Charleston

Fish Commission of Oregon

Research Division

# TRAWL INVESTIGATION

# PROGRESS REPORT

January 1, 1967-December 31, 1968

July 1970

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# TRAWL INVESTIGATIONS PROGRESS REPORT

January 1, 1967-December 31, 1968

## INTRODUCTION

This progress report covers the activities of the trawl investigations staff throughout the 1967 and 1968 calendar years.

Major field activities during this period consisted of the following (1) interviewing trawl fishermen from Astoria-Warrenton, Garibaldi, Newport, Coos-Winchester Bay, Port Orford, and Brookings for catch and effort data on the bottomfish and shrimp fisheries; (2) recovering tagged fish from trawl vessels and filleting plants; (3) collecting and analyzing shrimp samples from the commercial shrimp fishery for age and growth studies; (4) obtaining length frequencies, sex, and age structures from Dover, English, and petrale sole and Pacific ocean perch; (5) examining animal food landings for species composition; (6) PL 88-309 research studies on bottomfish with special emphasis on Dover sole; (7) PL 88-309 research studies on pink shrimp; (8) initiating a PL 88-309 study involving the charter of a research vessel on an annual basis; and (9) surveillance and documentation of foreign fleet activities.

Investigational work conducted in the laboratory consisted of (1) coding the 1967 and 1968 trawl catch and effort data with regard to hours fished, area of capture, and species and poundages caught; (2) preparation of 1966 and 1967 catch and effort data for PMFC annual and research staff meetings, International Trawl Subcommittee and Committee meetings, and Fish Commission meetings; (3) processing tag recovery data; (4) processing and analyzing pink shrimp and bottomfish market samples; (5) gathering information and presenting data relative to changes in the trawl regulations; (6) attending various state, interstate, and federal fisheries meetings relative to the trawl fishery; (7) writing and editing reports and manu-

scripts; and (8) handling budgeting and administrative matters relative to the trawl investigation.

## PERSONNEL

Several changes and promotions were made in the staff of Otter Trawl Investigations during the report period.

In July 1967 Terry Link was promoted to an Aquatic Biologist 1 on the PL 88-309 bottomfish project. In September 1967 John Bender was hired as an Aquatic Biologist 1 on the PL 88-309 shrimp study. Gary Milburn terminated employment, and John Bender transferred to Coastal Rivers Investigations in June 1968. Richard Berry was hired in July 1968 as an Experimental Biology Technician 1 to assist on the PL 88-309 shrimp study. He transferred to Coastal Rivers Investigations in September 1968. Gerald Lukas joined the staff as a Senior Aquatic Biologist 1 in September 1968 to fill the 88-309 shrimp position vacated by Milburn.

Seasonal employees included Mike Hosie during June-September 1967 and 1968, Bill Noonan during August-September 1967, Mike Tagliavento during June-September 1967, Florence Link during January 1968, Gary Hostick during March-June 1968, and Harry Albert and Tom McLain during June-September 1968.

## FLEET ACTIVITIES

The market for shrimp remained good throughout this 2-year period. The market for trawl-caught fish was weak during March-July 1967. Limits were placed on fillet sole (3,000-5,000 pounds per trip), rockfish (10,000 pounds per trip), and Pacific ocean perch (35,000 pounds per trip). Limits on Pacific ocean perch did not affect trawl fishermen, however, since reduction in availability prevented their catching the limit. During January 1968 limits were again placed on fillet sole. By March 1968, however, the market firmed up and was good for the rest of the year.

The vessels landing bottomfish and shrimp are listed in Table 1 for 1967 and Table 2 for 1968 by port of landing.

In March 1968 the new Astoria Seafoods plant at Coos Bay started processing bottomfish and shrimp.

In January 1967 new trawl fishing logbooks were distributed to the fleet. These logs contained NCR tear-out sheets, thus eliminating errors inherent in copying log information and reducing the time needed to collect log data from fishermen.

## REPORTS

Reports were prepared for the PMFC annual meeting in November 1967 and 1968, the International Trawl Technical Subcommittee meetings in June 1967 and 1968, and the Oregon Fish Commission Biennial Report, 66-68.

