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(revised 11/96 to include Stepovac Bay and Portlock Bank larval abundance estimates)

Chief Scientist's Report
MF94-05 (FOCI 5MF94)
1 - 15 May 1994

Scientific Party

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Objectives

This was the fifth cruise of 1994 in support of Fisheries-Oceanography Coordinated Investigations (FOCI). It was timed to examine the status of early walleye pollock larvae and their environment in the western Gulf of Alaska. Our major objectives were to:

1) determine distributions of pollock larvae southwest of the exit of Shelikof Strait,
2) maintain and calibrate existing surface and sub-surface moorings in the western Gulf of Alaska,
3) obtain physical and biological samples from traditional FOCI time series stations
4) collect while underway a) surface chlorophyll and PAR measurements for modeling and mapping the horizontal distribution and timing of the spring phytoplankton bloom, and b) EK-500 hydroacoustic estimates of the distribution of adult pollock in Shelikof Strait after spawning,
5) from contrasting environments, collect samples of first-feeding larval pollock, with their prey and predators, for age and condition factor analyses,
6) estimate copepod egg/prey production from shipboard experiments.

Operations

Our research was accomplished in five phases based on geographic location and scientific intent. These phases were accomplished according to the timeline in Table 1. Activities performed during each phase are listed in Table 2. This table also lists operations totals for the cruise.

During Phase 1 we accomplished a number of tasks. We spot sampled the larval pollock population at two sites in Stepovac Bay along the Alaska Peninsula near the Shumagin Islands where earlier cruises had detected a significant population of spawners. This location also furnished live copepods for maturity and naupliar-taxonomy experiments. We serviced the anemometer and light on meteorological mooring M4, then made comparison measurements. Mooring 9403, which had been fouled by a passing tugboat during April, was replaced by

mooring 9403a in the same general location. We made calibration measurements at this mooring and also at moorings 9401, 9402, 9443, and M3. Also during Phase 1 we occupied FOCI Time Series Lines 8 (Stations 56-61) and 16. CTD casts (with bottles for chlorophyll, nutrients, and microzooplankton samples) and bongo tows (Line 8 only) were taken.

Phase 2 was a large-scale survey of pollock larvae. The survey began at FOCI Grid Station B15 (north of Sutwik Island) and ended at station B33 in Shelikof Strait off Cape Kubugakli, near Line 8. Results from the survey were tabulated (Table 3) and contoured (Figure 1). [Note: Values contained in Table 3 and Figure 1 are preliminary, unconfirmed, and may not be used without the consent of the Chief Scientist.] During the survey we collected larvae for growth studies and nutritional condition assays, we sampled copepod nauplii to determine their horizontal distribution relative to that of phytoplankton and pollock, and we collected copepods for dry weight determination. As in the last several years, the overall abundance of larvae was low compared to the historical record. Larvae appeared to be healthy with sufficient food. Very few eggs and few yolk-sac larvae were noted. Some large, older larvae were gathered that apparently were not from the main Shelikof Strait spawn.

In Phase 3 we returned to a patch of larvae located over the sea valley east of Wide Bay, launched a radar-tracked drifter drogued at 40-m depth (where most larvae are found), then drifted with the patch while sampling the larvae and their environment for 72 hours. The patch was advected southward then westward by local ocean circulation. It arrived in the vicinity of meteorological mooring M4 after 24 hours, then stayed in that vicinity for the remaining two days. Experiments during the patch/storm study comprised growth, condition, food availability, food production, larval vertical distribution, and predator abundance. Sampling gear included 20- and 60-cm bongo nets for larval condition; CalVET casts for microzooplankton and copepod egg production estimates; CTD casts for chlorophyll, microzooplankton and light measurements; ring net for collection of live copepods for maturity and clutch size experiments and naupliar taxonomy; and Tucker trawls for vertical distributions of microzooplankton and larvae, and for assessment of predator populations. After 48 hours, we marked the patch with a satellite-tracked drifter so that future FOCI cruises could locate it. The last 24 hours in the patch were devoted to a storm experiment. For the first eight hours sustained winds of 20-30 kts mixed the upper ocean. Ongoing FOCI research has indicated that early larvae may be affected detrimentally by mixing. Our measurements during the patch and storm studies may help us determine the processes involved and will guide future studies of this kind. Following the storm study, we moved to a region across the Shelikof sea valley with significantly fewer larvae and repeated the measurements for six hours. At the end of phase 3 we intercepted a satellite-tracked drifter that had been deployed in upper Shelikof Strait during the last week of April at the expected time of peak phytoplankton bloom. At the drifter we sampled ocean structure, larval abundance and condition, and determined the integrated abundance of microzooplankton. This drifter may be sampled by later FOCI cruises.

