



TUNICATES

A NEW BIOMASS FOR ANIMAL FEED AND CELLULOSE APPLICATIONS

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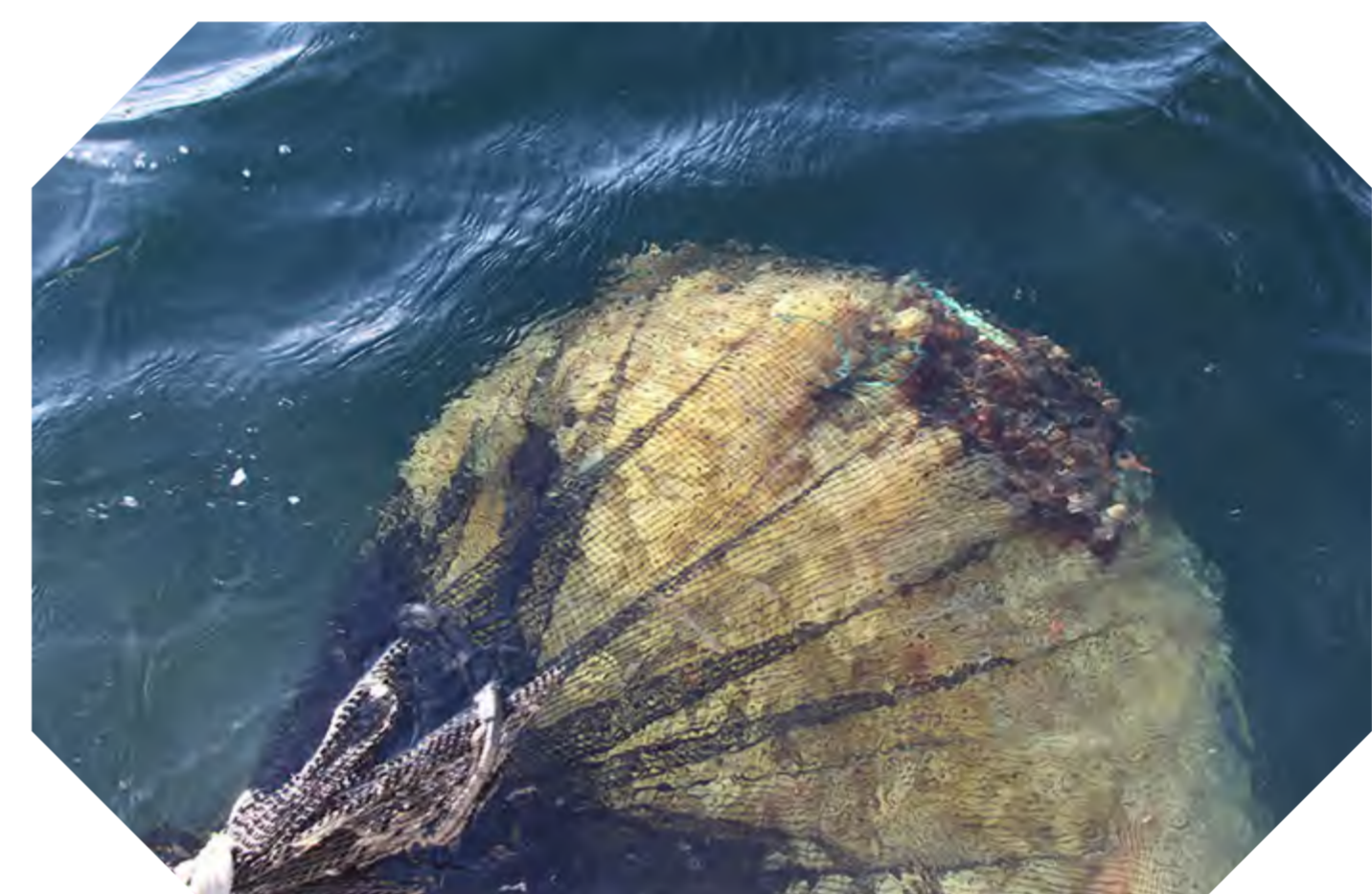
With an exponentially growing human population, there is an increasing demand for feed, energy and material as well as a drive for environmentally sound and sustainable manufacturing technologies. To meet future demands, we need to find new sustainable biomass resources. Tunicate ascidians encompass a large and unutilized biomass resource in the marine environment. Tunicates have an efficient filtration capacity of living and dead particles over a large size range and can attain large densities in mariculture.

1. SETTLEMENT AND GROWTH



- 200-450 kg WW/m² surface growth area
- Monoculture: *Ciona intestinalis*
- 6 month growth cycle

2. HARVESTING



- Harvestable biomass in the top 30 m.
- Annual production: 250 ton DW/hectare
 - One harvest/yr
 - 6 month harvest window

3. PROCESSING



- Efficient removal of water
- Separation: inner animal and tunic
- Inner animals = 75% protein, Tunic = 45% cellulose
- *Ciona* cellulose is free of lignin and hemicellulose

4. PRODUCTS

A. Animal feed

75% protein in the inner animal fraction as an ingredient in animal feed



B1. Biofuel

45% cellulose in the tunic fraction for bioethanol production



B2. Cellulose and nanocellulose

Higher crystallinity, longer and wider fibrils, and larger reactive surface than woody cellulose



Evaluation: Through efficient biomass production, harvesting, processing and documentation of products we have a new marine resource for 1) animal feed (from inner animal) and 2) biofuel or other cellulose/nanocellulose products (from tunic). High productivity coupled with efficient nutrient and energy uptake at the base of the food web, suggests that suspension feeding tunicates have promise as a sustainable large scale biomass resource.

