fish. This increase was also reflected in the greater numbers of embryos carried for given size in the European stock.

In the spiny dogfish the reproductive commitment of energy reserves in terms of total embryo and ovary weight to maternal weight is about 10%, which is similar to that of such marine teleosts as cod, herring or flatfish in which the mature ovary weight is about from 8% to 20% of maternal weight. Such teleosts are reproductive opportunists, spawning many thousands or millions of very small eggs so that some larvae may disperse successfully to nursery grounds; in strong contrast, during the course of their very long evolution, the elasmobranchs have tended to produce a few eggs (often with a period of retention in the uterii) allowing large embryos to develop having good chances for individual survival. The Maine dogfish well illustrates this selection for survivorship. The European dogfish appears to have departed in part from the elasmobranch strategy, females mature at a much smaller size, the total weight of embryos carried is greater for fish of comparable size and this reflects an increased number of embryos.

These differences in reproductive capacity are the ones which might be expected in a population which must restabilize rapidly or risk devastation in the face of heavy predation (in this case commercial fishing). The differences in fecundity of dogfish under conditions of reduced population numbers appear to fit a suggestion by Cody (Evolution, 20:174, 1966), that as the environment becomes less stable, and populations are held at low levels, then individuals would be less often faced with competition for resources. Under these circumstances, selection would favour the ability to multiply quickly, i.e., would favour increased fecundity rather than survivorship.

It would be curious if the intervention of man in recent decades were to begin a compensatory reversal of a reproductive strategy developed by elasmobranchs during the course of a long evolution.

During the summer of 1976, spiny dogfish became Maine's newest European export, and some 200,000 pounds of flesh were shipped overseas; it is planned to expand the fishery (Press Herald, Maine, 9/27/76). Records of the few commercial fisheries for elasmobranchs to date present a gloomy picture - initial exploitation was followed by rapid fall in catches to the point of collapse of the fishery. This could easily be repeated again. Further work is needed to clearly establish population parameters before the Maine fishery becomes established.

I am most grateful for the help given to me by P. M. J. Woodhead, A. M. Guarino, R. Woodhead and C. Woodhead.

TWINNING IN THE SPINY DOGFISH, *Squalus acanthias*

A. D. Woodhead, Brookhaven National Laboratory, Upton, New York

Uniovular (monozygotic) twins are a regular, though infrequent, feature of reproduction in most vertebrate classes and there is an extensive literature on spontaneous twinning in mammals, birds and amphibia. Twins are fairly common in teleost fishes, although monsters often are produced, in which there is duplication of only a part of the body; these monsters occasionally survive. Twinning appears to be a very rare event in elasmobranch fishes. Amongst the 270 mature females collected during the summer of 1976, however, we found one female bearing twins.

The female was large, weighing 7.8 kg and was 101 cm in length. The twins, females were carried in the right uterus, together with 4 female siblings. There were 5 embryos, 3 females and 2 males, in the left uterus. The twins and an embryo from the right uterus are shown on the accompanying plate and a size comparison is given below.

	Length cm	Weight, g		Yolk
		Body + Yolk	Body	
Twins	18	72 (together)	21 & 25	26 (together)
Sibling (mean of 2 embryos)	21	71	35	36

The fish were collected in July, about 5 or 6 months before the expected birth of the embryos. From the relationship between weight of the yolk sac and length of the embryo given by Templeman (Dept. Nat. Resources. Res. Bull., 5:1, 1941) for spiny dogfish caught in Newfoundland waters, we can estimate that the litter mates, at birth, would measure approximately 31 cm. This value is well in the upper size range for dogfish young at birth. From the same projection, the twin embryos might be 22 cm when born. This value is the lowest size at birth recorded by Templeman, although it is not unusually low for other populations of spiny dogfish. Thus the size at birth for spiny dogfish caught off the State of Washington average 26 to 27 cm (Botham, Sandford, Blegg & Bucher, U.S. Fish & Wildlife. Biol. Rep., 49:83, 1944) and ranges from 23 to 25 cm for populations in the English Channel (Ford, J. Mar. Biol. Ass. UK, 22:468, 1921). Despite their smaller size the twins were well

developed and showed no abnormalities. They were not attached to each other at any point on the body; the only mutual attachment was to the yolk sac, a non critical position. The twins may well have survived.