The following papers were written by the trawl staff during 1967-68:

Demory, Robert L. Investigation of the abundance and recruitment of bottomfish off Oregon with emphasis on Dover sole. PL 88-309 Ann. Prog. Rep., August 1967 (processed).

_____. Report of cruise 67-9, Pacific ocean perch. Fish Comm. Oreg., September 1967 (processed).

_____. Report of cruise 67-12, Dover sole. Fish Comm. Oreg., December 1967 (processed).

_____. Age-length frequency distribution of Dover sole (Microstomas pacificus) landed in Oregon in 1948 and 1951-65 from PMFC area 2D. Fish Comm. Oreg., Inv. Rep. (7):35 pp., February 1968.

_____. Report of cruise 68-4, Dover sole. Fish Comm. Oreg., May 1968 (processed).

_____. Investigation of the abundance and recruitment of bottomfish off Oregon, with special emphasis on Dover sole. PL 88-309 Ann. Prog. Rep., August 1968 (processed).

_____ and Halbert A. Bailey. Length-frequency and age-length-frequency distributions for Dover sole, English sole, petrale sole, and Pacific ocean perch landed in Oregon 1948-65. Fish Comm. Oreg., Inv. Rep. (6):53 pp., April 1967.

_____ and Terry Link. Report of cruise 67-3, Dover sole. Fish Comm. Oreg., August 1967 (processed).

Table 1. List of vessels engaged in trawling in Oregon by port during 1967

| Astoria | Garibaldi | Newport | Coos Bay-Winchester Bay | Port Orford | Brookings |
|---|---|---|---|---|---|
| Eagle 1/ | Clara G. 2/ | Anna W. 2/ | Anak 1/ 2/ | Amak 2/ | Anna W. 2/ |
| Empress 1/ | Diana 2/ | Azalea 2/ | Anna W. 2/ | Azalea 2/ | Azalea 2/ |
| Jennie Decker 1/ | Janet Ray 2/ | Barbara S. 1/ | Azalea 2/ | Bristol 2/ | Bonnie C. |
| Junior | Madeline J. 2/ | Clara G. 2/ | Christina J. 1/ | Daphne 2/ | Daphne 2/ |
| Kodiak 1/ | Mari Joann 2/ | Dare II 2/ | Columbia 1/ | Frank Lowe 2/ | Faymar 1/ |
| Lynda Dawn 1/ | Mary Ann 2/ | Destiny 1/ | Dare II 1/ 2/ | General Pershing 2/ | Francis E. 2/ |
| Margaret A. 1/ | Stephanie 2/ | Diana 2/ | Elaine Dell | Mari Joann 2/ | Janet Ray |
| Marian F. 1/ | | Francis E. 2/ | El Cerrito | | Jefferson 1/ |
| Meldon 1/ | | General Pershing 2/ | Francis E. 2/ | | KDM |
| Mitkof 1/ | | Helen Louise 2/ | Frank F. 1/ | | Kincheloe 1/ |
| Nestucca 1/ | | Madeline J. 1/ 2/ | Franklin 1/ | | St. John Bosco |
| New Hope 1/ | | Mari Joann 2/ | Frank Lowe 1/ 2/ | | Sea |
| New Mexico 1/ | | Mary Ann 2/ | General Pershing 2/ | | Silver Queen |
| New St. Joseph 2/ | | Miss Connie 1/ | Helen Louise 1/ 2/ | | Stephanie 1/ |
| Rodoma 1/ 2/ | | New St. Joseph 2/ | Intrepid 1/ | | Sunset |
| Roseann Hess 1/ | | Oregonian 1/ | Ikaros II 1/ | | |
| Tom & Al 1/ | | Pacific Queen 1/ | Kangaroo 1/ | | |
| Tonquin 1/ | | Pearl Harbor 2/ | Karen 1/ | | |
| Tralee 1/ | | Pisces 2/ | Margaret E. 1/ | | |
| Trask 1/ | | Rainbow 1/ | Mari Joann 2/ | | |
| Valhalla 1/ | | Rodoma 2/ | Mary Ann 1/ | | |
| Washington (big) 1/ | | Ruth Ellen 1/ | Nel-Ron-Dic 1/ | | |
| Western 1/ | | San Vito | Pearl Harbor 2/ | | |
| Western Maid 1/ | | Washington (little) 2/ | Pisces 1/ 2/ | | |
| Yaquina | | WCF No. 1 1/ | Washington (little) 1/ 2/ | | |

