

# Commercial seaweed farming of *Asparagopsis armata* on the west coast of Ireland: impact and distribution

Robert Wilkes, Kelly Barrington and Stefan Kraan

Irish Seaweed Centre, Martin Ryan Institute, National University of Ireland, Galway, Ireland

## Introduction

*Asparagopsis armata* was introduced into Europe from the Southern Hemisphere, probably Australia. It was first recorded in Europe in 1925 at Cherbourg and Biarritz and was identified in Ireland in Galway Harbour in 1939. *Asparagopsis* has a bi-phasic life history with two morphologically different stages in its development (Fig. 1). The tetrasporophyte is a bushy, many branched filamentous seaweed occurring in dense cotton-wool-like tufts up to 15mm in diameter. It occurs all year round but is most obvious from October to March. The male and female gametophytes occur from June to September and are bushy thalli with a cylindrical axis up to 1 mm wide and 200 mm long, arising from bare creeping stolons. The lower branchlets are differentiated into characteristic harpoon-like barbs (Fig. 2). They have an apparent association with *Ulva* species but may also be found free-floating. Drift thalli readily attach to various substrates using the barbed branches. No herbivores are known to eat this species and it contains strong bromo-phenolic compounds which gives out a strong smell as the seaweed decays. Since its appearance in Ireland in 1939 the species has become more widely distributed on Western and Southern coasts of Ireland, its present distribution is shown in Figure 3.

*Asparagopsis* has recently been identified as a species with commercial value. Interest from European cosmetics companies has led to the establishment of a commercial aquaculture facility in Connemara, Co. Galway, in 1998. This 1 hectare facility propagates the gametophytes on long-lines (Fig. 4) and has the capacity to produce up to 2 wet tonnes of *Asparagopsis* per year. The lines are seeded with fragments of wild thalli which spread along the substrate by vegetative propagation/fragmentation.

The aim of this study was to determine the extent of and explain the distribution of *A. armata* in Irish waters. The presence and abundance of the seaweed in the vicinity of the seaweed farm was also investigated to determine if the aquaculture operations were impacting on the local environment.

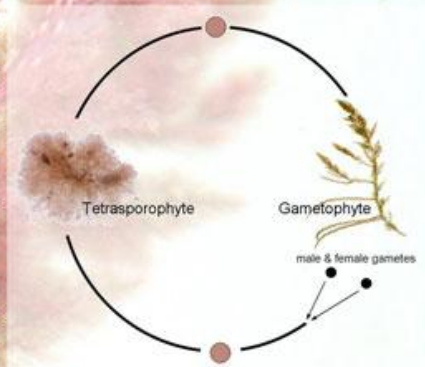


Fig. 1. Bi-phasic life cycle of *Asparagopsis armata*



Fig. 2. Barbed branchlets

## Materials and Methods

SCUBA surveys were undertaken around the coast of Ireland to look for *Asparagopsis armata*. Ard Bay, Co. Galway, location of the commercial seaweed farm, was examined on a monthly basis from April through September. Random quadrants were used to determine the abundance of the tetrasporophytic Falkenbergia-phase, in Ard Bay. Twelve random quadrants per dive were used. The epiphytic associations of *A. armata* in Ard Bay were also examined. Vegetative growth was monitored in the lab under a variety of different conditions. Relative growth rates of the thalli were calculated during their exponential growth phase. Preliminary

results for the effects of temperature are shown in Figure 5.

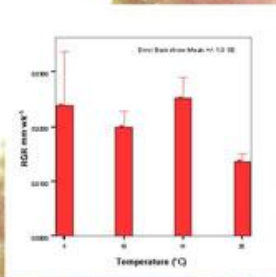


Fig. 5. Growth rates of *Asparagopsis armata* at different temperatures



Fig. 4. Long-lines seeded with gametophytic thalli of *Asparagopsis armata* for commercial cultivation