Phase 4 was planned to determine the horizontal distribution of phytoplankton during the spring bloom in Shelikof Strait and to detect the presence of adult pollock in Shelikof Strait after the spawning season. To determine this, we steamed zigzag tracks across the strait (Fig. 2), measuring chlorophyll content of near-surface sea water extracted through the sea chest, and drawing samples from the in-line system. At the same time we surveyed the adult population of pollock in the strait using the EK-500 echo sounder. The latter operation was a joint activity

with the Alaska Fisheries Science Center's Hydroacoustic research group. It will provide information to help assess the status of groundfish stocks in the Gulf of Alaska.

During Phase 5 we calibrated meteorological moorings M2 and M1, sub-surface moorings 9432, 9434, 9436, and 9437, and occupied the Gore Point CTD line. A satellite-tracked drifter deployed near M1 will document late May circulation in the western Gulf of Alaska. Remaining time was used to perform an acoustic Doppler current profiler calibration maneuver and to survey the northwestern Gulf of Alaska for pollock larvae. For this operation we used seven stations of the regular FOCI bongo grid (N61, N57, N53, P53, R53, T53, V53).

Conclusions

We surpassed our objectives during this cruise. We were able to do this because 1) the weather cooperated, dealing us no delays and delivering a spring storm at just the right time for the storm study; 2) there were minimal problems with the ship's electrical system; 3) all major scientific and scientific support systems functioned to expectation; and 4) well-trained ship and scientific personnel conducted hundreds of operations with few errors.

A significant accomplishment was the continuous sampling of pollock larvae and their environment before, during, and after passage of a spring storm. An important FOCI discovery is the apparent relationship between springtime winds and survival of first-feeding pollock larvae. Results from the storm study will provide insight into the processes behind this relationship and help formulate plans for additional investigations.

Aspects of Shelikof Strait FOCI relate to the overall distribution of pollock stocks in the Gulf of Alaska. During MF94-05 we were able to survey larval populations in Stepovac Bay near the Shumagin Islands and over Portlock Bank northeast of Kodiak Island, and we measured the distribution of post-spawning adult pollock in Shelikof Strait. Results from these surveys will provide guidance to other NMFS programs investigating groundfish of the Gulf of Alaska.

The *in situ* calibrations of the meteorological and subsurface moorings provide ground truth for our field program. Sampling of primary and secondary production, larval prey and predators, pollock larvae and evaluation of their condition provide information to researchers attempting to understand the complex ecology of pollock. All of the research performed on this cruise related to FOCI's primary objective: to identify and understand the complex interaction of physical and biological processes that contribute to recruitment of walleye pollock.

For Future Consideration

The Scientific Computer System (SCS) is a tool that we rely on heavily for collection of physical and biological data. Over the last several years, SCS software has increased in sophistication and has become easier to use. The hardware platform for SCS has changed little over this time and is now inadequate. Our productivity during this cruise was hampered by slow computer response to simple commands. Some important tasks, such as quality assessment of oceanographic and meteorological signals, could not be performed effectively by watch standers. We request that the platform for SCS be upgraded to provide fast, user-friendly service.

Hydroacoustic information is regarded highly by FOCI. Establishing hydroacoustic operations during Phase 4 proved frustrating and required several lengthy INMARSAT calls. For future cruises FOCI personnel need to have complete instructions on use of the system or a representative from the hydroacoustics group should participate in the cruise.

