August 28, 1995

CRUISE RESULTS

Cruise 95-1 Crawdad
1995 Togiak Nearshore Beam-Trawl Survey

The Resource Assessment and Conservation Engineering (RACE) Division of the Alaska Fisheries Science Center (AFSC) conducted a nearshore bottom-trawl survey of the Togiak Bay area from May 18 to May 29, 1995. This was an additional RACE survey designed to examine abundant eastern Bering Sea fish species such as yellowfin sole (*Pleuronectes asper*) in an area not covered by the RACE Division's annual eastern Bering Sea crab/groundfish bottom trawl survey.

OBJECTIVES

The primary survey objective was to assess the abundance of yellowfin sole in the Togiak Bay area of the eastern Bering Sea, to determine whether a significant portion of the yellowfin sole resource was being missed by the standard annual eastern Bering Sea bottom trawl survey.

Additional objectives and questions were:

1. Evaluation of spawning locations of female yellowfin sole in waters shallower than those sampled during the standard RACE survey. Was spawning more concentrated in shallower waters? Did yellowfin sole adults aggregate there, and if so, was spawning the primary reason?

2. Was feeding a major reason for nearshore yellowfin sole concentration? Previous unpublished reports indicated high concentrations of yellowfin sole feeding on Pacific herring (*Clupea pallasi*) roe in nearshore areas of Togiak Bay.

3. Estimation of size at maturity of yellowfin sole. Is the migration of yellowfin sole into nearshore waters based on their state of maturity? Are inactive (nonspawning)

yellowfin sole absent in nearshore "spawning" waters? If so, how biased are estimates of size at maturity when inactive fish are excluded?

4. Historically during the standard RACE survey, female yellowfin sole outnumber males (60% to 40%) overall. At the shallowest depths (< 30 m), however, males outnumber females. Is the standard survey biased against males due to sampling which excludes nearshore waters? Do males outnumber females in the Togiak Bay area?

5. Examination of the length distribution of juvenile yellowfin sole and collection of whole juvenile fish samples for later age-length determination.

6. Examination of species composition in the Togiak Bay area and location of possible nursery grounds for species such as yellowfin sole and Alaska plaice (Pleuronectes quadrituberculatus).

VESSEL AND GEAR

The 32-ft purse seiner/gill-netter F/V Crawdad was chartered for 12 days from May 18 to May 29, 1995. A plum staff beam trawl (Fig. 1) with specifications detailed in Gunderson and Ellis (1986) was used at all stations. The beams were made of 3.8 cm aluminum conduit and were 3.1 m in length. The trawl consisted of a 5.1 m footrope; 4.1 m headrope; 1.0 m breastlines; tickler chain arrays; and 9.5 kg wingtip weights. The body of the net was made of 7-9 mm square knotless nylon and the codend was lined with 4.0 mm mesh. The net from wingtips to codend measured 7.9 m. The beam was attached to 1.3 cm X 3.1 m nylon bridles and 183 m of 3/8 inch (.95 cm) nylon towline. An emergency retrieval line with 20-cm float was attached to the codend. The net was deployed and retrieved with a hydraulically powered net-drum located in the forward area of the deck. Net retrieval was assisted with a hydraulically powered stern roller.

ITINERARY

The F/V Crawdad departed King Salmon, Alaska, on May 18 and returned May 28. Transit time from King Salmon to the Togiak Bay area was approximately 10 h. Five fishing days were lost due to weather. Port calls on May 20, 21 and 24, were made at Togiak Fisheries Cannery.

