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BEFORE THE

CALIFORNIA STATE WATER RESOURCES CONTROL BOARD

HEARING IN THE MATTER OF THE CALIFORNIA DEPARTMENT OF WATER RESOURCES AND UNITED STATES BUREAU OF RECLAMATION REQUEST FOR A CHANGE IN POINT OF DIVERSION FOR CALIFORNIA WATER FIX	**TESTIMONY OF MICHAEL BELCHIK**

I, Michael Belchik, do hereby declare:

I. INTRODUCTION, QUALIFICATIONS AND EXPERIENCE

My name is Michael Belchik. I am presenting this testimony on behalf of the PCFFA and IFR in this evidentiary hearing before the State Water Resources Control Board (State Water Board) concerning the petition to change the point of diversion for the California WaterFix State Water Project (SWP) and federal Central Valley Project (CVP), as specified in the licenses and permits of the US Bureau of Reclamation (USBR) and the California Department of Water Resources (DWR).

I am employed by the Yurok Tribe as a Senior Water Policy Analyst in the Yurok Tribal Fisheries Department (YTFD). I have been employed with the Yurok Tribe as a Senior Biologist and then Senior Water Policy Analyst, since July 14, 1995. The YTFD employs up to 55 people to manage, conserve, and restore Yurok's fishery resources, depending on the season. Of these, 19

are biologists or other professionals in the fields of geomorphology and engineering, and the remainder are technicians. YTFD also contracts with numerous experts in various disciplines, including hydrology, geology, pathology, and biology, to assist with protecting Yurok's fishery resource and associated habitat.

I have two Bachelor of Science degrees, one in Fisheries Biology and one in Oceanography, both from Humboldt State University.

From 1995 through 2000, I was the technical lead on the EIS team for the Trinity River Record of Decision (ROD) for the Yurok Tribe. Because of this, I am very familiar with, and have extensive knowledge of, the upper Trinity River and the studies that were carried out prior to the ROD. I have first-hand knowledge of the Trinity and Klamath Rivers that informs my conclusions set forth below.

I have conducted numerous studies on anadromous fish in the Klamath River including Chinook and Coho Salmon, steelhead, sturgeon, eulachon, and lamprey. The studies I have been involved with include flow studies, studies on fish disease, real-time monitoring of fish health and condition, and spawning enumeration studies as well as other studies. I have published papers in peer-reviewed journals on these subjects. I have been responsible for the preparation of many technical papers, technical memos, and progress and final reports regarding these studies. I have provided declarations in legal proceedings, been deposed, and have presented live expert witness testimony on behalf of the Yurok Tribe.

In the course of my duties working for YTFD, I have acquired intimate and detailed knowledge of flow management on both the Klamath and Trinity Rivers, and how that flow management affects anadromous fish and other aquatic species in the Klamath and Trinity Rivers. I regularly monitor river flow predictions, hydrological conditions, and weather and climate predictions insofar as they relate to anadromous fish in the Klamath River Basin.

In the course of my duties I have also acquired knowledge and familiarity with the Yurok Tribal fishery. The Yurok Tribe and the Hoopa Valley Tribe are annually allocated 50% of the harvestable surplus of Klamath Basin fall Chinook salmon. Of this Tribal allocation, 80% is dedicated to the Yurok Tribe and 20% to the Hoopa Valley Tribe. The Yurok Tribe manages,

conserves, and restores tribal trust species such as Coho and Chinook Salmon, steelhead trout and the various seasonal races based on the best available science.

Due to the immense importance of the Klamath and Trinity River fisheries to the Yurok Tribe, some of my primary duties since the 2002 fish kill (which I describe later in this evidence) have been to thoroughly investigate the cause of that fish kill event, the *Ichthyophthirius multifiliis* ("Ich") outbreak of 2014, and the development of scientific information that can be used to guide management actions to minimize the risk of another fish kill similar to 2002. I have thoroughly researched the Ich organism, outbreaks of Ich in natural systems and in controlled settings, and have published reports on both the fish kill in 2002 (Belchik, Hillemeier, Ronnie, 2004), as well as the subsequent Ich outbreaks of 2014 (Belchik 2015). Exhibits PCFFA-155 and PCFFA- 156 are true and correct copies of Belchik, Hillemeier, Ronnie, 2004 and Belchik 2015. In particular, a primary focus of my work has been to understand the role Trinity River releases have had in preventing another fish kill such as happened in 2002.

