example of a well-planned approach to minimize disease risks, while proceeding with reestablishment of anadromous fish runs above the Pelton-Round Butte dam complex on the Deschutes River. The project licensees funded extensive research to evaluate the risks of establishing whirling disease above the barrier. Licensees and regulating agencies cooperated to develop detailed plans and procedures to reduce risks to a practical minimum. An adaptive management approach with intensive monitoring by fish health specialists will be utilized at each stage of fish handling and reintroduction above the dams.

Low Risk of Establishing Salmonid Whirling Disease in the Deschutes River Basin
Whirling Disease Mini-Workshop – Central Oregon Environmental Center

Don Ratliff,
Portland General Electric Fish Biologist Donald.Ratliff@pgn.com
November 17, 2009

After more than 10 years of research, study conclusions indicate that current conditions in the Deschutes Basin are prohibitive to the establishment of salmonid whirling disease and that native salmon, steelhead, and trout should not experience population level impacts. However, these same studies caution that with the movement of stray steelhead and salmon of unknown origin, the parasite, *Myxobolus cerebralis* (the causative agent of salmonid whirling disease), could become established at low levels both downstream and upstream of the Pelton Round Butte Project (PRB). In anticipation of having fish passage at the Pelton Round Butte Project, the Licensees have funded long-term studies of *M. cerebralis*, the aquatic worm *Tubifex tubifex* (alternative host for *M. cerebralis*) and its affect on Deschutes salmonids. Final recommendations are to proceed with caution and continue monitoring populations of *T.* tubifex, and salmonids. This aquatic worm does best in areas of high sediment and high organic nutrient enrichment. For example, high populations of *T. tubifex* were found in the settling pond at Wizard Falls Fish Hatchery. In my presentation I will highlight the major findings by OSU microbiologists and ODFW Fish Heath Specialists that should limit disease expression. Study findings include:

1. Myxospores of *M. cerebralis*, the causative pathogen, have been deposited by stray steelhead and Chinook annually into the lower Deschutes River basin since 1987.

2. Sentinel live-box studies using very susceptible fry have only detected the triactinospore (TAM) stage, the stage that infects salmonids, in very low numbers some years in lower Trout Creek, Mud Springs, near Oak Springs, and Buck Hollow Creek. Most diagnoses were by PCR, a very sensitive genetic test. Characteristic myxospores were only observed from a small percentage of sentinel fry exposed to lower Trout Creek in 1997. Disease was not observed in these sentinel fry. Myxospores have not been found in juvenile or adult wild steelhead from Trout Creek.

3. No Deschutes Basin resident or anadromous salmonids have ever been found to have myxospores after more than 10 years of looking.

4. Studies of water temperatures, and the alternative host, *T. tubifex*, show why whirling disease has not become a problem over the 20+ years of introduction of *M. cerebralis* into the lower Deschutes Basin by stray adult steelhead and salmon from Snake River watersheds. These studies also indicate that if the parasite is introduced with adult salmon or steelhead passed above PRB with fish passage, it should not result in whirling disease within the middle Deschutes Basin because of the mitigating factors of water temperatures, and the alternate host not aligned for parasite proliferation.

Study results that determined these factors include:

- Water temperatures in most of the Deschutes Basin are either too cold or too warm for high production of TAM stage of *M. cerebralis* when salmonids are in the susceptible fry stage. In *T. tubifex*, water temperatures below 10^{o}C (50^{o}F) significantly delay the development of the TAM stage, and those above 20^{o}C (68^{o}F) disrupt the parasite's development.

- *T. tubifex* are not abundant in the Deschutes Basin. Where found they normally make up a very small percentage of the aquatic oligochaete (worm) population. In other words, of the worms in the sediment, most all of them are not *T. tubifex*. An exception is lower Trout Creek where *T. tubifex* is more abundant.

- In many of the *T. tubifex* populations, the *M. cerebralis*-resistant, genetic lineage VI worms will actually reduce the numbers of TAMs produced.

- Even in the susceptible lineage III populations, there is low potential production of TAMs from most populations as demonstrated in laboratory studies at the OSU Salmon Disease Laboratory. In these studies different *T. tubifex* populations were fed myxospores, and the TAMs produced enumerated. The exception is the *T. tubifex* population from lower Trout Creek that produced relatively large numbers of

TAMs. This may be why lower Trout Creek is the only place where some transmission has been documented by actually observing myxospores in a small percentage of susceptible fry exposed during sentinel live-box studies.

Nature and History of *Myxobolus cerebralis*
Whirling Disease Mini-Workshop – Central Oregon Environmental Center

Richard Stocking,
ODFW – Fish Health Services Richard.W.Stocking@State.OR.US
November 17, 2009

Myxobolus cerebralis is a microscopic parasite that can cause a fatal disease in susceptible salmonids known as "whirling disease" and has been implicated in losses of cultured or wild trout in certain States. The parasite has a two-host life-cycle where an aquatic worm (*Tubifex tubifex*) serves as the primary host and trout or salmon (salmonids) serve as the secondary host. After leaving the infected worm as a neutrally buoyant triactinomyxon (TAM for short), the parasite drifts in the current until it comes into contact with, and attaches to the skin, of a susceptible salmonid. If the salmonids skeleton is still mostly cartilage (such as in trout fry less than 9 weeks post-hatch) the parasite will migrate through the body tissues and consume the cartilage causing skeletal deformities and nerve damage. This tissue damage often results in the characteristic whirling behavior (tail-chasing) for which the disease is named. When the infected fish dies and decomposes, the heavier and robust myxospores are released back into the environment, sink to the substrate and may be consumed by *T. tubifex* to complete the life-cycle.