SURVEY DESIGN AND METHODS

A total of 80 pre-designated stations (Fig. 2) encompassing the Togiak Bay area between Hagemeister Island and the Nushagak Peninsula (159°00' to 161°00'W) were selected. Stations were spaced 5 nautical miles apart extending from the shoreline out to latitude 58°20'N, just within the boundary of the standard annual RACE survey area. Latitudes and longitudes obtained via Global Positioning System (GPS) and Loran readings for starting and ending positions were recorded for each tow. Tow durations (on bottom to haul back time) were originally set at 10 min., but were changed to 5 min. after initial catches became unmanageably large. The scope-depth ratio ranged from 10:1 at shallow depths to 5:1 at deeper stations. The following scope-depth ratios, based on research by the University of Washington with the same net designs, were used here:

Depth (m)	Scope (m)
< 3	30
3 - 4.5	45
4.5 - 6	60
7 - 18	90
19 - 27	135
28 - 36	180
37 - 45	230
46 - 55	275
56 - 65	320
> 65	365

Surface temperatures (bucket) were recorded at each station. A micro-bathythermograph (MBT) was also dropped immediately after most of the tows to get a complete temperature profile of the water column. The F/V Crawdad generated only 12 V DC, so a power inverter was used in conjunction with a lap-top computer to initiate and dump MBT data.

The entire catch from each haul was sorted, weighed to the nearest 0.1 kg, and enumerated by species. Length measurements and maturity stage codes (1995 AFSC, RACE Division ADP codebook, Table 9) were recorded for yellowfin sole. All walleye pollock (*Theragra chalcogramma*), Alaska plaice, rock sole (*Pleuronectes bilineatus*), and Pacific cod (*Gadus macrocephalus*) were also measured. Stomach scans were conducted on approximately 10 yellowfin sole (5 males, 5 females) per station. Fish length, sex, maturity stage, stomach fullness (%), prey items, prey volume (%), and digestion codes were recorded for each specimen. Juvenile yellowfin sole and Alaska plaice were collected at various stations and frozen for later age determination.

RESULTS

Tows were made at 30 of the 80 pre-designated stations (Fig. 2). Tows made in Togiak Bay proper (hauls 2, 9), Metervick Bay (haul 23), and near Summit Island (haul 7) and High Island (haul 11) were found to be rocky and difficult to trawl without either ripping up or catching rocks too large to retrieve. Nonetheless, only hauls 7 and 9 were considered unsuccessful.

Depths sampled ranged from 1.8 m nearshore to 30.2 m offshore. Bottom temperatures ranged from 3.8° C to 7.5° C and surface temperatures ranged from 4.7° C to 8.8° C. Catches averaged 30.8 kg per tow but ranged from 6.9 kg to 243.3 kg/tow. Yellowfin sole was the predominant species caught at every station, accounting for 60% of all the catches by weight (Table 1). Length measurements collected are summarized in Table 2. Catch per unit effort (CPUE) of yellowfin sole was very high relative to areas sampled during the standard RACE bottom trawl survey. CPUE ranged from 635 kg/hr to 79,517 kg/hr averaging 10,731 kg/hr per station (Fig. 3).

Yellowfin sole length distributions were bimodal for both males and females (Fig. 4). The first mode indicates the distribution of resident juveniles which align themselves on a depth continuum (i.e. smaller fish in shallower water) and the second mode indicates the distribution of sexually mature yellowfin sole that have migrated from the shelf-slope break and entered shallow waters during spring. Yellowfin sole in the middle size range (17-25 cm) were minimal in abundance. These fish were found in greater abundance at depths greater than 50 m during the standard RACE bottom trawl survey indicating that sexually inactive yellowfin sole generally do not migrate inshore. The Alaska plaice sampled were predominantly juveniles (Fig. 5) as were walleye pollock (Fig. 6).

A total of 284 yellowfin sole stomachs were examined (scanned) for content. Of these, 137 were empty. The most common prey item was a polychaete tube worm, genus Neosabellides. These were present in 66% of the yellowfin sole without empty stomachs, and were also present in the intestines of many of the specimens with emty stomachs. Clams and gammarid amphipods were found in 21% and 20% of the non-empty stomachs, respectively. At stations where Pacific herring had spawned (hauls 8, 23), 55% of the yellowfin sole stomachs were full of herring roe, 21% had tube worms present, and 14% were empty. Based on stomach fullness, feeding activity was highest at the shallowest depths (< 6 m).