1/ *Home port.*

2/ *Landed and listed in more than one port.*

Table 2. List of vessels engaged in trawling in Oregon by port during 1968

| Astoria | Garibaldi | Newport | Coos Bay-Winchester Bay | Port Orford | Brookings |
|---|---|---|---|---|---|
| Empress 1/ | Diana 2/ | Barbara S. 1/ | Amak 1/ 2/ | Amak 2/ | Azalea 2/ |
| Jennie Decker 1/ | Madeline J. 2/ | Clara G. 2/ | Azalea 2/ | Bristol 2/ | Bristol 2/ |
| Junior | Mari Joann 2/ | Daisy | Clara G. 2/ | Bonnie C. 2/ | Bonnie C. 2/ |
| Kodiak 1/ | Mary Ann | Destiny 1/ | Columbia 1/ | Daphne | Daphne 2/ |
| Lynda Dawn 1/ | | Diana 2/ | Christina J. 1/ | Janet Ray | Empire II 2/ |
| Margaret A. 1/ | | Jaka-B 1/ 2/ | Dare II 1/ | KDM | Faymar 1/ |
| Margaret E. 1/ | | Madeline J. 1/ 2/ | Diana 2/ | | Frances E. |
| Marian F. 1/ | | Mari Joann 2/ | Defender | | Intrepid 1/ |
| Mitkof 1/ | | Miss Connie 1/ 2/ | Elaine Dell | | Irene K. 1/ |
| Nestucca 1/ | | New St. Joseph | Empire II 2/ | | Janet Ray 2/ |
| New Mexico 1/ | | Oregonian 1/ | Flyer | | Jefferson 1/ |
| Paragon | | Pacific Queen 1/ | Frank F. 1/ | | KDM 2/ |
| Rodoma 1/ | | Rainbow 1/ | Frank Lowe 1/ | | Kincheloe 1/ |
| Roseann Hess 1/ | | Ruth Ellen 1/ | Guide 1/ | | Silver Queen |
| Sonny Boy | | Stephanie 2/ | Helen Louise 1/ | | Stephanie 1/2/ |
| Tom & Al 1/ | | Tradewind | Ikaros II 1/ | | |
| Ronquin 1/ | | | Jaka-B 2/ | | |
| Tralee 1/ | | | Janet Ray 2/ | | |
| Trask 1/ | | | Kangaroo 1/ | | |
| Valhalla II 1/ | | | Karen 1/ | | |
| Washington (big) 1/ | | | Miss Connie 2/ | | |
| Western 1/ | | | Nel-Ron-Dic 1/ | | |
| Western Maid 1/ | | | Pisces | | |
| | | | Stephanie 2/ | | |
| | | | Trego | | |
| | | | Washington (little) 1/ | | |

1/ *Home port.*

2/ *Landed and listed in more than one port.*

Link, Terry. Cruise report 66-7, Dover sole cruise. Fish Comm. Oreg. February 1967 (processed).

_____. Cruise report 66-13, shrimp cruise, phase B-fish. Fish Comm. Oreg., February 1967 (processed).

_____. Report of cruise 67-2, shrimp survey, phase B-fish. Fish Comm. Oreg., August 1967 (processed).

_____. Report of cruise 67-7, Dover sole. Fish Comm. Oreg., September 1967 (processed).

_____. Report of cruise 68-2, Dover sole. Fish Comm. Oreg., April 1968 (processed).

Meehan, James M. Cruise report 66-8, Pacific ocean perch survey. Fish Comm. Oreg., February 1967 (processed).

