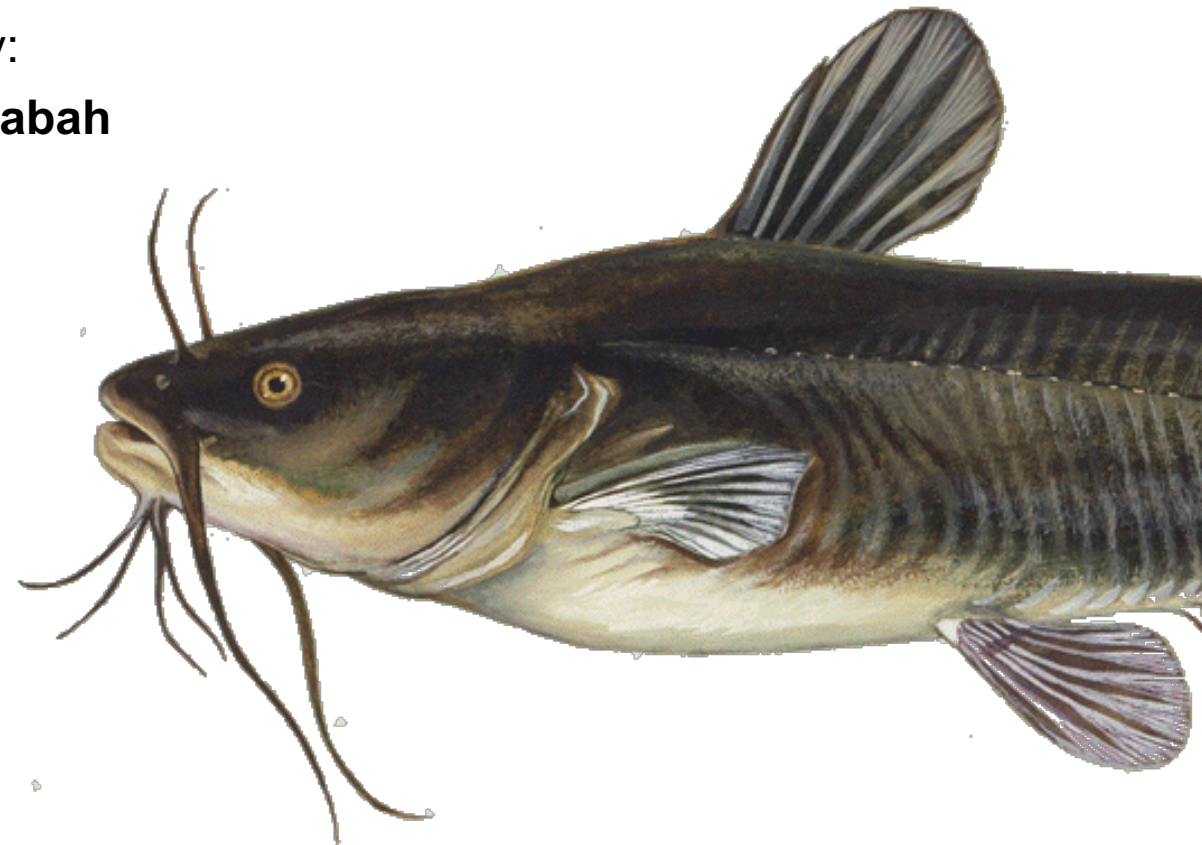
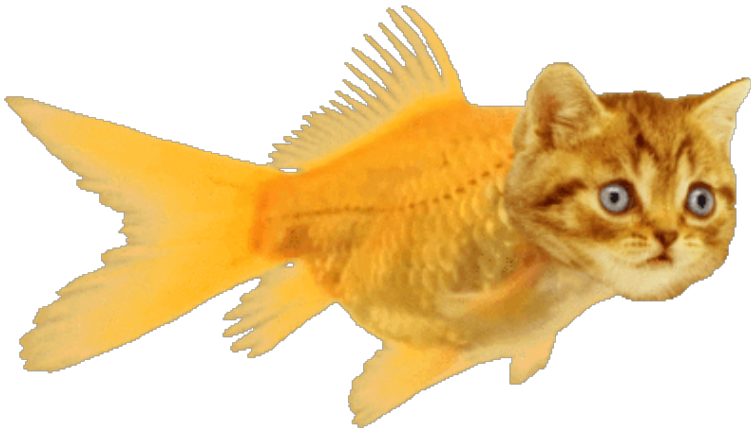