The Yurok Tribe has made this research a priority for its staff, myself included, because the fish kill disrupted Yurok fishing and impacted future runs by significantly reducing the number of spawning fish in 2002, especially in some sub-basins such as the Trinity River. I have been involved in the preparation of several pieces of scientific evidence regarding flow management on the Klamath and Trinity Rivers as it relates to the 2002 fish kill. In 2014, another outbreak of Ich occurred on the Klamath and Trinity Rivers, primarily on the Lower Klamath River on the Yurok Reservation, and I have worked to analyze and publish the data associated with that event (Belchik 2015). In 2015 another outbreak occurred, and those results are soon to be published.

This year, as in previous years, I have visited the Lower Klamath River to check river conditions and observe fish health conditions first hand. The crews that have collected relevant river and fish condition information in previous years, have done so under my direct supervision. No Ich data was collected in 2017 because the projected run size was so small that YTFD could not harvest fish to monitor the status of Ich on adult salmon in the Lower Klamath River.

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II. OVERVIEW OF TESTIMONY

Klamath and Trinity anadromous species are vitally important to the Yurok Tribe and its members for sustenance, cultural values, and economic opportunities. The Klamath River and the fishery resource it supports are an integral component of the Yurok way of life. Yurok people depend upon various species/races of anadromous fish that migrate through the Yurok Reservation throughout the year, such as Spring and Fall Chinook Salmon, Coho Salmon, Steelhead, Green Sturgeon, Pacific Lamprey and Eulachon. All of these runs are of utmost importance to Yurok people, however the only run that has been robust enough to support occasional commercial opportunities during recent decades has been the Fall Chinook Salmon run. The fall Chinook Salmon were most impacted by the catastrophic fish kill of 2002.

My testimony covers significant impacts on Klamath and Trinity River species observed from, in particular, low flows. It is set out as follows:

a. the 2002 fish kill, and contributing causes, including low flow

b. the outbreak of Ich in the Klamath and Trinity Rivers in 2014

c. the role of increased Trinity flows in reducing the risk of an Ich outbreak

d. the role of Trinity River fall flow augmentation releases to prevent a repeat of the 2002 fish kill.

III. 2002 FISH KILL AND RESEARCH OF CAUSES

In 2002, over 34,000 adult salmon died due to a massive disease outbreak of Ich, with a secondary infection of columnaris. This fish kill happened entirely within the Yurok Reservation on the Lower Klamath River. During this catastrophic fish kill event, I visited the fish kill area on multiple days, collecting data, making observations as to the cause of the fish kill event, and photographing the devastation.

During my site visits to the fish kill area in the Lower Klamath River in 2002, I observed tens of thousands of adult dead Chinook Salmon, steelhead trout and Coho Salmon, ranging in size from approximately 5 to 40 pounds. The number of dead Chinook was conservatively estimated at over 33,000 adult salmonids, but was likely higher.

During my site visits in 2002, I saw numerous dead adult Coho Salmon in and near the mouth of Blue Creek. Given their depleted status, Coho Salmon are listed under the Federal Endangered Species Act (ESA) as part of the Southern Oregon/Northern California Coastal (SONCC) Coho Salmon evolutionarily significant unit (ESU); these Coho Salmon are also listed under the State of California Endangered Species Act. It was estimated around 350 Coho Salmon died during the fish kill event of 2002[1]. Although this is a much smaller number than the tens of thousands of adult Chinook that died, it is important given the imperiled status of Coho Salmon in the Klamath Basin. Because I witnessed mortality of Coho Salmon in the fish kill of 2002, it is clear that Coho are at risk from a future fish kill. Augmented flows from the Trinity River that reduce the risk of a fish kill event to Chinook Salmon will also lessen the likelihood of mortality for the ESA listed Coho Salmon.

I have read all studies evaluating the causes of the 2002 fish kill event, and co-authored one of the reports. There is a general consensus in these studies that the cause of death of the fish in 2002 was a massive epidemic of Ich, which is a single-celled protozoan parasite that passes from fish to fish in crowded, low flow, poor water quality conditions. A secondary infection of columnaris (a bacterial infection) was also implicated.