_____. Cruise report 66-9, Pacific ocean perch survey. Fish Comm. Oreg., February 1967 (processed).

_____. Cruise report 66-10, Pacific ocean perch survey. Fish Comm. Oreg., February 1967 (processed).

_____. Cruise report 66-11, Pacific ocean perch survey. Fish Comm. Oreg., February 1967 (processed).

_____. Boat charter. PL 88-309 Ann. Prog. Rep., October 1968 (processed).

_____ and Gary S. Milburn. Comparison of returns from dart and Petersen disc tags on Dover sole. Fish Comm. Oreg. Res. Briefs 13(1):127, June 1967.

_____, et al. Trawl investigation progress report, January 1, 1965-December 31, 1966, Oreg. Fish Comm. Res. Div., November 1967.

Milburn, Gary. Report of cruise 67-4, shrimp. Fish Comm. Oreg., August 1967 (processed).

_____. Report of cruise 67-8, shrimp. Fish Comm. Oreg., September 1967 (processed).

_____. Report of cruise 67-10, shrimp. Fish Comm. Oreg., October 1967 (processed).

_____. Report of cruise 67-11, shrimp. Fish Comm. Oreg., January 1968 (processed).

_____. Report of cruise 68-1, shrimp. Fish Comm. Oreg., June 1968 (processed).

_____. Report of cruise 68-5, shrimp. Fish Comm. Oreg., July 1968 (processed).

Milburn, Gary and Jack G. Robinson. Study on the vertical distribution and movement of pink shrimp, Pandalus jordani, in the Pacific Ocean off Oregon. PL 88-309 Ann. Prog. Rep., July 1968 (processed).

Niska, Edwin L. and Austin R. Magill. Occurrence of Greenland halibut and Asiatic flounder off Oregon. Fish Comm. Oreg., Res. Breifs 13(1):123, June 1967.

Robinson, Jack. Cruise report 66-12, phase A-shrimp. Fish Comm. Oreg. February 1967 (processed).

_____. Cruise report 67-2, phase A-shrimp. Fish Comm. Oreg., June 1967 (processed).

_____. Report on World Scientific Conference on the biology and culture of shrimps and prawns. Fish Comm. Oreg., September 1967 (processed).

_____. Study on the distribution and abundance of pink shrimp, Pandalus jordani, in the Pacific Ocean off Oregon. PL 88-309 Ann. Prog. Rep., September 1967 (processed).

_____ and Gary S. Milburn. Length-frequency and sex composition data for pink shrimp landed in Oregon 1951-65. Fish Comm. Oreg. Inv. Rep. (5):110 pp., February 1967.

## REGULATIONS

The special season for shrimp captured south of 42°00' N. Latitude was closed August 28, 1967, and August 2, 1968.

Several Brookings area fishermen in 1968 continued to fish south of 42° N. Latitude after August 2. They were cited for it and brought to trial. A court hearing at Gold Beach exonerated them on the grounds that FCO had altered the season without a public hearing which is contrary to state statutes. Hereafter changes in the basic May 1-October 1 season in the area south of 42° N. Latitude will be made at public hearings.

The regulation limiting petrale sole landings to 6,000 pounds per trip during January through March was rescinded in December 1967. The 3-4 1/2 inch trawl net mesh restriction was rescinded in August 1968. The 3,000 pound incidental fish limit for shrimp landings was rescinded in August 1968. The undersize sole limit of 100 per landing was rescinded

in August 1968. A new limit of 250 undersized sole per landing for boats using or possessing a net with a mesh size under 4-1/2 inches was enacted in August 1968.

## BOTTOMFISH MARKET SAMPLING

Market sampling was expanded in 1967 to include weight and maturity sampling for Pacific ocean perch and species composition sampling for rockfish landings, including Pacific ocean perch.

Total sampling effort in 1967 resulted in 43 English sole samples, 48 petrale sole samples, 38 Dover sole samples, 22 Pacific ocean perch samples, and 29 rockfish composition samples. In 1968 samples numbered 44 English sole samples, 41 petrale sole samples, 50 Dover sole samples, 19 Pacific ocean perch samples, and 78 rockfish composition samples.

