Fisheries and Oceans Canada | Pêches et Océans Canada
Science | Sciences

GENOMICS & BIOTECHNOLOGY RESEARCH

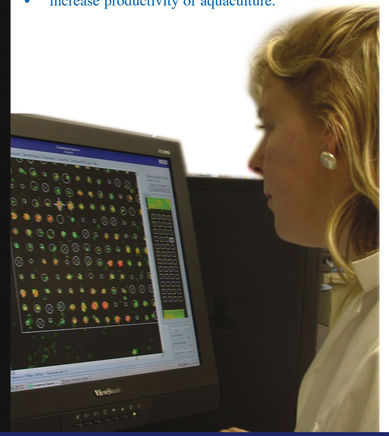
for healthy oceans, sustainable fisheries and aquaculture

Photo Credit Mike Wetklo

Genomics and biotechnology research at Fisheries and Oceans Canada (DFO) is transforming commercial fisheries management, aquaculture development and ocean protection strategies.

Unlocking the genetic secrets of fish, and other aquatic organisms will help:

- identify, track and protect vulnerable species;
- protect the biological diversity of our oceans;
- minimize the impact of disease outbreaks; and
- increase productivity of aquaculture.



what is marine genomics?

Marine genomics is the science of identifying and recording the structure and function of selected genes in fish, shellfish, marine mammals, aquatic plants and other organisms.

Like a fingerprint or a barcode, each living organism has a unique DNA sequence that identifies it. DFO scientists use this barcode to distinguish individuals as well as populations that share similar genetic patterns.

The result? More complete and reliable science information about how marine species live and breed, and how they are affected by environmental changes, such as a rise in ocean temperature or by human activities like fishing and oil spills.

All this information translates into a better ability to support sustainable fisheries and aquaculture and ensure healthy oceans. Here's how.

better science information is helping to ...

... preserve genetic diversity

- One of the four major Fraser River sockeye salmon populations, known as the Late Run, sometimes has a high death rate when it returns to the river to spawn. Genomics tools now enable DFO to quickly and accurately distinguish fish from the different populations and close the fishery when high numbers of Late Run fish are present. This identification of fish returning to the river in "realtime", i.e. not after the season is over, represents a major breakthrough for managing the fishery resources.

... protect vulnerable populations and species

- DFO undertakes "salmon enhancement" – hatching and releasing wild salmon at various ages along different points of a river. Using DNA fingerprinting to track these salmon in the Bay of Fundy allows DFO to determine which mix of age and release location results in the best survival rates.

DNA to the witness stand - more guilty pleas, lower court costs and less illegal harvesting. Courtroom use of forensic DNA analysis is putting poachers in hot water. DNA assays of fillets from restaurants, scales from coolers, smoked or tinned fish pin-point origins of seafood products in question.

- Genetic studies of Strait of Georgia lingcod showed that a clutch of eggs is fertilized by several males. The males would spread out in the vicinity with each guarding a nest of eggs. This breeding strategy helps to maintain genetic diversity. This is useful to keep in mind when designing marine protected areas.

... reduce the impacts of disease and environmental stress

- DFO scientists are using a genetic test that distinguishes between two oyster diseases (MSX and SSO). These diseases do not affect other shellfish or human health. Only the MSX causes high mortality in oysters and has to be controlled by quarantine measures. Farm closures and negative economic impacts can now be limited to the MSX affected areas.
- Genetic tools are helping scientists track migrating fish stocks and assess how they respond physiologically to environmental stress, such as disease, pollution, climate change and habitat degradation. Scientists can pinpoint the genes linked to survival, disease resistance and for example, can eventually estimate if populations can combat certain disease outbreaks.

Photo credit: Mike Wetklo

... improve aquaculture practices

- The aquaculture industry can improve its competitiveness by selecting desirable traits (e.g. disease resistance, growth, etc.) by knowing the genetic makeup of their stocks, instead of waiting for discernable differences to appear over several generations through traditional breeding practices.

... monitor aquatic environmental health

- Tools are being developed to monitor recovery of contaminated sites and the efficacy of remediation strategies.

... this is just the beginning

Robotic systems that can process hundreds of samples in minutes are advancing the pace of research at a rate that was unimaginable a decade ago. This represents exciting potential to strengthen our conservation and stewardship abilities, improve commercial fisheries management, support aquaculture development, and enhance the preservation and bioremediation of the aquatic environment.

want to find out more?

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