Available information, including reports from the US Fish and Wildlife Service, the California Department of Fish and Wildlife, and the Yurok Tribe, show that low flows, marginal (but not unusual) water quality conditions, and a large run size were the primary factors in causing the outbreak of Ich with warm water temperatures being a secondary, but contributing factor. Of these conditions, flow is the only one that can be affected to any significant degree by management actions, and the temperature of the lower river can only be lowered through increased Trinity River releases. Although no single factor was cited as the direct cause of the fish kill, all three reports linked the combination of low flows and a relatively large run size to the disease outbreak and subsequent death of tens of thousands of fish.

[1] USFWS, 2003. *Klamath River Fish Die-off, September 2002, Report on Estimate of Mortality*. USFWS, Arcata Fish and Wildlife Office, a true and correct copy of which is submitted as PCFFA-157, pp. 12, 27.

IV. THE 2014 OUTBREAK OF *ICHTHYOPHTHIRIUS MULTIFILIIS* IN THE KLAMATH AND TRINITY RIVERS

In 2014, YTFD, under my direct supervision conducted real-time monitoring of the Klamath River for Ich in adult salmonids, as we have every year since the the 2002 fish kill. The sampling began on July 17, 2014, and on August 21, 2014, YTFD confirmed that an outbreak of Ich was occurring on the Lower Klamath River for the first time since 2003. The full results from this monitoring effort are detailed in Belchik 2015 (PCFFA-156).

In July and August 2014, the Yurok Tribe notified the USBR that conditions on the river, including low flow, high water temperature, and large numbers of adult salmonids holding for extended periods of time, were leading to a higher than normal risk of an Ich outbreak and associated fish kill. The Bureau of Reclamation then released these flows, with increased flow arriving in the Lower Klamath River on or about August 26, 2014 (Figure 1).