Naturally, there are a number of factors that determine whether fish and fish populations are susceptible to the parasite or developing whirling disease such as: age of fish at exposure (after 10 weeks post-hatch all species are resistant to the disease), the exposure dose (how many parasites and how often), and the species of salmonid. Other factors involve T. tubifex (some strains are resistant to the parasite) and its distribution and abundance and whether the special overlap of the two host's favors the parasite. Equally important are water temperatures which determine parasite development in both hosts. For a thorough and excellent review of these and other factors, the reader is directed to the Trout Unlimited website (keyword: Whirling Disease) and a recent review publication entitled "**Whirling Disease in the United States**: A Summary of Progress in Research and Management 2009" that can be downloaded from the following URL

http://www.iats.csic.es/~patolog2/files/WD%20in%20the%20United%20States_2009_sc.pdf

It is believed that the parasite was introduced into North America along with brown trout (*Salmo trutta*) from central Europe where the two organisms coevolved. The parasite spread on both U.S. coasts prompting more stringent import and export measures at all levels (e.g. screening and certification) and constant monitoring. The parasite was first detected in Oregon's Grand Ronde and Imnaha basins in the mid 1980's. Subsequent research indicated that, although the prevalence of infection in fish was high, the parasite was not causing population declines. Later these infected carriers would show up as stray steelhead and Chinook into the lower Deschutes River. For more than a decade, continuous monitoring has not found the parasite to be established in any area of the Deschutes or its tributaries until recently when very low levels of the parasite were detected in test fish held in Trout Creek. Although the parasite has been moving into Oregon waters for more than 20 years, the disease itself has never been documented.

Whirling Disease and Anadromous Fish Reintroduction in the Upper Deschutes River Subbasin – Managing Risk
Workshop Presentation Summary
November 17, 2009

Brett Hodgson
Deschutes District Fish Biologist, Oregon Department of Fish and Wildlife

The Oregon Department of Fish and Wildlife (ODFW) co manages fish and wildlife resources in the Deschutes River basin with the Confederated Tribes of the Warm Springs (CTWS).

ODFW was a party to the settlement negotiations regarding the relicensing of the Pelton Round Butte Dam complex by Portland General Electric and CTWS. The primary mitigation required of the co licensees was facilitating the reintroduction of anadromous fish species into their historic habitats in the upper Deschutes River subbasin. These populations were extirpated with the construction of the PRB dam complex. ODFW is a strong supporter of the reintroduction effort, however, great recreation and conservation value is also placed on the resident fish populations present in the Upper Deschutes. ODFW will not support or participate in management actions that compromise the health of resident fish populations without clear indicators that reintroduction has a high likelihood of success and all preventative measures are employed to minimize the risk of pathogen transfer.

The 2003 Anadromous Fish and Bull Trout Management Plan in the Upper Deschutes, Metolius and Crooked River Subbasins prepared by ODFW serves as the agency's guiding document identifying goals, objectives and policies associated with reintroduction. This document was formally adopted by the Commission and incorporated into the Oregon Administrative Rules in 2004. Complimenting this document is the 2008 Anadromous Fish Reintroduction Plan authored by ODFW and CTWS. The Reintroduction Plan outlines the procedures to be implemented in moving forward with the reintroduction effort.

Fish passage at the PRB complex is beneficial for multiple reasons. Paramount among these is providing anadromous fish access to their historic habitats This will produce ecological, economic, social and cultural benefits. There is also biological and genetic benefits to be gained through providing connectivity to resident fish populations which are currently disjunct. Coupled with the considerable positives associated with fish passage is a level of risk. The primary risk is exposing fish populations in the upper basin to a pathogen currently not present. Presently, this risk is perceived as minimal yet real. ODFW will recommend management strategies that mitigate the risk to the fullest extent possible while enabling the reintroduction process to move forward.

Central to ODFW's role in the reintroduction is a conservative, step wise approach that incorporates strategies to manage the risk of whirling disease transfer into the upper basin and protocols for detecting transfer. Specific measures to be implemented to reduce the risk include refraining from passing adults upstream into the upper basin until two key benchmarks for success are met indicating that outmigration through Lake Billy Chinook and collection and handling at the new outlet structure are effective. These criteria are: 1) a minimum of 50% of either steelhead or Chinook smolts captured at the heads of either of three reservoir arms are captured at the collection facility and, 2) 95% of the smolts captured at the collection facility are safely transferred to the lower Deschutes River.

Each fish transferred to the lower river will receive a unique mark to facilitate its identification as a fish originated from upstream releases. After the previous benchmarks are met, only those fish known to have originated from upstream will be transferred back into Lake Billy Chinook as adults. This will minimize the potential for transferring adults carrying whirling disease through two factors: smolts typically are beyond the most vulnerable life history stage and the only known adults to be carriers of M. cerebralis to date are out of basin strays entering the Deschutes. Both ODFW and PGE will monitor resident fish populations to detect any incidence of whirling disease in the upper basin.

Ultimately, if all facets of reintroduction are successful there will be a point in the process when there will be volitional passage both upstream and downstream. This will be many years into the future and it is anticipated that there will be a great deal of knowledge gained pertaining to whirling disease prior to this occurring. In the interim, as new information is gathered adaptive management strategies will be incorporated into the reintroduction protocols to manage and minimize the risk associated with whirling disease transfer.