measurements and evaluations are being made at smaller test.beds in the southern part of Puget Sound and on the Ocean Coast.

Concurrent with the experiments in natural seeding, Dr. Waaland has investigated methods of growing seaweed in laboratory conditions. It was during early attempts at tank culture of seaweed that the importance of moving water to the survival of the plants became apparent.

"In the preliminary experiments in the spring of 1973, we used cylindrical tanks with no provision for agitating the water or the plants," Dr. Waaland said. "There was little or no growth. Within a few weeks the plants had deteriorated."

Since that time, experiments have been conducted using tanks with constant aeration. "We believe the water motion near the plant surface replenishes nutrients in the boundary layer immediately adjacent to the plant surface," Dr. Waaland said. "The addition of aeration almost immediately increased the yield — by about six times — over the net cultured plants, although the rate of yield from net cultures now is catching up to the tank cultured plants."

The use of tanks for growing seaweed offers the possibility for selection of strains with commercially-desirable characteristics, such as rapid growth, Dr. Waaland said. In some cases it may also be possible to increase the plants' carrageenin content by manipulation

Dr. Tom Mumford, Department of Natural Resources marine biologist, examines seaweed growth on a naturally-seeded test bed net.

of the nutrient content of the water. Laboratory or control situations also are used to measure the optimum light, either natural or artificial, necessary for strong plant growth and to test measures for discouraging growth of other naturally present but less desirable species that can rob seaweed of nutrients.

Dr. Mumford and Dr. Waaland agree that solutions to the biological problems involved in seaweed farming are within reach. But there are still technical and socio-economic barriers to be hurdled before seaweed farming can progress from research to commercial venture. Chief among these is the problem of harvesting. "What we're looking for is a sort of sea-going combine," Dr. Mumford explained. The best machine, he noted, would be able to separate the seaweed blades from the nets and then draw them to the surface to a waiting barge.

Carrageenin extracted from this seaweed has a variety of commercial uses, including food processing, paint manufacture and the making of toothpaste.

Both researchers feel that seaweed farming would be a beneficial use of the state's tidelands resource. "We would be encouraging private industry to come in and use state-owned bedlands for this purpose in exactly the same way sharecroppers use the state's agricultural lands. That's definitely within the

charge of responsibility to the Department (of Natural Resources)," Dr. Mumford said. According to Dr. Waaland, the bulk of the tidelands suitable for seaweed farming are not utilized for other marine resource activities, such as clam beds. And because generally shallow waters would be utilized, there would be little or no interference with recreational use of the water, such as boating or fishing, Dr. Mumford noted.

A U.S. market for the seaweed's carrageenin extract already exists and currently is being met by imports from countries such as the Philippines and Chile, where wild stocks are harvested using inexpensive local labor. With the establishment of a stable domestic market for the carrageenin-producing species, new uses and markets could be opened up.

"Food production from seaweeds is only one possibility. The Japanese already consider it an everyday food," Dr. Mumford said. He noted that there are at least 30 edible types of seaweed that can be grown in Washington waters.

Seaweed is considered an excellent source of iodine and vitamins. In addition to carbohydrates, fats, and proteins, seaweed contains vitamins A, B-complex, and C, sodium, iodine, and trace elements.