Channel Catfish (*Ictalurus punctatus*)

Introduction to Genomics
0497-485

Presented by:
Muneerah.H.AISabah

Fall
2021

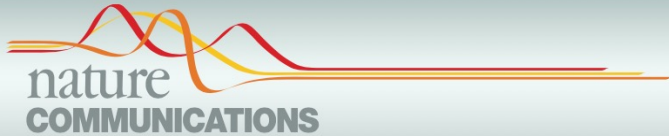


Presentation outline

1. The genome paper.
2. Fun facts.
3. General information about the genome.
4. Sequencing strategy.
5. Sequencing method.
6. Assembly.
7. Genome outcome.
8. Questions.



The Genome Paper



ARTICLE

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OPEN

The channel catfish genome sequence provides insights into the evolution of scale formation in teleosts

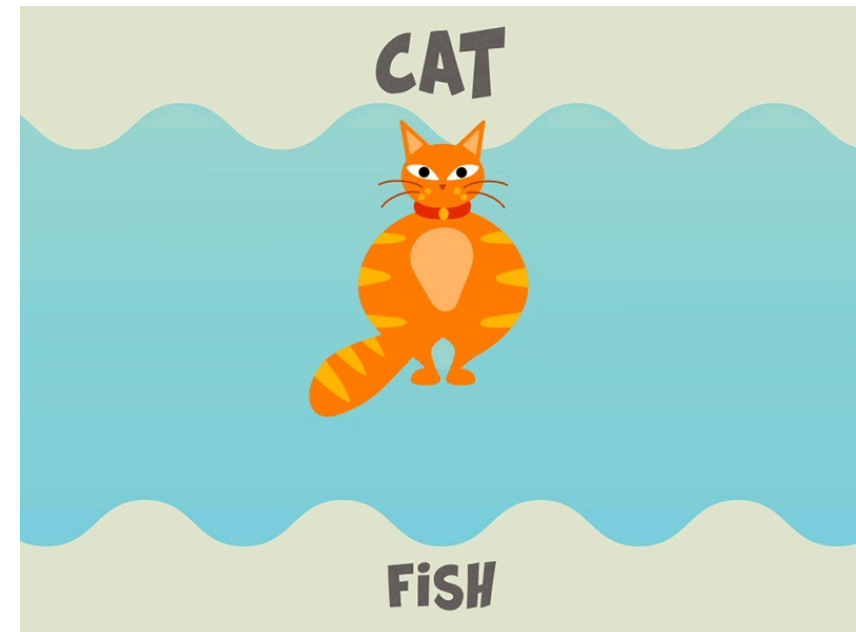
Zhanjiang Liu^{1,*,**}, Shikai Liu^{1,*}, Jun Yao^{1,*}, Lisui Bao^{1,*}, Jiaren Zhang^{1,*}, Yun Li^{1,*}, Chen Jiang¹, Luyang Sun¹, Ruijia Wang¹, Yu Zhang¹, Tao Zhou¹, Qifan Zeng¹, Qiang Fu¹, Sen Gao¹, Ning Li¹, Sergey Koren^{2,†}, Yanliang Jiang¹, Aleksey Zimin³, Peng Xu¹, Adam M. Phillippy^{2,†}, Xin Geng¹, Lin Song¹, Fanyue Sun¹, Chao Li¹, Xiaozhu Wang¹, Ailu Chen¹, Yulin Jin¹, Zihao Yuan¹, Yujia Yang¹, Suxu Tan¹, Eric Peatman¹, Jianguo Lu¹, Zhenkui Qin¹, Rex Dunham¹, Zhaoxia Li¹, Tad Sonstegard^{4,†}, Jianbin Feng¹, Roy G. Danzmann⁵, Steven Schroeder⁴, Brian Scheffler⁶, Mary V. Duke⁶, Linda Ballard⁶, Huseyin Kucuktas¹, Ludmilla Kaltenboeck¹, Haixia Liu¹, Jonathan Armbruster⁷, Yangjie Xie¹, Mona L. Kirby⁸, Yi Tian¹, Mary Elizabeth Flanagan⁸, Weijie Mu¹ & Geoffrey C. Waldbieser^{8,**}

