Marsh Rehabilitation on the Fraser River Estuary: A Pilot Project

by

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Introduction

Transplantation of marsh vegetation as a means of habitat stabilization and rehabilitation has been carried out in estuaries and rivers of the United States for some time. However, little use has been made of this technique of estuarine rehabilitation in Canada. The present pilot study was undertaken to: (1) determine the best method for collecting, transporting and planting marsh vegetation; (2) identify the best species to transplant into an area and; (3) identify factors (physical, chemical and/or biological) which may influence the success of transplantation. This report presents some preliminary findings after one season's growth in 1979.

Methods

Three sites were selected on the estuary representing different habitat types within the range of 2.5-3.5 m above chart datum (Table 1, Fig. 2). This elevation is suggested as having optium submergence/emergence ratios for marsh vegetation selected as transplant species (*Carex lyngbyei*, *Scirpus americanus* and *S. maritmus*) common on the marsh.

Donor sites were matched as closely as possible to transplant sites with respect to sediment grain size, salinity and organic content, percent water content as well as elevation. The donor site for Iona posed the greatest problem in trying to find an area of high enough salinity. An area off Lulu Island at the foot of Francis Street was selected, having the highest salinity in the *Scirpus* zone on the foreshore (Fig. 2).

Carex was taken from Steveston Island for Iona as a trial in long distance, wide salinity range transplants. Transplant material for the other 2 sites came from Steveston Island, requiring short distance transport (Fig. 1).

Transplants were carried out in January and February when marsh vegetation was dormant. Sediment plugs 10 x 15 cm (1 kg) were taken at low tide at 1 m intervals, placed in herring skiffs and towed to the transplant site at high tide. On the following low tide, the plugs were planted at 1 m intervals. Snow fence was initially placed around the quadrats to stop washout of the newly planted plugs. However, the fence was removed by wave action and as few plugs washed out, was considered unnecessary.

Monitoring of donor and transplant sites is continuing as outlined in Table 2.

Results and Discussion

Donor Sites

It is very apparent that in order to minimize any adverse effects of plug removal, donor sites must be selected carefully. Soft, sandy substrates such as on the river side of Steveston Island make excellent donor sites, the holes filling almost immediately after plug removal. However, there is some problem with maintaining the cores intact during transportation. The next preferred type of donor site is one of soft sediment away from hummock areas. The inside of Steveston Island (*Carex*) and the Francis Road site (*Scirpus*) are representative. In these areas the effects of plug taking and tramping in the soft, fine sediments were evident for about 1½ - 2 months after which no signs were present that plugs had been removed from the area.

The least desirable area for plug removal is firm hummocks (i.e. foreshore of Lulu Island). On these areas the plug holes were still evident 6 months after plug removal, only being about 3/4 filled by sediment. There were even a few cases of plug holes joining to form small pools (ca. 0.25 m across) at this time. However, 9 months after plug removal holes on the hummocks had filled in and pools which had been created were not getting larger.

Transplant Sites

At the Steveston Island and Albion sites growth of transplants was very successful while at Iona only minimal short term growth occurred. Lack of growth in the latter is attributed to high energy (waves), compact sediments and high salinity (> $15^{o}/oo$). Of these, salinity appears to be a major factor with shoots of *Carex lyngbyei* and *Scirpus* spp. requiring a low salinity period for initiation of growth. The seasonal salinity patterns at Steveston Island donor site and the Steveston and Albion transplant sites were quite similiar (Fig. 3). Salinity at Albion began to rise in July - early August with an accompanying decrease in growth and health of the plants. The Francis Road donor site off Lulu Island with a high salinity during the transplant period in January had a significant salinity drop during the summer growth period. Iona did not have this salinity drop. These results suggest that salinity is important in initiating and determining the duration of growth.

The number of transplanted plugs growing continued to increase, reaching a mid-summer maximum of both transplant species (Table 3). At the Albion site success of *Scirpus* and *Carex* plugs were about the same, reaching 75 and 71%, respectively in July. Little elevation effect was evident aside from September when *Scirpus* plug growth increased from 27% in the lowest elevation row to 82% at mid quadrat. Plug success on Steveston Island was comparable, with maxima of 71% for *Scirpus* and 67% for *Carex* in July (Table 3). Elevation effects were clear for *Carex* (31% to 87% per row at the highest elevation).