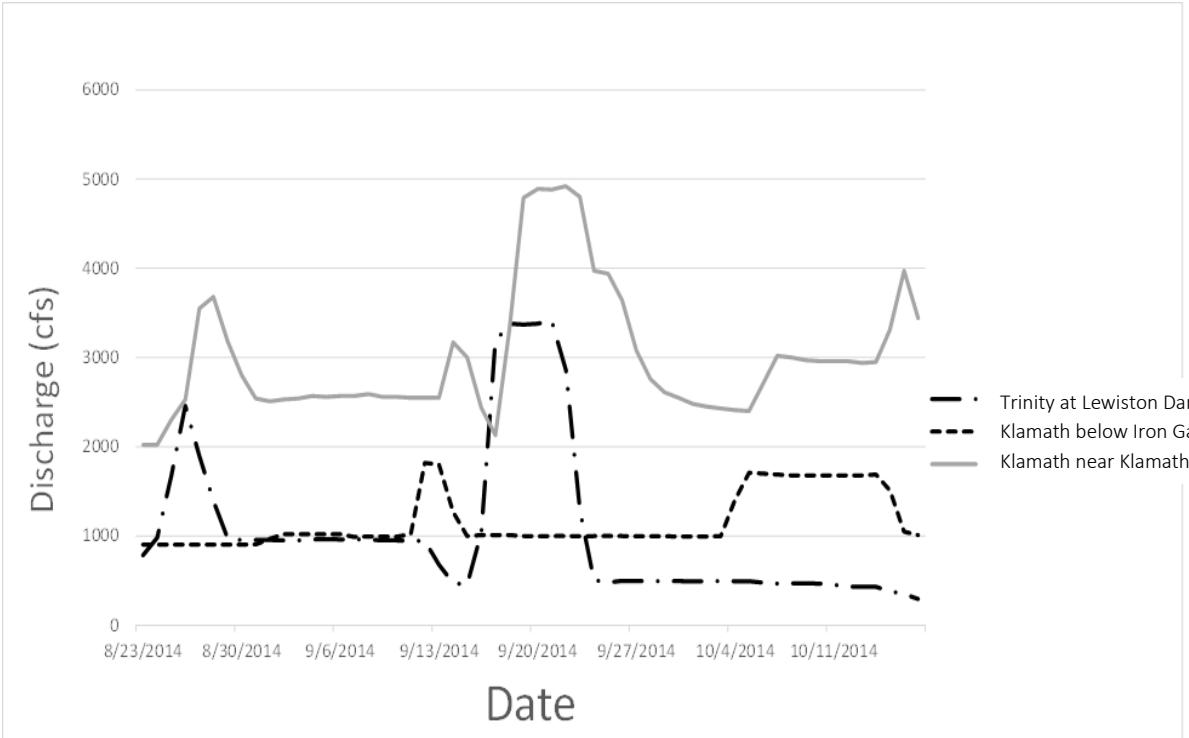

Figure 1: Flows at Lewiston, Iron Gate Dam, and the KNK gage near the mouth of the Klamath.

The Ich outbreak in 2014 reached detection levels on August 21 with sporadic cases of light Ich infections were noted (PCFFA-156, Belchik 2015, page 11). The finding of low levels of Ich was confirmed by USFWS fish pathology experts on September 12, when slide imprints

taken by the Yurok Tribe in August were submitted to USFWS and examined by their staff. The presence of Ich at severe levels (>30/gill arch) was subsequently confirmed by myself personally on September 13, 2014 by microscope examination, and by USFWS expert fish pathologist Dr. Scott Foott of USFWS on September 15, 2014 (Foott 2014, memorandum, a true and correct copy submitted as PCFFA-158). On that day, Dr. Foott confirmed that the trigger of severe Ich infection prevalence for emergency flows was met, and USBR initiated emergency flows from the Trinity River the next day.

Subsequently, the YTFD under my direct supervision and with direct participation by myself personally, sampled adult salmon and steelhead throughout the duration of the fall Chinook Salmon run on the Yurok Reservation. During 2014, a total of 398 fish were sampled for Ich, 308 fish from the Yurok Reservation, and an additional 90 fish from Iron Gate and Trinity River Hatcheries combined. At first, fish were captured in the Blue Creek thermal refugia area, where they were confined due to high water temperatures. However, in early September, normal seasonal cooling combined with the effects of cold water Trinity flow releases allowed fish to leave the Blue Creek area. From September 4, 2014 and on, fish were captured at Tectah Creek (approximately 3 river miles upstream from Blue Creek), and other locations in the Lower Klamath River. The last fish examined for Ich on the Yurok Reservation was on October 8, 2014, and at the Trinity Hatchery was on November 13, 2014. Sampling was discontinued on the Yurok Reservation due to low fish abundance, not due to low Ich abundance. Throughout the sampling on the Yurok Reservation in 2014, Ich levels on the gills of Chinook Salmon continued to climb, until they surpassed literature values for other Ich-related salmon kills (e.g. Traxler 1998, Maceida-Veiga et al. 2009), but there were no obvious signs of mortalities on the Yurok Reservation. However, a review of prespawn Coho Salmon mortalities on the Trinity River indicated that high prespawn mortalities of Coho Salmon may be linked to the Ich outbreak (PCFFA-156, page 20).