Catfish represent 12% of teleost or 6.3% of all vertebrate species, and are of enormous economic value. Here we report a high-quality reference genome sequence of channel catfish (*Ictalurus punctatus*), the major aquaculture species in the US. The reference genome



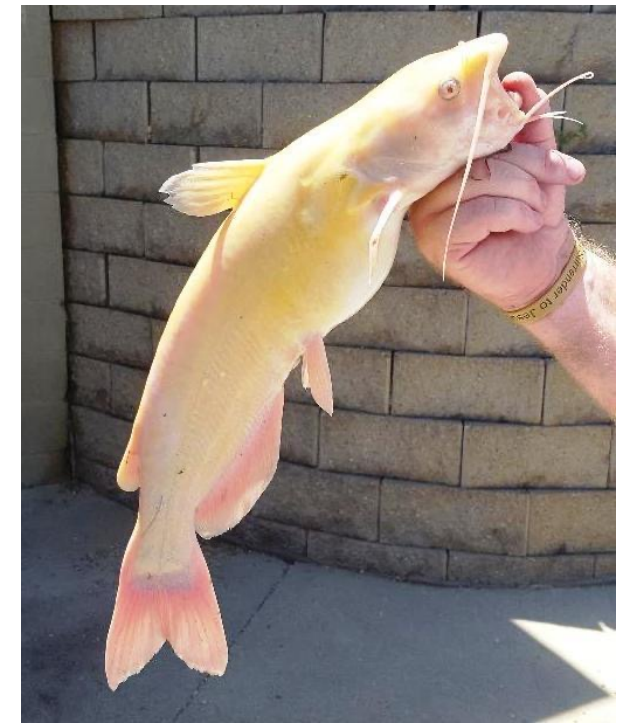
Fun Facts

- The barbels aren't the only place this fish has taste buds. While you might think of your tongue when you hear the word taste buds, this fish actually has them across its entire body!
- The fish uses those taste buds for purposes outside of food, they actually taste each other as well. The catfish release pheromones, or special chemicals, to communicate with one another.
- The world record weight for a channel catfish was a 58-pound (26.3 kilograms) fish caught in South Carolina in 1964.
- It is the official fish of Kansas, Missouri, Iowa, Nebraska, and Tennessee, and is informally referred to as a "channel cat".
- This fish is omnivorous, though most of its diet consists of other animals. They eat a wide range of different foods, and feed on just about anything that is edible.