### English sole

Graphed in Figure 1 are the length frequencies of 1,644 English sole measured at Astoria in 1967. Figure 2 contains the length frequencies of 453 English sole measured at Coos Bay in 1967. The length-frequency distributions are graphed by month by sex as well as by composite annual total. The skewness to the right is partially the result of an industry size limit. Soles less than 32 cm are not considered large enough for fillet market and are discarded at sea. The same skewness is apparent in the 1968 samples shown in Figures 3-5. Figure 3 is for 1,554 English sole measured at Astoria in 1968. Figures 4 and 5 show the length-frequency of 473 and 253 measured at Newport and Coos Bay, respectively.

### Petrale sole

Petrale sole market samples for 1967 and 1968 are summarized in Figures 6-10.

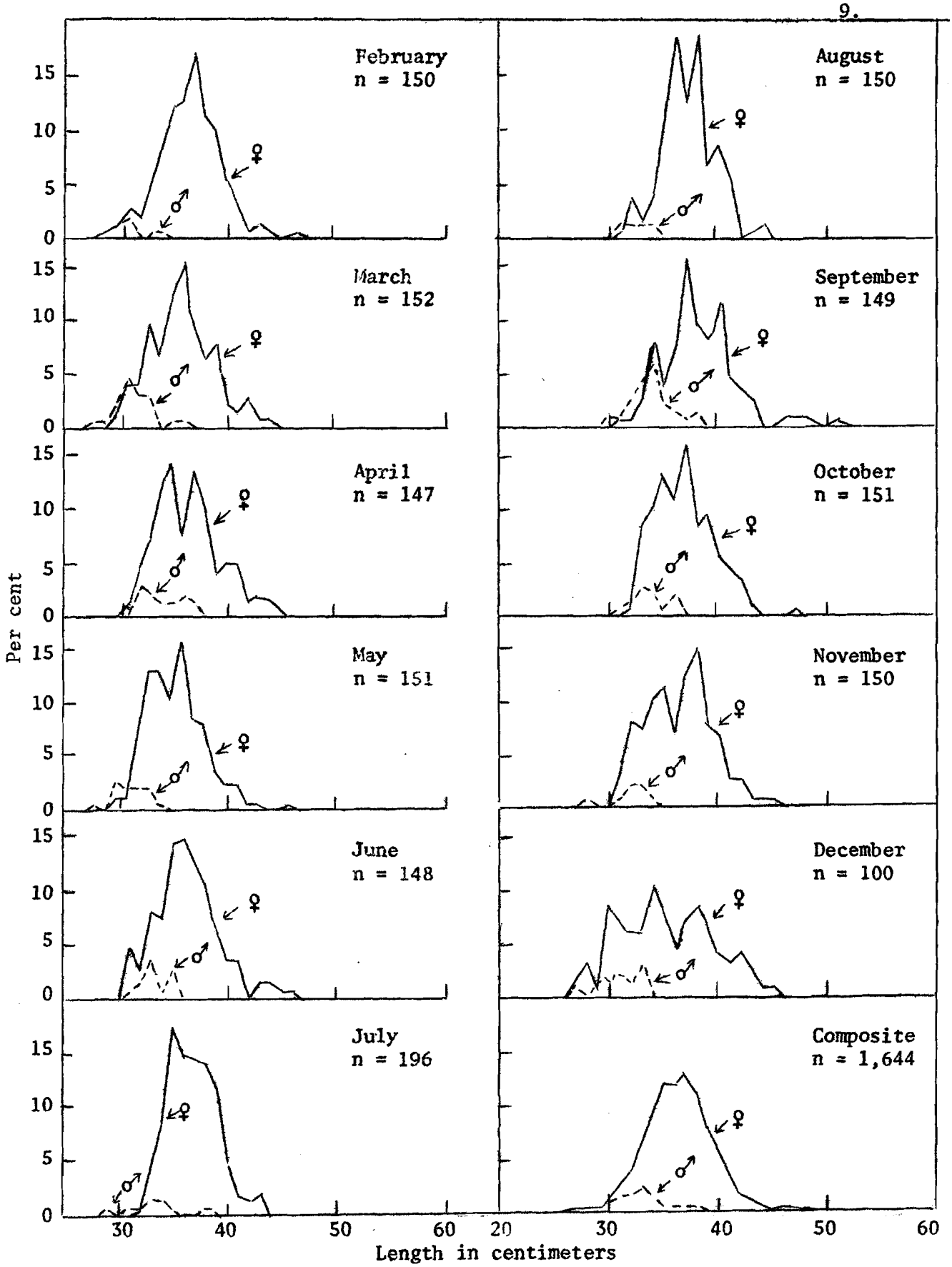


Figure 1. English sole length-frequency by sex, by month in 1967 Astoria market samples