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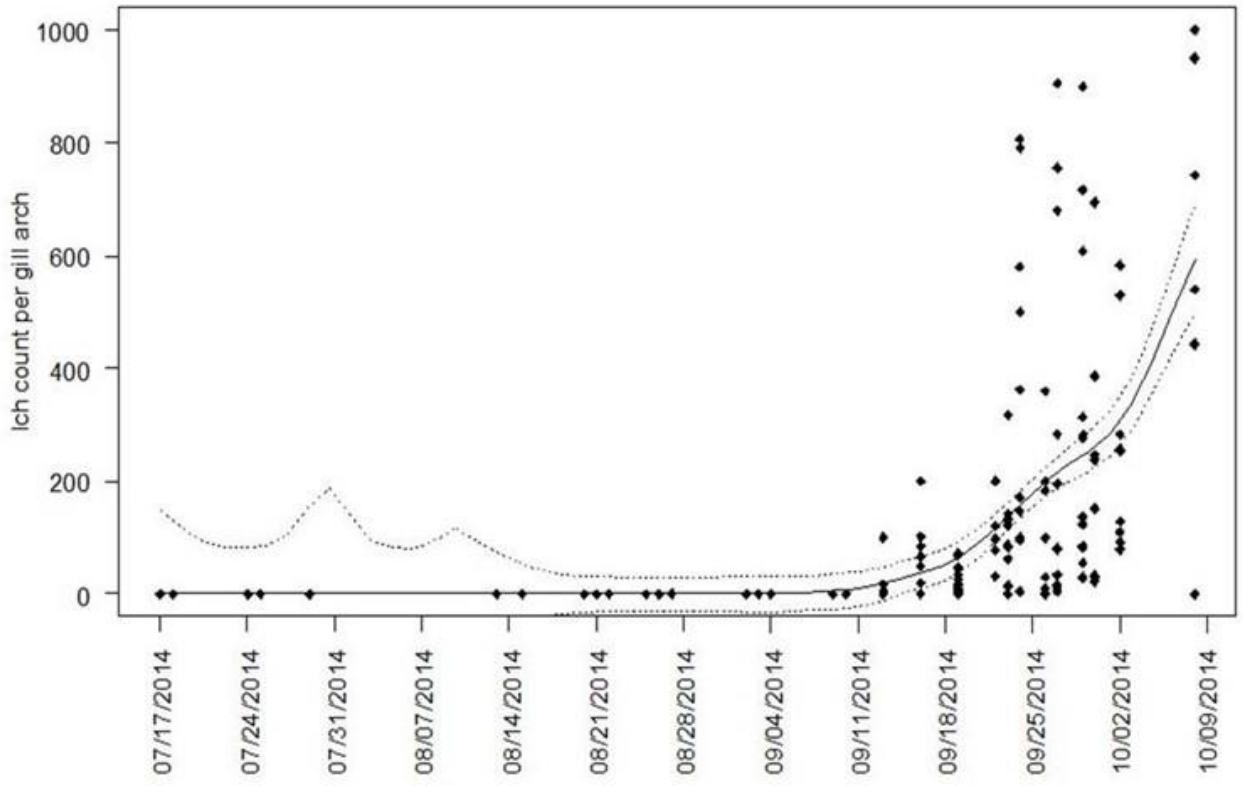

Figure 2: Maximum Ich count between left and right gill arch during the 2014 Ich sampling period (a surrogate for infection severity) fit with non-parametric model curves using local linear smoothing. Hoopa Valley and Karuk data not presented in this graph. Each data point represents at least one individual fish (some data points overlap each other). Counts on 9/13/14 were stopped at 100 organisms, and between 9/14 and 9/22 were stopped at 200 organisms. After 9/22 all Ich were counted. Hatchery results are not included in this graph. (Figure from Belchik 2015).

Based on the data collected and a thorough review of relevant literature related to the life cycle of Ich, I have concluded that flow was a primary factor in preventing the Ich outbreak from reaching the severity where it would begin to cause fish mortalities. This conclusion is based on a combination of a review of scientific literature related to Ich, which is replete with references to flow as a means to control Ich outbreaks, and my own field experience and original analysis of Ich in the Lower Klamath River.

a. <u>Increased Flows Reduce The Risk Of A Severe Ich Outbreak</u>

There is broad scientific consensus among fisheries managers in the Klamath that higher flows have the capability to significantly reduce the chances of an epidemic outbreak of Ich by 1)

increasing water velocities and 2) causing higher turnover rates of water in holding areas, which reduces the ability of Ich to find and attach to a host fish during its free swimming infectious stage as a theront[2]. This consensus is supported by numerous scientific studies on Ich spanning many decades. Full references for these studies can be found in Belchik 2015 (PCFFA-156, page 27).

The theme of these scientific references is that flow is a contributing factor in determining the severity of a given Ich outbreak. It is therefore very likely that increased water flows and lowered temperatures reduced the severity of the Ich outbreak in 2014 in the Lower Klamath River.

Sufficiently high water velocities and turnover rates need to be maintained before and throughout the primary fall Chinook Salmon migration season in order to reduce the probability of an Ich outbreak. In addition, higher base flows accompanied by lower water temperatures may help to reduce the overall density of adult fall-run Chinook Salmon, and thereby reduce the probability that the Ich theronts are successful in finding a host. Finally, increased flows reduce the risk to Coho Salmon that may be in the river or that migrate into the river after the disease has already been established.

