DEPARTMENT OF AGRICULTURE FOR N. IRELAND
AGRICULTURAL AND ENVIRONMENTAL SCIENCES DIVISION

CRUISE REPORT: LF/18/99: SMALL CLUPEOIDS SURVEY

VESSEL: R.V. *Lough Foyle* (DANI) **DATES:** 3 - 7 May 1999

AREA OF OPERATION: Western Irish Sea ; ICES Division VIIa

TYPE OF SURVEY: Acoustics / midwater trawling / Gulf-7 plankton

PERSONNEL:

M. Armstrong	(DANI; S.I.C.)
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OBJECTIVES

1. To quantify food selection and intake of sprat and juvenile herring in the western Irish Sea, with particular reference to predation on eggs and larvae of commercial fish species.

2. To estimate the biomass and population structure of sprat and juvenile herring in the study area.

3. To investigate competition for resources between sprat and juvenile herring.

4. To investigate reproductive parameters of sprat.

METHODS

Phase 1 acoustics: A calibrated Simrad EK-500 acoustic system with 38 kHz split-beam transducers mounted in a towed body was employed to carry out echo integrations during daylight along transects in the western Irish Sea (Fig. 1). Instrument settings used during the survey are given in Table 1. Data were collected in 15-minute intervals (approximately 2.5 n.miles at survey speed of 10 knots). Echo integration data were recorded using Simrad EP-500 software, and backed up daily on duplicate digital tapes. Position and trawl data were captured on standard Excel spreadsheets. Acoustic targets were identified by means of aimed tows of a Maritin 54m x 47m midwater trawl fitted with a 20-mm stretched-mesh liner and a Furuno netsonde. Species compositions and length frequencies were recorded from all trawl catches. Length-weight parameters were estimated for all fish species contributing significantly to the acoustic integrals. Samples of sprat and juvenile herring were frozen for diet analysis. Sprat with hydrated oocytes were preserved in buffered formaldehyde solution for fecundity studies.

Phase 1 plankton sampling: Plankton was sampled during darkness at 18 stations within the area of the acoustic survey (Fig. 2). A Gulf-7 sampler fitted with a 40cm nose cone, 270 micron mesh net, and internal and external flowmeters was deployed in a double-

oblique haul to near the seabed at each station. Gulf-7 deployment and oceanographic variables (net depth, flow rate, temperature, salinity and fluorescence) were recorded using the PRO-NET system. Plankton samples were preserved in buffered formaldehyde solution.

Phase 2: An area with high densities of sprat was identified. At 6-h intervals, densities of sprat and juvenile herring were estimated acoustically along three 0.75 n.mile transects at 0.25 n.mile spacing (Fig. 3). The targets were then sampled by midwater trawl. Two Gulf-7 tows were carried out between each acoustic transect, one to the seabed and the second to midwater.

CRUISE NARRATIVE

The vessel departed from Belfast Harbour at 22h.00, Sunday 2 May, and proceeded overnight to the start of transect 1 where the Phase 1 acoustic survey commenced at around 07h.00 on Monday. Transects 1 to 6 were surveyed, finishing after Trawl 4 at around 21h.00 on Monday. Gulf-7 plankton stations 11 and 17 - 32 were then sampled during darkness. Vertical ring-net hauls for zooplankton were made near the oceanographic buoy north of Gulf-7 station 19 and between stations 17 and 24. The acoustic survey recommenced at 07h.22 on Tuesday at transect 11 and was completed after Trawl 9 at 22h25 on Tuesday. An area towards the offshore end of transect 9 was selected for the 6-hourly diel feeding study which commenced at 15h00 on Wednesday. Three sampling sessions (15h.00, 20h.00, 02h.00) were carried out at this location, comprising acoustic survey, midwater trawl and Gulf-7 tows. Due to the declining density of sprat targets on the survey grid, a new location was found on a nearby bank where three further sampling sessions took place on Thursday commencing at 08h.13, 14h.00 and 20h.00. On completion of work on Thursday night, the vessel proceeded to Belfast and berthed during Friday morning.

WORK COMPLETED

Echo integration

The Phase 1 and Phase 2 survey transect design are shown in Figures 1 and 3. The location of the Phase 2 surveys is shown in Fig. 1. The 38kHz echosounder was run continuously during the Phase 1 and 2 acoustic surveys. Data were captured using Simrad EP-500 software and were backed up daily on duplicate digital audio tapes. No calibrations were carried out. EK-500 test data were as recorded during the January 1999 calibration exercise. The transceiver settings from January 1999 were retained and are shown in Table 1 together with other relevant instrument settings.