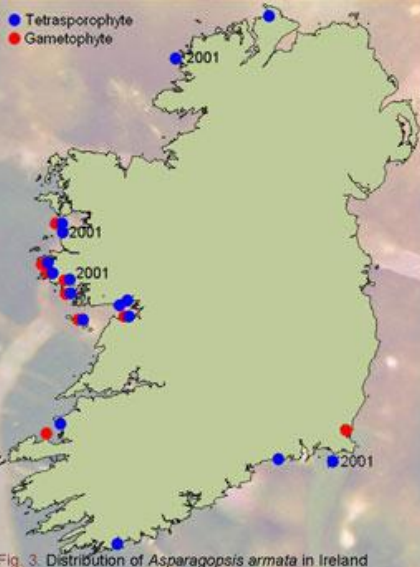


Fig. 3. Distribution of *Asparagopsis armata* in Ireland

Tetrasporophyte Location	Date	Reference	Gametophyte Location	Date	Habitat	Reference
Galway Harbour (Co. Galway)	1939	Drew 1950	Muigh Inis (Co. Galway)	1941		Drew 1950
Mutton Island (Co. Galway)	1943	Herbarium NUIG	Ballynakill Harbour (Co. Galway)	1941	Drift in 1941, attached in 1942	Herbarium NUIG & De Valera 1942
Aillebrach (Co. Galway)	1944	Herbarium NUIG	Clifden (Co. Galway)	1943		Herbarium NUIG
Lough Hyme (Co. Cork)	1949	Drew 1950 & Guiry et. al. 1979	Aran Islands (Co. Galway)	1944	Drift	Herbarium NUIG
Garrarus (Co. Waterford)	1950	Herbarium NUIG	Crossfintan Point (Co. Wexford)	1970	Attached	Guiry et. al. 1979
Carndonagh (Co. Donegal)	1957	De Valera 1957	Fahamore (Co. Kerry)	1972	Attached	Herbarium NUIG & Guiry et. al. 1979
Salthill (Co. Galway)	1957	Herbarium NUIG	Finavra (Co. Clare)	1972		Herbarium NUIG
Ballyheigue (Co. Kerry)	1959	Guiry et. al. 1979	Clare Island (Co. Mayo)	1990	Drift in 1990, attached in 2001	Herbarium NUIG
Inish Boinn (Co. Mayo)	1962	Herbarium NUIG	Kingston Bay (Co. Galway)	1997	Growing on mael bed	Herbarium NUIG
Bantry Bay (Co. Cork)	1973	Guiry et. al. 1979	Ard Bay (Co. Galway)	2001	Both drift and attached	Herbarium NUIG
New Quay (Co. Clare)	1994	Herbarium NUIG				
Ard Bay (Co. Galway)	2001	Herbarium NUIG				
Clare Island (Co. Mayo)	2001	Herbarium NUIG				
Aranmore Island (Co. Donegal)	2001	Herbarium NUIG				
Little Saltee Island (Co. Wexford)	2001	Herbarium NUIG				
Blacksod Point (Co. Mayo)	2001	Herbarium NUIG				

Fig. 6. *Asparagopsis armata* gametophytes are present all year in Ard Bay, but the population reaches its highest levels during July. There were just as many plants growing epiphytically in Ard Bay as there were growing attached directly to the rocky substrate. The epiphytic thalli were primarily found in association with *Ulva*. The precise mechanism of attachment between *Asparagopsis armata* gametophytes and the *Ulva* thalli is unknown; however, the most obvious method would be via the barbed branchlets coming into contact with the blade.



## Discussion

Although previous reports have found the gametophytic phase of *Asparagopsis armata* at a number of sites around the Irish coast, recent surveys have only found these thalli within a 75 km radius of the commercial farming operation in Ard Bay, Co. Galway. Past reports are likely to have been short lived introductions that failed to thrive due to unfavourable environmental conditions. Further investigations are needed to fully understand the environmental optima for the growth and reproduction of this species. Initial data suggest that while Irish conditions are favourable for growth, reproduction is inhibited by low seawater temperatures. The only established populations of the gametophytic thalli are found close to the aquaculture facility suggesting that it is this operation that is providing the source material. However, despite the presence of the tetrasporophytes at other locations no other gametophytic populations were found around the Irish coast. The current distribution of *A. armata* is probably sustained through asexual reproduction from the source population used in the seaweed farm.