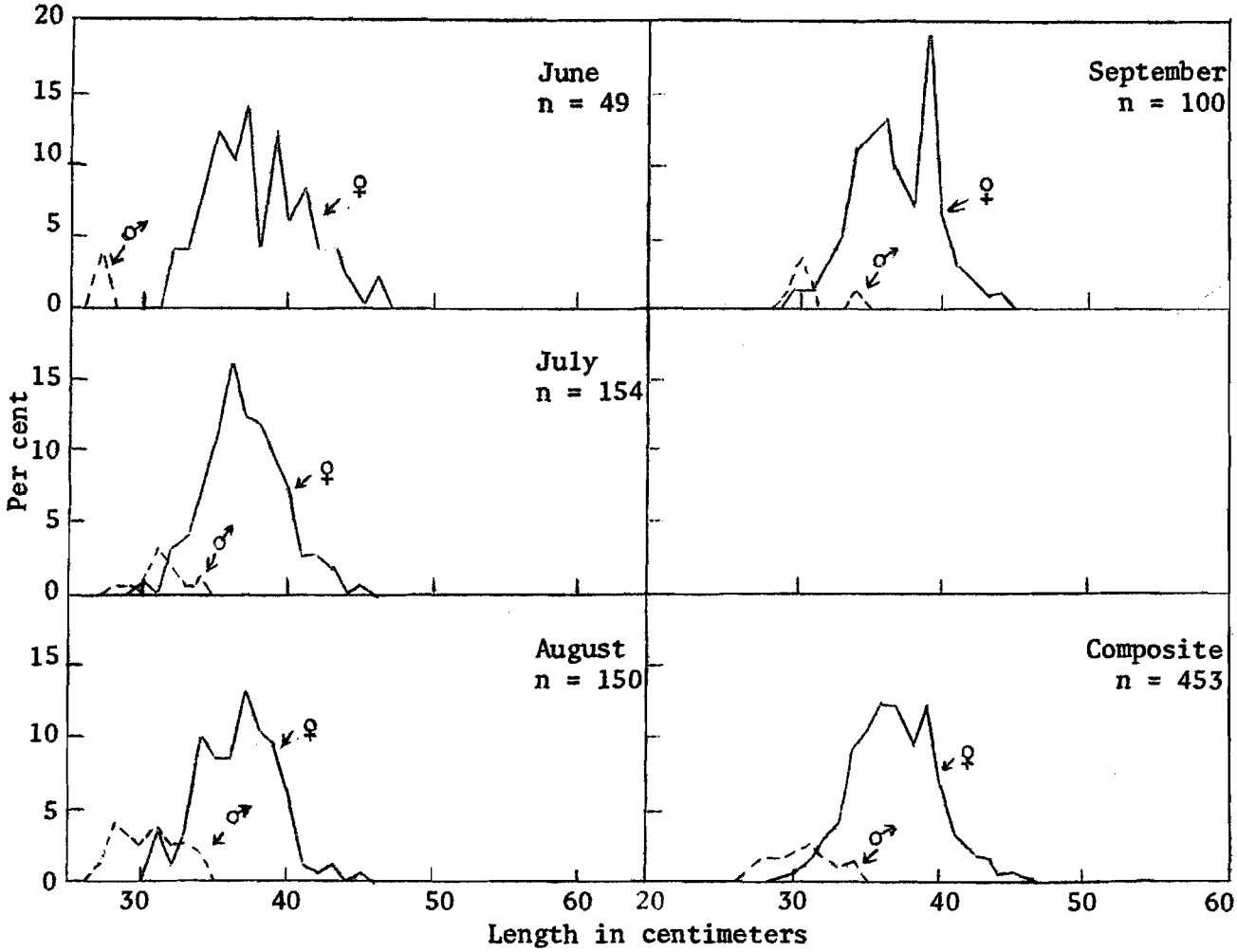


Figure 2. English sole length-frequency by sex by month in 1967 Coos Bay market samples