Target identification and biological analysis

Fourteen successful midwater trawl tows were completed for identification of acoustic targets. The trawl positions for Phase 1 are shown on Figure 1. Details of the tows are given in Table 2. Species compositions and length frequencies were recorded for each catch. Up to 25 individuals of each fish species caught in selected trawls were measured and weighed for estimation of length-weight function parameters (Table 3).

Gulf-7 plankton stations

Zooplankton and fish larva sampling was successfully carried out all Gulf-7 stations shown in Fig. 2 except station 12 where sea conditions were too rough. Four stations

were sampled during each of the six sessions of the diel feeding study (two hauls to near the seabed and two to midwater).

Preliminary results

Small clupeoids were present at much lower densities than recorded in the same area during the September 1998 survey. Some dense schools were observed in Dundrum Bay but could not be caught by trawling due to a combination of shallow water and rough seabed. Aggregations of small schools were found consistently on the outer parts of the Phase 1 acoustic transects, in water deeper than 50m. The fish were close to the seabed during daylight, and comprised mainly small sprats of 6-8 cm in length. Dense zooplankton back-scatter was observed over most of the survey grid. Gulf-7 catches contained large quantities of zooplankton, mainly copepods. At some stations, sprat and herring were observed to have been feeding heavily on copepods.

The results of this cruise will contribute to a study of the importance of small clupeoids as consumers of zooplankton and the eggs and larvae of commercial fish in the Irish Sea.

ACKNOWLEDGEMENTS

The Ship's Master, Officers, Fishing Master, Engineers, Catering Staff and Crew are thanked for their cooperation and service during this cruise. The scientific staff are also acknowledged for their thorough work throughout the cruise.

Signed

SIC..... M.J. Armstrong..... date 7-5-99

Ships master..... date 7 May 1999.

Head of Aquatic Sciences..... S. D. Heaney date 13-5-99

Table 1 EK-500 instrument settings used during cruise LF1899

Transducer	ES38B	
Serial No.	26535	
Frequency	38 kHz	
(1) TRANSCEIVER MENU		
Absorption coefficient	10 dB/km	
Pulse length	Medium (1.0 ms)	
Bandwidth	Wide	
Max. power	2000 W	
Angle sensitivity	21.9	
2-way beam angle	-20.9 dB	
Sv transducer gain	26.77 dB	
TS transducer gain	26.81 dB	
3 dB beamwidth Alongship	6.9 deg	
3 dB beamwidth Athwartship	6.9 deg	
Alongship offset	0.0 deg	
Athwartship offset	-0.08 deg	

(2) OTHER SETTINGS	
Operation menu:	Ping rate = 0.6 s (50m,100m range); 0.8 s (150m, 250m range) [25m range not used]
Log menu:	Mode = ping based Ping interval = 1490 (50, 100); 1115 (150, 250m range)
Layer menu:	Super-layer = 11 - 250 metres Layers: 8-11, 11-20, 20-30, 30-40, 40-50, 50-60, 60-80, 80-100, 100-1
Printer / EP-500 settings:	Sv colour min. = -70 dB TS colour min. = -60 dB
TS detection menu: (both frequencies)	TS min. = -60 dB Min. echo length = 0.8 Max. echo length = 1.3 Max. gain compensation = 3.0 dB Max. phase deviation = 4.0 dB
Bottom detection menu:	Minimum level = -45 dB

Table 2 Details of trawl catches taken during cruise LF1899

Tow	Date	Shooting details						Total	percentage composition by weight					Mean length	
		Time	Lat.		Long.		depth (m)	catch kg.	sprat	herring	mackerel	gadoids	other	sprat	herring
1	03-May	08h.57	54	11.0	5	44.3	25	0	0.0	0.0	0.0	0.0	0.0		
2		11h.20	54	7.1	5	33.0	57	87	28.0	68.3	0.0	3.6	0.1	10.0	14.2
3		13h.27	54	4.8	5	28.4	86	200	93.3	3.9	0.0	0.5	2.3	7.8	13.5
4		20h.16	53	51.4	5	38.5	93	160	76.0	22.6	0.0	0.0	1.4	7.3	12.8
5	04-May	08h.11	53	35.1	5	52.2	55	31	99.9	0.0	0.0	0.0	0.1	9.2	
6		09h.49	53	35.4	5	40.9	91	94	77.1	22.1	0.0	0.0	0.8	7.4	12.3
7		14h.03	53	43.7	5	56.1	47	151	36.9	62.7	0.0	0.3	0.1	10.1	13.5
8		15h.28	53	43.6	5	48.7	63	35	48.0	49.7	0.0	1.9	0.5	7.9	12.7
9		21h.26	53	51.7	5	39.7	91	88	90.1	7.4	0.0	0.1	2.4	7.2	12 0
10	05-May	16h.39	53	44.2	5	52.2	54	0	0.0	0.0	0.0	0.0	0.0		
11		17h.15	53	43.7	5	50.6	57	15	92.3	6.8	0.0	0.8	0.0	7.5	12 8
12		21h.22	53	43.9	5	51.1	56	2	91.8	5.9	0.0	0.0	2.3	7.2	12.0
13	06-May	03h.53	53	44.7	5	50.6	58	17	98.0	1.7	0.0	0.2	0.0	7 8	12 6
14		08h.54	53	47.0	5	45.5	70	49	93.8	4.2	0.0	0.0	2.0	7 6	12.4
15		15h.58	53	48.0	5	43.1	84	26	90.9	7.1	0.0	0.5	1.5	7 3	11.6
16		21h.13	53	47.2	5	43.9	66	52	64.3	33.2	0.0	0.0	2.6	7 6	12.0

