# NEW TECHNOLOGY PROVIDES TOOLS TO PROTECT WATER QUALITY

Fish farmers have a vested interest in maintaining ideal water quality. Fish grown in clean water yield a better tasting, healthier product. Water quality and bottom habitat can be impacted near aquaculture facilities when nutrients exceed the site's ecological carrying capacity. However, the ability to avoid these impacts has significantly improved over the past 20 years. Today's farms use modern tools and technology to ensure good water quality. Siting tools, deposition models, high digestibility feeds, optimal pen configurations and farm orientation, and improved feeding through in-pen cameras and sensors all help to ensure minimal impacts to our ocean ecosystem from aquaculture. In addition, most commercial net pen farms have eliminated the use of anti-foulants on nets and are using mechanical robotic net cleaners.

**With proper planning, regulation, and farm management, the risk of nutrient enrichment is very low.**

## LOCATION! SITING IS KEY

Siting farms in well flushed areas with adequate current and depth reduces water quality impacts. Deposition models can predict water bottom impacts based on conditions around a farm site. This allows farms to be planned and operated to avoid excessive nutrient loading and biodiversity impacts.

## PRECISION FEEDING

Better feed formulation and feeding efficiency have resulted in decreased nutrient loading at fish farms. Technologies that reduce feed wastage result in less nutrients entering the environment and fewer total impacts. Using feed cameras, biomass estimation systems, pellet detection or AI algorithms that predict when fish stop eating, reduces environmental loading, increases efficiency, and reduces waste. Likewise, higher quality feeds are more digestible and as a result, fewer nutrients enter the water.

## ASSIMILATION

Water quality problems can occur when nutrient discharges exceed the environment's ability to assimilate it in a healthy manner. When a farm is properly sited and managed, nutrients are assimilated into the food web, meaning they are taken up by the organisms in the water column. As part of the natural cycle of the food web, phytoplankton absorb dissolved nutrients. In turn, zooplankton consume them, which are then feed larger organisms like filter feeders. Deposits on the seafloor are eaten by organisms like worms, crustaceans, sea stars or sea cucumbers or decomposed by microbes.

## CASE STUDY: FOREVER OCEANS

The Nature Conservancy modelled farm waste and nutrient impacts on Forever Oceans' offshore Kanpachi farm in the Bay of Charco Azul, on the Pacific coast of Panama. The farm is sited in deep water with good currents, using cages with a single-point mooring that can be raised and lowered, and a precision feeding system. The results found that Forever Oceans operations will not have a significant impact on the marine aquatic environment.

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