Yellowfin sole were commonly found in near-spawning and spawning conditions. Fifty-four percent of all mature females and 80% of all mature males were in near-spawning to spawning conditions. At shallow depths (< 6 m), however, only 12.2% of the females were in near-spawning condition with none actually spawning.

SCIENTIFIC PERSONNEL

Dan Nichol- Field Party Chief, AFSC biologist
Terry Sample- AFSC biologist
Tom Crawford- Skipper/Owner of F/V Crawdad

REFERENCES

Gunderson, D.R. and I.E. Ellis, 1986. Development of a plumb staff beam trawl for sampling demersal fauna. Fish. Res., 4:35-41.

Table 1.--Catch composition by total species weight encountered during the 1995 nearshore Togiak Bay beam trawl study.

Species	Weight (kg)	Percent
Yellowfin sole	556.5	60.2
Asterias amurensis	175.1	18.9
Crangon alaskensis	37.5	4.0
Tube worm sp.	25.8	2.8
Myoxocephalus jaok	20.5	2.2
Starry flounder	14.2	1.5
Telmessus crab	13.8	1.5
Snake prickleback	13.7	1.5
Gastropod unident.	11.4	1.2
Alaska plaice	10.1	1.1
Pighead prickleback	6.2	0.7
Rock sole	6.2	0.7
Empty bivalves	3.8	0.4
Longhead dab	3.7	0.4
Gymnocanthus sp.	3.2	0.3
Sea anemone unident.	2.6	0.3
Rainbow smelt	2.2	0.2
Saffron cod	2.0	0.2
Clam unident.	2.0	0.2
Bering poacher	1.8	0.2
Walleye pollock (juv.)	1.7	0.2
Tubenose poacher	1.5	0.2
Miscellaneous sp.	5.8	0.6

Table 2.--Number of length measurements taken for the major fish species encountered during the 1995 nearshore Togiak Bay beam trawl study.

Species	Number of length measurements			
	males	females	unsexed	total
Yellowfin sole*	1,982	1,596	163	3,741
Alaska plaice	90	80	98	268
Walleye pollock	-	-	95	95
Rock sole	5	23	-	28
Pacific cod	-	-	1	1
Starry flounder	-	1	-	1

* Maturity codes (1995 AFSC RACE Division ADP codebook, Table 9) also recorded.

Figure 1.--System developed for sampling juvenile Dungeness crabs and flatfish. 1, 5.1-m footrope; 2, 4.1-m headrope; 3, 1.0-m breastlines; 4, tickler chain arrays (4.3 and 4.9-m sections of 1.9-cm chain); 5, wingtip weight, 6.0 X 40.6 cm, 9.5 kg; 6, beam, 3.8 cm X 3.1 m aluminum conduit; 7, quick-release snap; 8, upper net bridle, 1.0 cm X 1.8 m; 9, lower net bridle, 1.3 cm X 1.4 m; 10, 7.6-cm cork float; 11, ribline; 12, main body of net, 7-9 mm (lumen) square knotless nylon; 13, cod-end, with 4.0-mm liner; 14, emergency retrieval line, with 20-cm float; 15, beam bridle, 1.3 cm X 3.1 m. Total length, wings to cod-end, is 7.9 m. From Gunderson and Ellis (1986).

Figure 2.--Stations sampled during the 1995 nearshore Togiak Bay beam trawl study. Numbers indicate hauls sampled in sequential order. Plus symbols indicate pre-designated stations not sampled.

Figure 3.--Catch per unit effort (CPUE) of yellowfin sole during the 1995 nearshore Togiak Bay beam trawl study.