Table 3 Length - weight parameters estimated during cruise LF1899
(Lengths in cm; weights in g)
Formula: weight = $a * L^b$

SPECIES	*a*	*b*	SAMPLE SIZE
Herring	0.00521	3.086	150
Sprat	0.00640	3.025	175
Whiting	0.00952	2.897	53
Grey Gurnard	0.00365	3.212	39

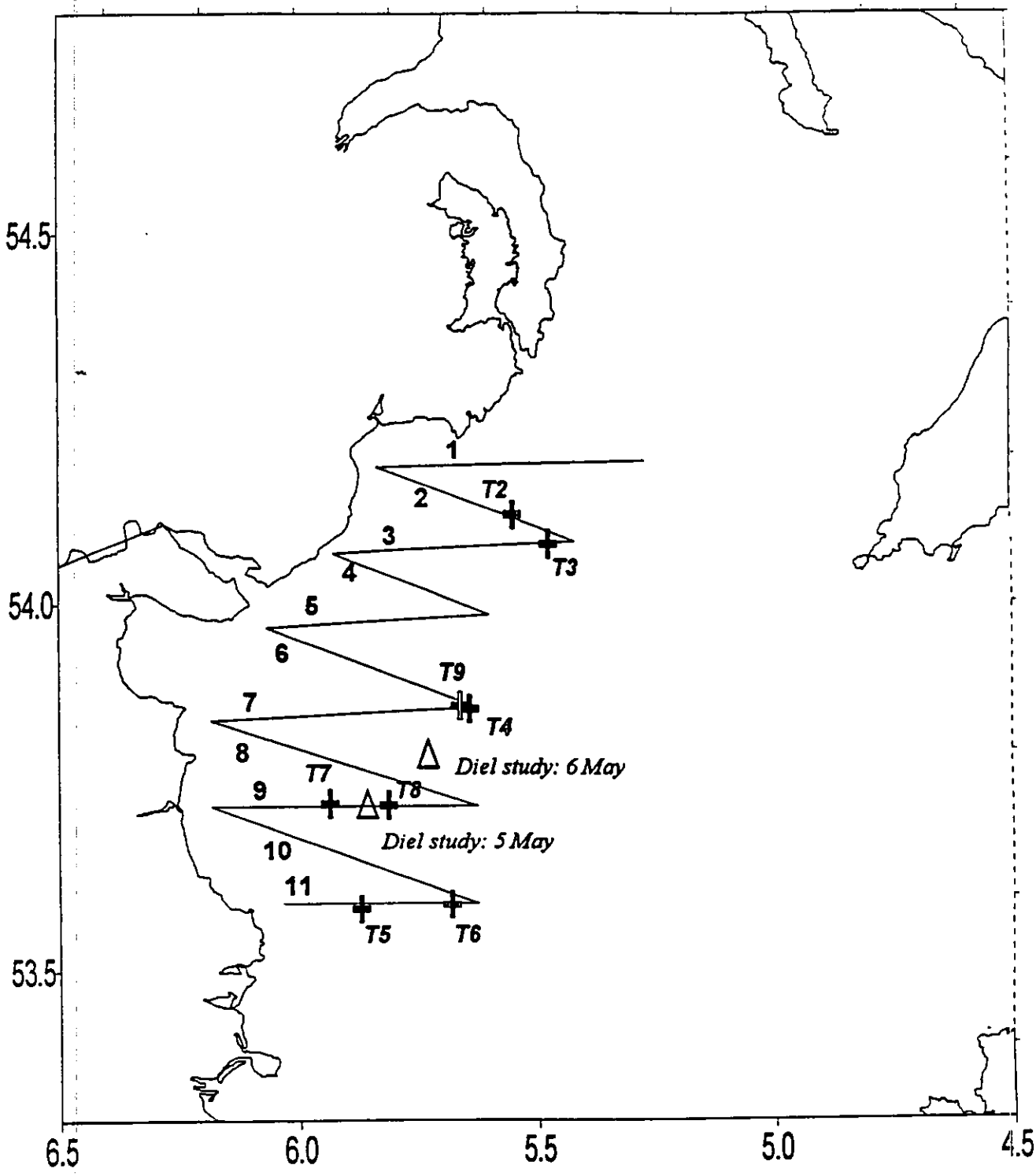