Acknowledgments

We are indebted to the women and men of the NOAA Ship MILLER FREEMAN for their unwavering support during these operations. We cite especially the contributions made by CDR Robert. Pawlowski, Commanding Officer; LT Scott Hill, Operations Officer; Mr. Rick Pietrusiak, Chief Boatswain; Mr. Steven Bus, Chief Engineer; Mr. Bill Floering, Chief Survey Technician and Mr. Phil White, Survey Technician. The skilled technical abilities of the Survey Department and the Deck Department are fundamental to the realization of our scientific objectives. We extend special thanks to Mr. Bill Smith and his Stewards for nurturing and nourishing us, and to Mr. Rick Phillips, Lead ET, for helping us keep our gear running and keeping us in contact with the outside world.

Table 1. Timeline, MF94-05

Activity	ADT (UCT-8)	Duration (hrs)
Depart Dutch Harbor	5/1/94 15:00	
Steam to Stepovac Bay		24.50
Arrive Stepovac Bay	5/2/94 15:30	
Sample stations		1.83
Depart Stepovac Bay	5/2/94 17:20	
Steam to 9443		10.00
Arrive 9443	5/3/94 3:20	
Sample 9443		1.58
Depart 9443	5/3/94 4:54	
Steam to M4		4.10
Arrive M4	5/3/94 9:00	
Repair and sample M4		5.12
Depart M4	5/3/94 14:08	
Steam to 9403a		4 81
Arrive 9403a	5/3/94 18:56	
Deploy and sample 9403a		2.75
Depart 9403a	5/3/94 21:41	
Steam to Line 8		0.14
Arrive Line 8-56	5/3/94 21:50	
Sample Line 8-56,57,58		4 18
Depart Line 8-58	5/4/94 2:00	
Steam to 9402		0.24
Arrive 9402	5/4/94 2:15	
Sample 9402		2.66
Depart 9402	5/4/94 4:54	
Steam to 8-59		0.14
Arrive 8-59	5/4/94 5:02	
Sample 8-59,60		2.96
Depart 8-60	5/4/94 8:00	
Steam to 9401		0.28
Arrive 9401	5/4/94 8:17	
Sample 9401		2.48
Depart 9401	5/4/94 10:46	
Steam to 8-61		0.20
Arrive 8-61	5/4/94 10:58	
Sample 8-61		1.56
Depart 8-61	5/4/94 12:31	
Steam to M3		1.32
Arrive M3	5/4/94 13:50	
Sample M3		0.33
Depart M3	5/4/94 14:10	
Steam to Line 16		8.73
Arrive Line 16	5/4/94 22:54	
Sample Line 16		3.95
Depart Line 16	5/5/94 2:51	
Steam to Grid start		0.74
Arrive Grid start	5/5/94 3:35	
Sample Grid		67.5
Depart Grid	5/7/94 23:05	
Steam to Patch		8.90
Arrive Patch [57°16.4',155°34.0']	5/8/94 7:59	
Sample Patch		72.01
Depart Patch	5/11/94 8:00	
Steam to non-patch (G28)		2.50
Arrive non-patch	5/11/94 10:30	
Sample non-patch		6.00
Depart non-patch	5/11/94 16:30	
Steam to drifter		3.55
Arrive drifter	5/11/94 20:03	
Sample drifter		1.34
Depart drifter	5/11/94 21:23	
Steam to map start (HA 1)		0.62
Arrive chlorophyll map start	5/11/94 22:01	
Map to M2		39.15
Arrive M2	5/13/94 13:10	
Sample M2		2.03
Depart M2	5/13/94 15:12	
Steam to GP1		7.10
Arrive GP1	5/13/94 22:18	
Sample CTD line		10.77
Depart CTD line	5/14/94 9:04	
Steam to Portlock Bank		1.50
Arrive Portlock Bank	5/14/94 10:34	
Sample Portlock Bank		10.00
Depart Portlock Bank	5/14/94 20:34	
Steam to Kodiak with Backtrack-L		10.50
Arrive Kodiak	5/15/94 7:04	

Table 2. Activities accomplished by phase, MF94-05.