RESULTS OF DOGFISH COLLECTIONS: FRENCHMAN BAY, 1976

A. D. Woodhead, P. W. Eichenholz, and A. M. Guarino, Brookhaven National Laboratory, Upton, N.Y. and National Cancer Institute, Bethesda, MD.

In connection with studies on the reproductive ecology of the spiny dogfish, *Squalus acanthias*, a tally was made of the sex distribution in catches at selected collecting stations. The stations were selected by the collecting crew as most likely to provide good catches with some preference for the larger (female) specimens required by investigators.

Fish were caught on 100 foot trawl lines set in 30 or 60 feet of water on muddy or sandy bottoms and left for two to three hours. Hooks were spaced 12 inches apart on 2½ foot leaders and baited with aged salted herring. Five to thirty fish were caught per setting, with an average of 10 to 15. During the period June - August, 40 to 50 trips were made with 2 or 3 trawl lines being set. In addition to dogfish, skates (*Raja erinacea*) were frequently caught and conger eels (*Leptocephalus conger*) and sculpin (*Myxocephalus sp.*) occasionally.

Stations surveyed are shown in Figure 1. A summary of the season's results for various periods follows.

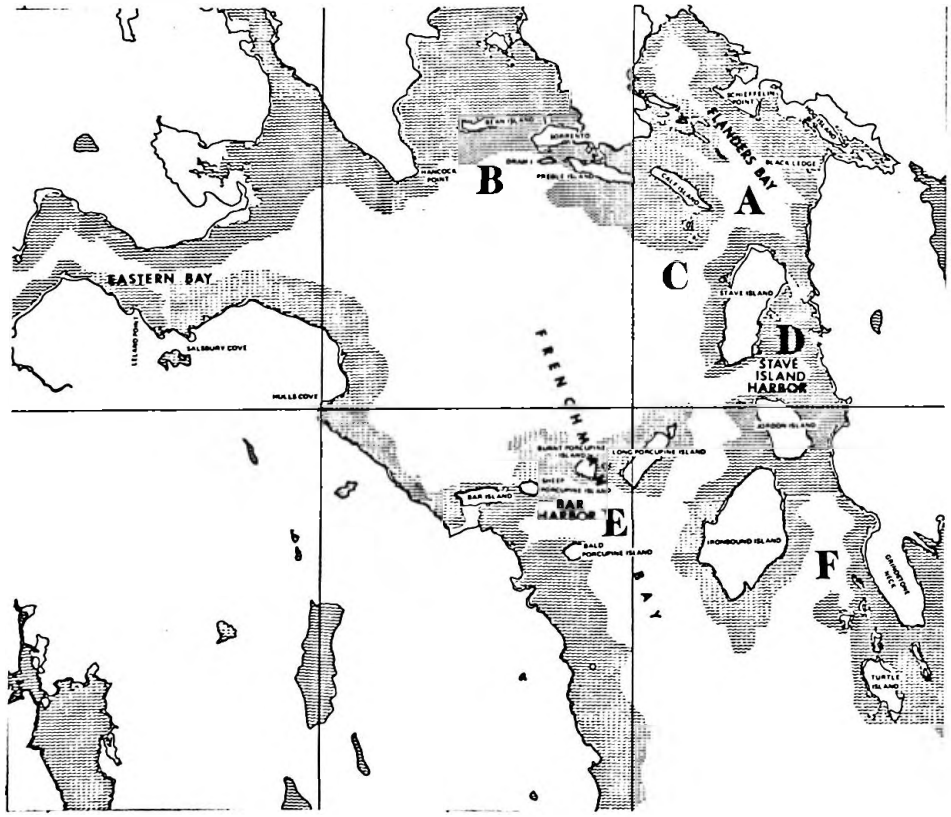

Figure 1. Collecting areas 1976: Frenchman Bay, 68° W. Long. 44° N. Lat.