Fig. 1 Phase 1 acoustic survey grid for cruise LF1899 (daytime survey only). Trawl positions for Phase 1 are shown as T2, T3 etc. Positions of the diel feeding studies are indicated.

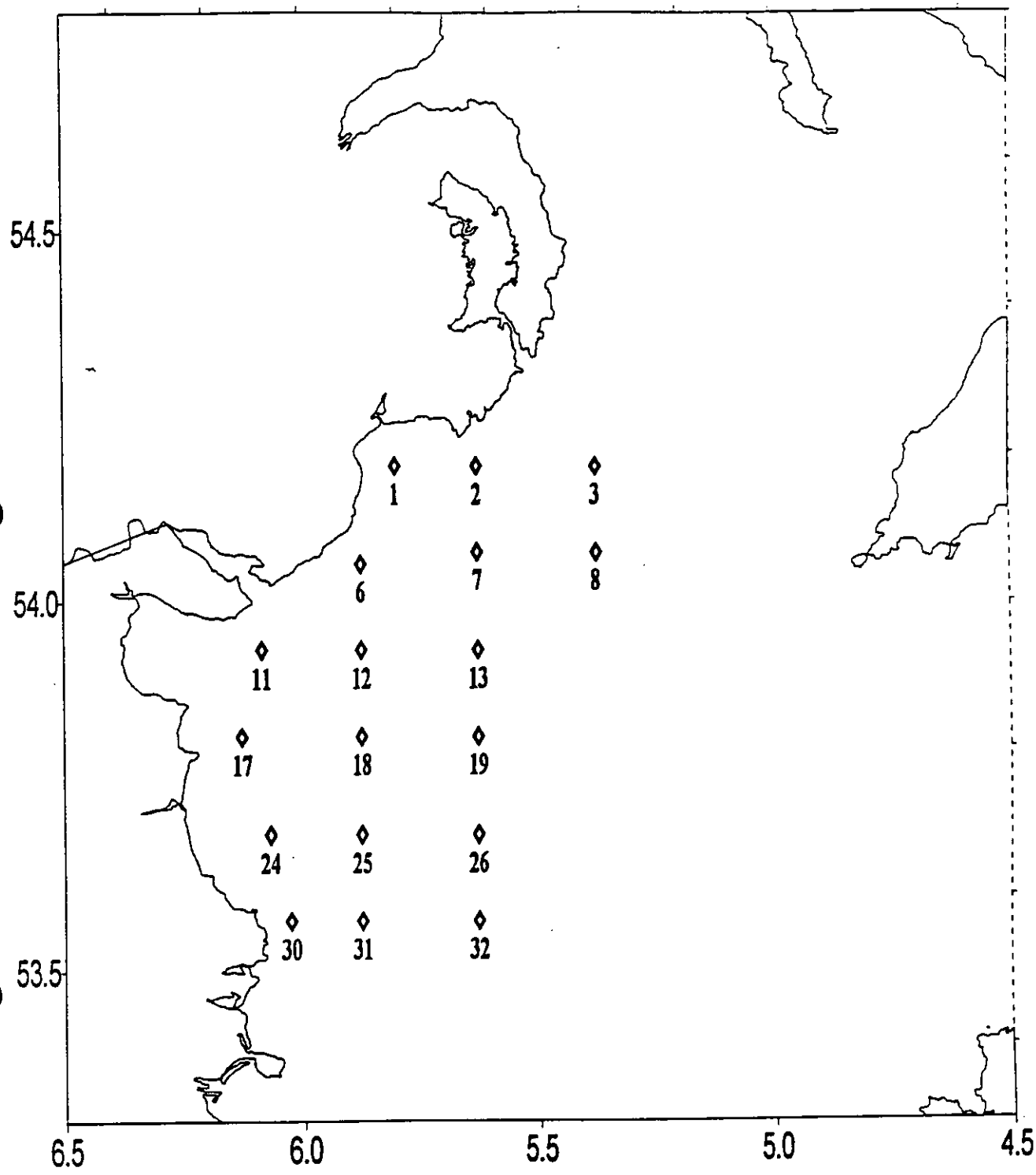

Fig. 2 Phase 1 plankton survey stations for cruise LF1899.
Stations are numbered as in previous GULF-7 surveys.
Station 12 was not sampled due to rough sea conditions.