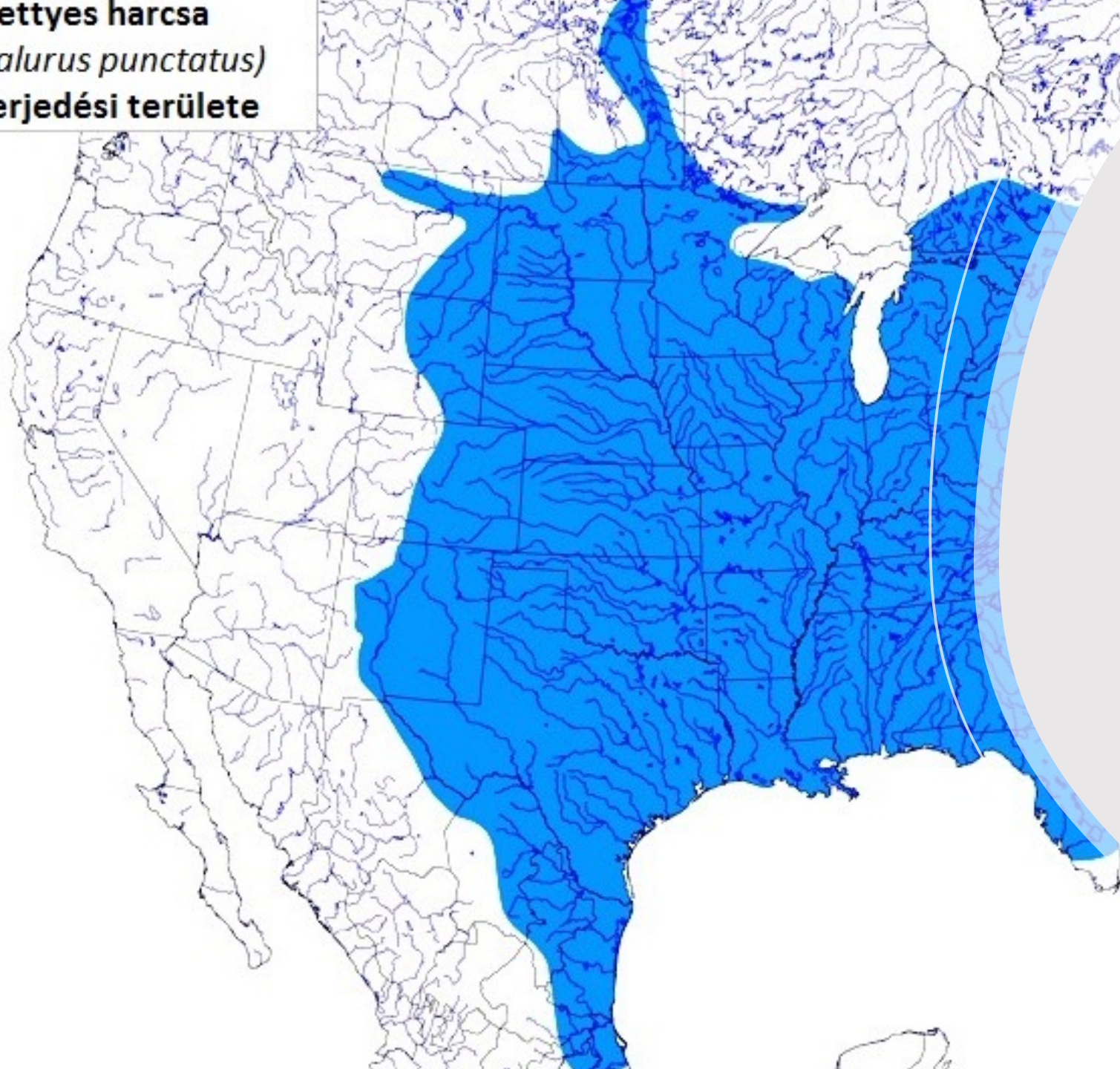


Fun Facts

- A channel catfish can carry the recessive alleles resulting in lack of pigmentation, known as albinism, albino channel catfish have a peach coloration. Some domestic channel catfishs have been bred to carry the recessive albino alleles, which are popular in aquariums and ornamental ponds.
- They have skin instead of scale.
- Their upper jaw is longer than their lower jaw.
- The channel catfish is also known as the channel cat, river cat, willow catfish, spotted catfish, forked-tail cat, lady cat, chucklehead, and sometimes blue cat although there is a blue catfish.
- *Ictalurus* in Greek means “fish cat” and *punctatus* in Latin means “spotted,” although adults often lose their spots.



A pettyes harcsa
(Ictalurus punctatus)
elterjedési területe



Fun Facts

- This fish has an incredibly wide distribution, and they are unbelievably common throughout their range. You can find this fish from the east coast all the way to the Midwest United States and into northeast Mexico. Their range runs from Montana to New Mexico and from Maine to Florida. Humans have also introduced this species to a few regions outside of its native range. You can find populations in parts of Europe, Indonesia, Malaysia, and more.