V. THE NECESSITY OF TRINITY RIVER FALL FLOW AUGMENTATION RELEASES TO PREVENT A REPEAT OF THE 2002 FISH KILL

Trinity River flow augmentation releases were made in 2003, 2004, 2012, 2013, 2014, 2015, and 2016. As a result of the need for these flows, the USBR implemented the Long-Term Plan to Protect Adult Salmon in the Lower Klamath River and drafted an associated EIS (https://www.usbr.gov/mp/nepa/nepa_project_details.php?Project_ID=22021) analyzing the efficacy of such releases and ultimately deciding that they were 1) effective, 2) substantially

[2] A theront is the free-swimming stage of the Ich disease. It is about 5 microns long, and has a long tail which it uses to swim as it searches for a new fish host. Theronts have 24-48 hours to find a new host after which they die of starvation.

reduced the risk of a fish kill event, 3) were immediately implementable, and 4) were consistent with laws and regulations.[3]

In addition to increasing water velocities and turbulence, and reducing fish density in the Lower Klamath River, Trinity River flow releases have a substantial and important impact on water temperatures (Figure 3).

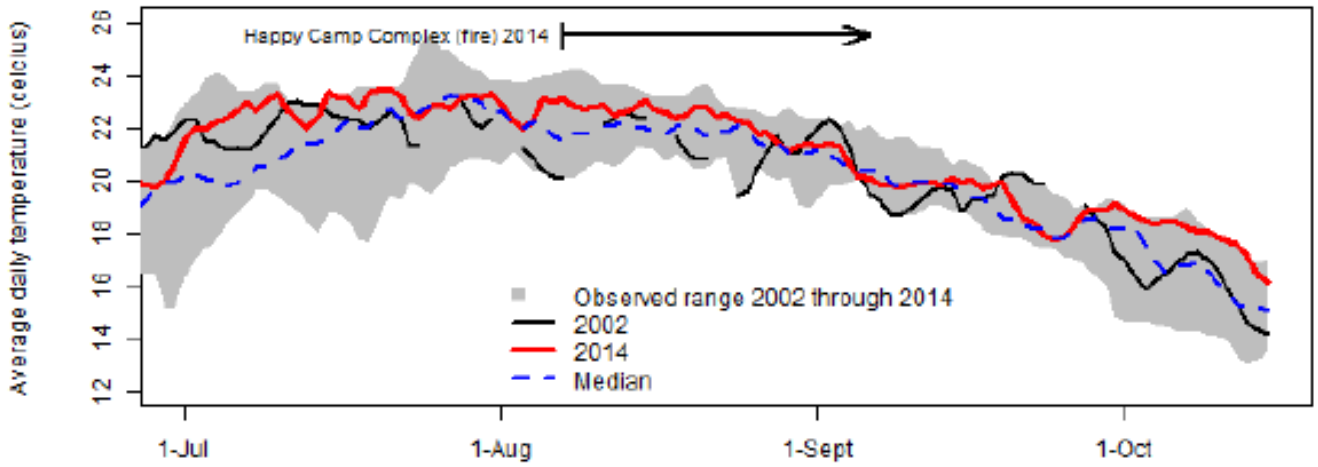

Figure 3: Effect of 2014 Trinity River flow releases to the Klamath River.

Lowering the water temperature is a key element of reducing the risk of a catastrophic fish kill because 1) it can reduce the density of fish by lowering the temperature of the river below migration-blocking temperatures (~22°C), 2) it reduces the disease load in the river by lengthening generation time of the Ich organism. This is extremely important, because if a large number of adult salmonids spend a lengthy amount of time in close proximity, the stage is set for a runaway epidemic and subsequent fish kill.

If cold water is not available from Trinity Reservoir from the cold pool for any reason, including excess diversions to the SWP and CVP, the cold water benefit of the release will be lost and the risk of a fish kill in the Lower Klamath will not be minimized as much from Trinity River releases from Trinity Reservoir.

[3] U.S. Department of Interior, 2017. *Long-Term Plan to Protect Adult Salmon in the Lower Klamath River, Humboldt County, California, Final Environmental Impact Statement*, Executive Summary and Chapter 4, a true and correct copy of which is submitted as Exhibit PCFFA-159.

I declare under penalty of perjury under the laws of the State of California that the foregoing is true and correct, and that I executed this declaration November 27, 2017 in Tully Creek, California.

Michael Belchik