Transplant plugs of *Carex* and *Scirpus* on Steveston Island had greater shoot density per plug compared to those at Albion (Fig. 4). *Carex* rose from an initial planting density of 3 to a mean of 14 at Steveston and 11 at Albion. *Scirpus* plugs had a mean of 9 shoots at Steveston and 5 at Albion during the period of maximum growth. Although the plug success at both sites was about the same, as previously noted, there does appear to be a restriction of growth at Albion. A salinity increase beginning in July when shoot density levelled off may be responsible.

Mean shoot height for *Carex* (40 cm) was ca. 1/3 - 1/4 that recorded at the donor site. A similar reduction in height was noted for *Scirpus*, about ½ that in the donor site. This is to be expected as the plants are acclimating to a new environment, putting a greal deal of energy into rhizome and root growth. The mean shoot height for both transplant species appears to be higher at Albion (Fig. 4). This, however, may not be the true situation since waterfowl appeared to be grazing the plants at Steveston much more than at Albion.

Rhizome extension is an indicator of good growth and potential for stabilization and cover. Extension by *Carex* was about half that recorded for *Scirpus* and *Eleocharis palustris*, a "contaminant" species in the plugs (Table 4). The latter two plants had such extensive rhizome growth that the 1 m area between plugs was filling in rapidly after one season. In view of extension rates, *Scirpus* and *Eleocharis* would appear to be good for stabilizing substrates initially. *Carex* with its lower rhizome extension and greater above surface biomass would be less valuable for stabilization but of greater importance as a source of organics and detritus. *Carex* also acts as low tide refugia for amphipods with none being recorded from around *Scirpus* within the same quadrat. Benthic algae (filamentous forms) became entangled in the *Carex* shoots and began extensive growth around the plugs.

As yet the data on sediment chlorophyll, organic and C/N content and microalgal colonization have not been worked up. These and a more detailed discussion of results presented above will appear in a future publication. To date, results indicate that it is feasible to carry out transplants on the Fraser estuary using techniques outlined. Good growth can be expected by selecting donor and transplant sites carefully.

Tidal re-activation and salmonid utilization of a portion of the Englishman River Estuary, Vancouver Island, British Columbia

by

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The knowledge of the importance of estuarine habitat for rearing fry of the chum salmon, (*Oncorhynchus keta*), has gradually evolved (e.g. Mason 1974; Healey 1979; Sibert 1979). Delayed seaward movement from spawning streams may be of adaptive value to chum fry if associated with sufficient epibenthic food prey items and covering habitat in estuaries. The Englishman River estuary located at Parksville, Vancouver Island, B.C. was the location of a rehabilitation program to tidally re-activate a previously dyked and alienated estuarine slough habitat in the northern portion of the Englishman River flats. In 1969 a sea dyke had been constructed that cut off 218 acres (88 ha) from tides $\geq$ 16 ft (4.9 m) over chart datum. On March 27, 1979 a 10 meter breach was excavated in the sea dyke so that tidal inundation would once again occur.

The main purpose of this study was to rehabilitate the estuary and ascertain whether any juvenile salmonids would gain access and utilize this new habitat. Also the succession of epibenthic and benthic invertebrate communities was measured inside and adjacent to the breached dyke so that dietary selection by salmonids captured during the study could be better understood. A series of fish trapping and benthic sampling surveys were completed to assess whether salmonid rearing occurred in the re-activated estuary. Significant rearing by chum fry did occur during April and May 1979 and the prey found in their stomach contents appeared to be most representative of invertebrates found in the epibenthos of the re-activated estuary.

LITERATURE CITES

Healey, M.C. 1979. Detritus and juvenile salmon production in the Nanaimo River estuary: I. Production and feeding rates of juvenile chum salmon (*Oncorhynchus keta*). J. Fish. Res. Board Can. 36: 488-496.

Mason, J.C. 1974. Behavioural ecology of chum salmon fry in a small estuary. J. Fish Res. Board Can. 31: 83-92.

Sibert, J. 1979. Detritus and juvenile salmon production in the Nanaimo River estuary: II Meiofauna available as food to juvenile chum salmon. J. Fish. Res. Board Can. 36: 497-503.