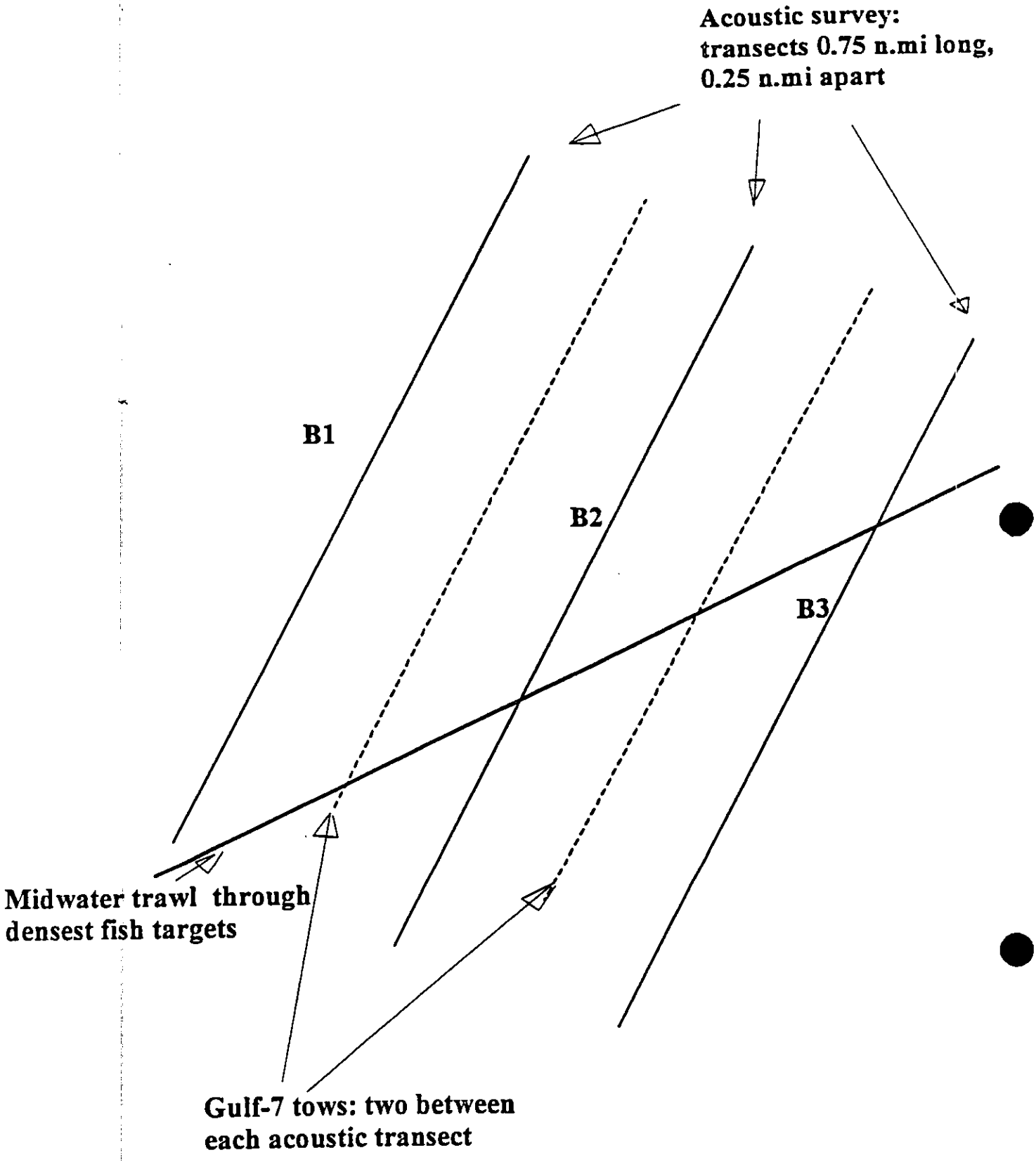

Fig. 3 Experimental design for study of diel patterns of feeding and spawning in sprat (see Fig. 1 for study locations).