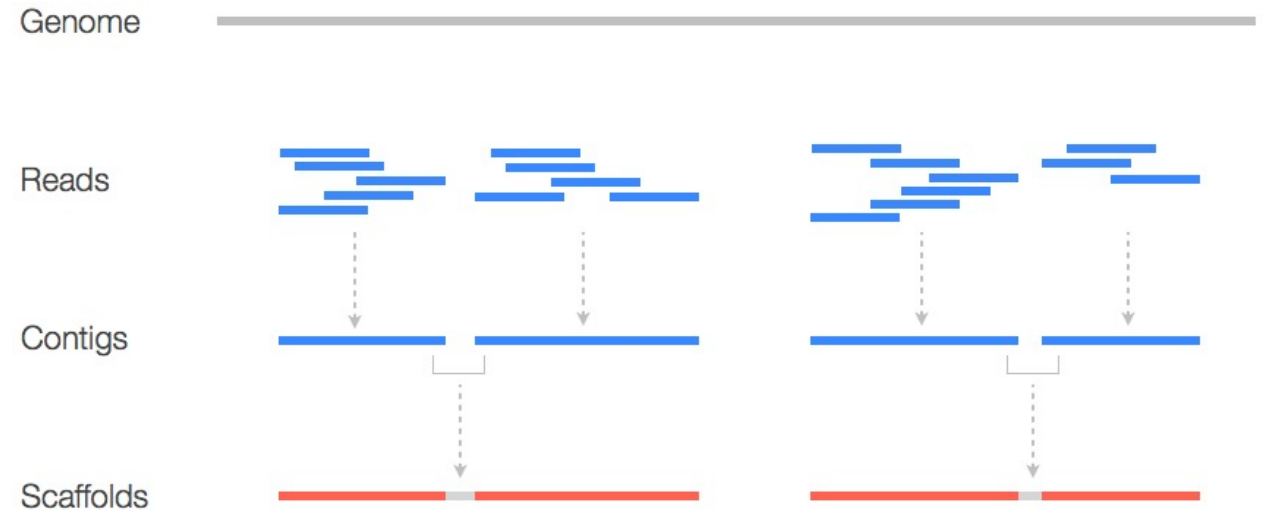
General Information About The Genome

- Genome Size: 1.0 Gb
- Level of ploidy: Haploid Genome
- Chromosome Number: 29 chromosomes
- Protein Coding Genes: 26,661
- GC Ratio: no GC ratio found in the paper
- Repetitive Sequences contigs: 159 Mb
- Number of genes: 34,906
- Average/total coding sequence: 33.8 lengthMb
- Average copy number: 5.3
- Sequencing depth : 98.1×
- Source of sample: A doubled haploid channel catfish individual was used as template for sequencing, and genomic DNA was isolated from blood cells.



Sequencing strategy

- A **scaffold** is a portion of the genome sequence and is created by connecting contigs together.
- **Scaffolds** are composed of **contigs** and gaps.
- A **contig** is a contiguous length of genomic sequence in which the order of bases is known to a high confidence level.



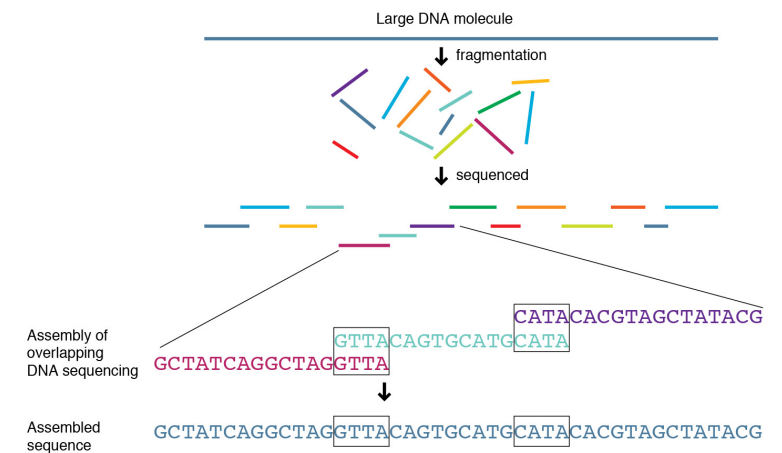
Sequencing strategy

- Illumina TruSeq PCR-Free kit which works by eliminating PCR amplification steps, the PCR-Free protocol removes typical PCR-induced bias and streamlines.
- This results in excellent data quality and detailed sequence information for traditionally challenging regions of the genome.