Phase	Location/ Activity	CTD with water samples	60-cm bongo tow	20-cm bongo tow	CalVET	Larval condition tow	Live zoo-plankton tow	Tucker trawl	In-line water sample	Chlorophyll and EK-500 tracks	Meteoro-logical comparison	Mooring and drifter deployment	ADCP calibration
1	Stepovac Bay		3	2					2				
	9443	1			3		1		1				
	M4	1			3				1		1		
	Line 8 region	9	6	6	9				8		1	1	
	Line l6	5											
2	Larval survey		57		4	5	2		56				
3	Patch studies	13	15	13	46	23	6	23	1			1	
	Drifter intercept	1	1										
4	Fluorescence and hydroacoustic mapping								54	18			
5	M2	1			3						1		
	Gore Point region	7			12						1	1	
	Portlock Bank		7										1
	TOTAL	38	89	21	80	28	9	23	123	18	4	3	1

Table 3. Estimates of larval abundance at FOCI bongo grid stations from the survey periods in Stepovac Bay, Shelikof Strait (1200 UCT 5 May l 994 - 0700 UCT 8 May 1994), and Portlock Bank. [Note: These values are preliminary, unconfirmed, and may not be used without the consent of the Chief Scientist.]

Station	Haul	Grid Station	Flowmeter revs	Tow time (sees)	Net depth (m)	Rough count	Abundance (/10 m2)
1	1					10	71
1	2					0	0
19	1	B15	2590	778	131	0	0
20	1	Dl5	2557	685	101	8	48
21	1	F15	2285	619	102	10	68
22	1	H15	2286	621	99	1	7
23	1	J15	2128	414	102	15	112
24	1	L15	1289	363	57	12	81
25	1	L17	1231	330	52	1	6
26	1	J17	2390	615	95	0	0
27	1	H17	2311	656	103	0	0
28	1	F17	2225	639	102	0	0
29	1	D17	2180	618	102	14	100
30	1	B17	1567	428	67	0	0
31	1	B19	1786	501	80	8	55
32	1	D19	2266	649	101	110	748
33	1	F19	2168	604	103	90	653
34	1	H19	2423	678	99	26	162
35	1	J19	1767	463	69	0	0
36	1	L19	751	228	41	0	0
37	2	L21	460	146	22	0	0
38	1	J21	1463	384	56	0	0
39	1	H21	2276	644	99	63	418
40	1	F21	2291	657	101	11	74
41	1	D21	2220	639	99	38	258
42	1	B21	1689	463	69	90	562
43	1	B23	1919	554	85	60	405
44	1	C23	2380	680	102	50	327
45	1	D23	2357	688	100	110	711
46	1	F23	2286	625	99	110	728
47	1	H23	2234	627	99	65	440
48	1	J23	1536	416	56	10	56
49	1	J25	1184	297	41	0	0
50	1	H25	2066	617	101	50	372
51	1	F25	2228	596	101	180	1248
52	1	D25	2284	663	104	110	763
53	1	B25	2122	603	98	63	444
54	1	B27	2161	622	101	190	1354
55	1	D27	2154	625	99	200	1401
56	1	F27	2305	638	98	30	195
57	1	H27	2238	629	100	105	716
58	1	J27	1014	274	38	19	109
59	1	H29	1603	434	66	30	189
60	1	F29	2153	599	100	10	71
61	1	D29	2182	631	101	110	776
62	1	B29	2320	690	103	120	811
63	1	B31	2137	632	100	40	285

Table 3. (cont.)

Station	Haul	Grid Station	Flowmeter revs	Tow time (sees)	Net depth (m)	Rough count	Abundance (/10 m2)
64	1	D31	2222	653	99	150	1018
65	1	F31	1189	338	51	15	98
66	1	F33	2300	626	93	14	87
67	1	D33	2166	642	101	7	50
68	1	B33	2077	600	100	3	22
125	1	N61				10	76
126	1	N57				5	33
127	1	N53				22	156
128	1	P53				9	62
129	1	R53				7	53
130	1	T53				48	410
131	1	V53				14	95