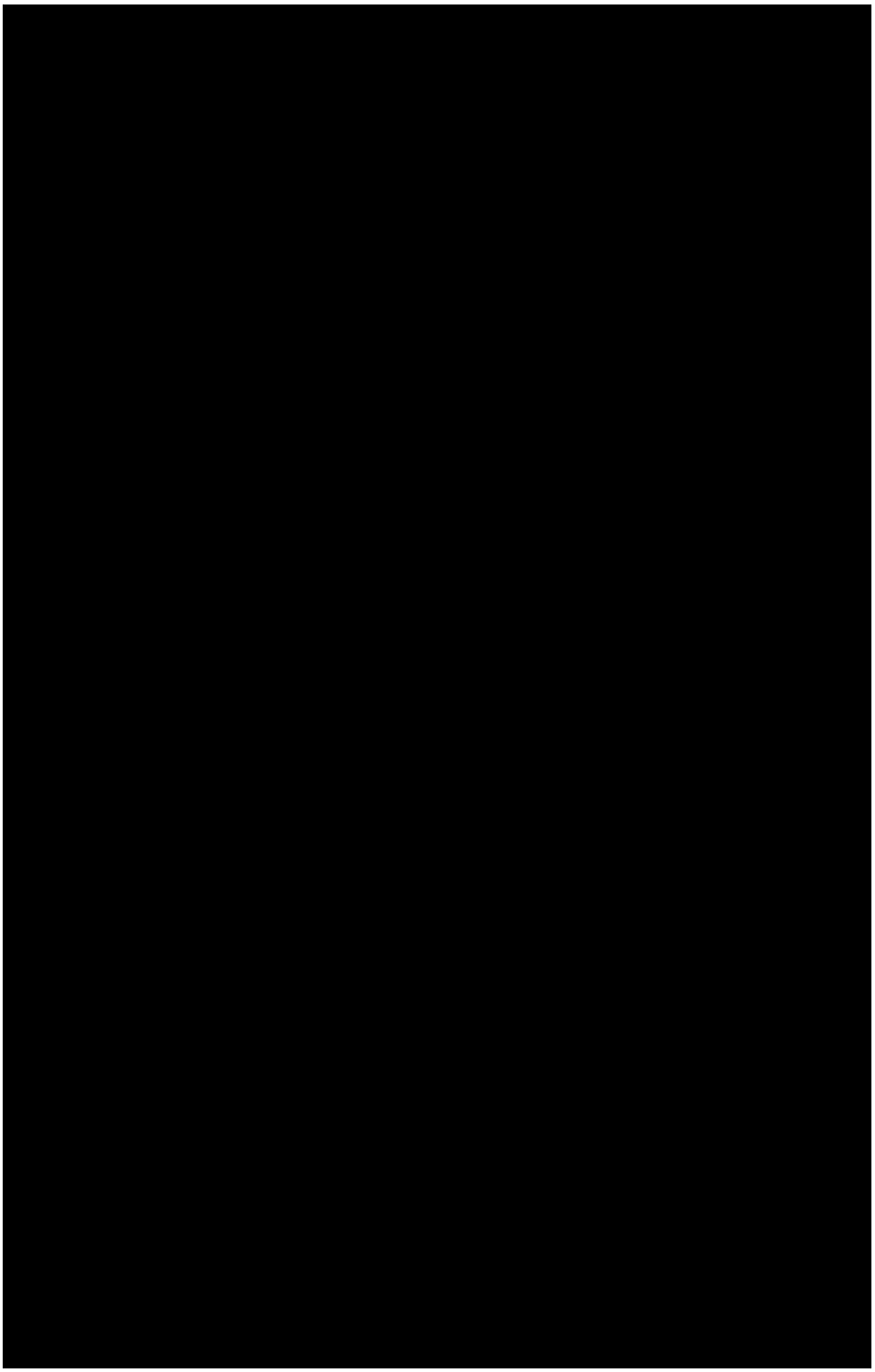

Figure 3.--Length distribution of male and female yellowfin sole from the Togiak Bay area of the eastern Bering Sea.

Figure 5.--Length distribution of Alaska plaice, sexes combined, from the Togiak Bay area of the eastern Bering Sea.

Figure 6.--Length distribution of Walleye pollock, sexes combined, from the Togiak Bay area of the eastern Bering Sea.