Sequencing Method

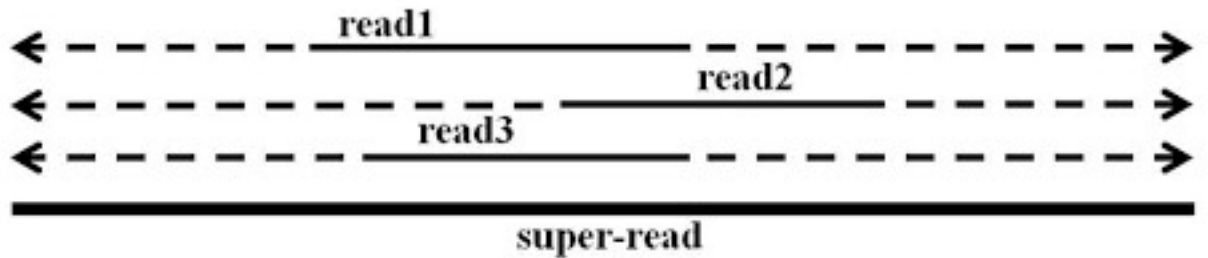
- Illumina HiSeq 2000 platform, which is a computer system that uses the method based on sequencing-by-synthesis (SBS), and reversible dye-terminators that enable the identification of single bases as they are introduced into DNA strands.
- The sequences were error-corrected using the pacbioToCA algorithm within Whole Genome Shotgun assembler v7.0



Assembly

- MaSuRCA (Maryland Super-Read Celera Assembler) which is a genome assembly software. MaSuRCA requires Illumina data, and it supports third-generation PacBio/Nanopore MinION reads for hybrid assembly.

- Clean reads amounting to $98.1\times$ were used to assemble the genome using MaSuRCA.



Genome Outcome

- The channel catfish haploid genome contains 29 chromosomes with an estimated 1.0Gb of DNA.
- The final channel catfish genome assembly included 783Mb in 34,615 contigs and 9,974 scaffolds, with a contig N50 of 77,200 bp and a scaffold N50 of 7,726,806 bp, accounting for 78% of the total genome.
- The assembler collapsed the remaining genome coverage into 159 Mb of repetitive sequence contigs.
- The catfish genetic map contained 54,000 SNPs at 31,387 unique SNP locations along 29 linkage groups.
- 723 genes included in zebrafish were not found in the channel catfish assembly, but 970 genes found in channel catfish were not found in the zebrafish assembly, suggesting a similar level of completeness.
- The channel catfish genome contain 26,661 protein-encoding genes.

	Scaffolds	Contigs
Number	9,974	34,615
Total length	783,193,925 bp	771,933,303 bp
N50	7,726,806 bp	77,200 bp

Genome Outcome

- The largest scaffolds ranging from 7.7 to 22.6Mb, and 98% of the assembly was contained in only 594 scaffolds of at least 28.0 kb.
- The remaining 2% of the genome assembly was contained in 9,380 smaller scaffolds.
- Chromosome orthology between channel catfish and zebrafish was determined and suggests that total number of genes in channel catfish is similar to zebrafish.
- The majority of the assembled sequence (96.8%) was anchored to the 29 haploid chromosomes, the highest among all sequenced fish genomes.
- Analysis of genomic variation revealed more than 8.3 million SNPs across the channel catfish genome, although their distribution varies along its 29 chromosomes.
- Such a SNP rate made catfish one of the species with most highly variable genomes among vertebrate species.

	Scaffolds	Contigs
Number	9,974	34,615
Total length	783,193,925 bp	771,933,303 bp
N50	7,726,806 bp	77,200 bp

Questions

1. How can the channel catfish communicate with each other ?
2. What do catfish's eat ?