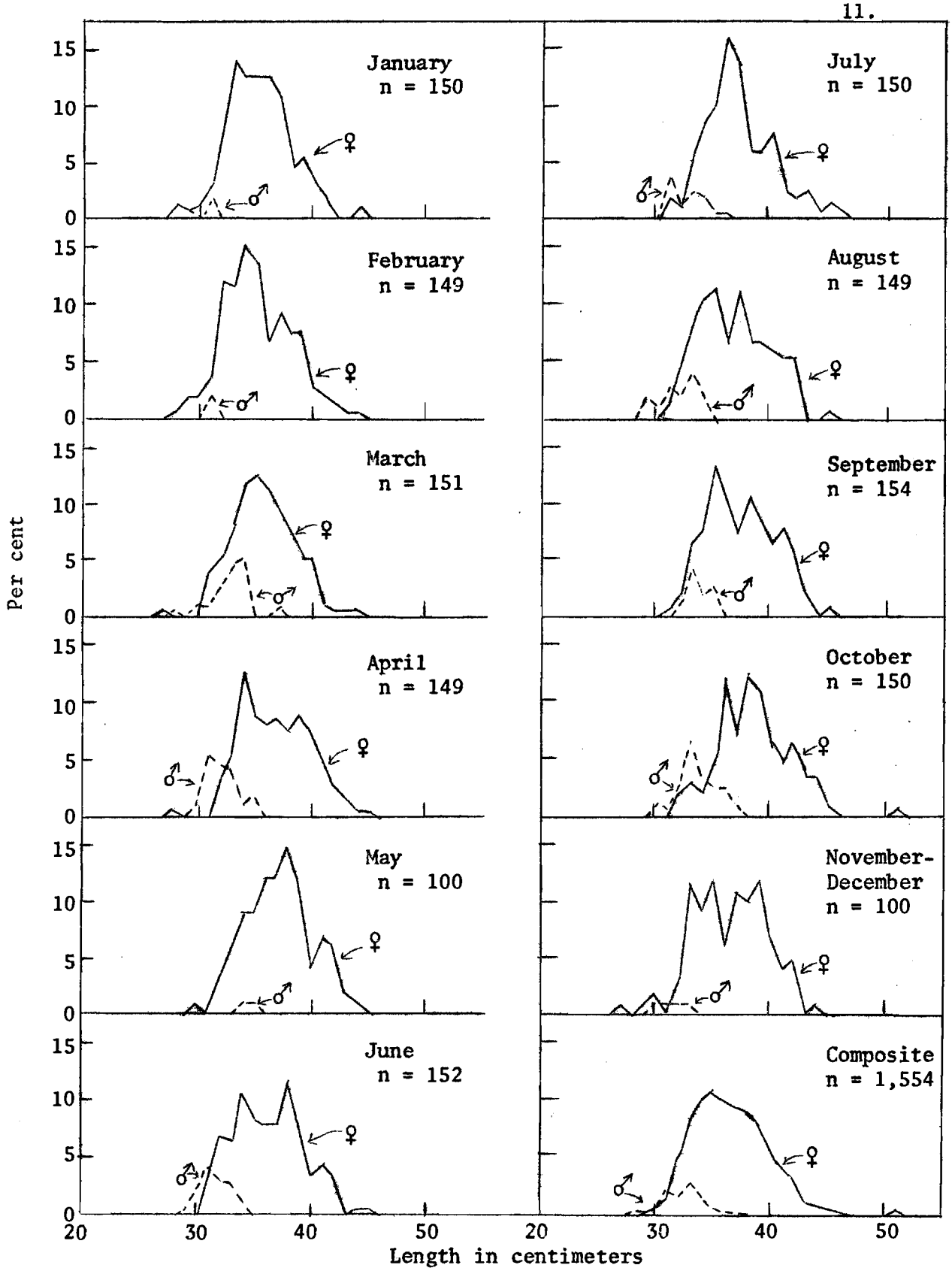


Figure 3. English sole length-frequency by sex, by month in 1968 Astoria market samples

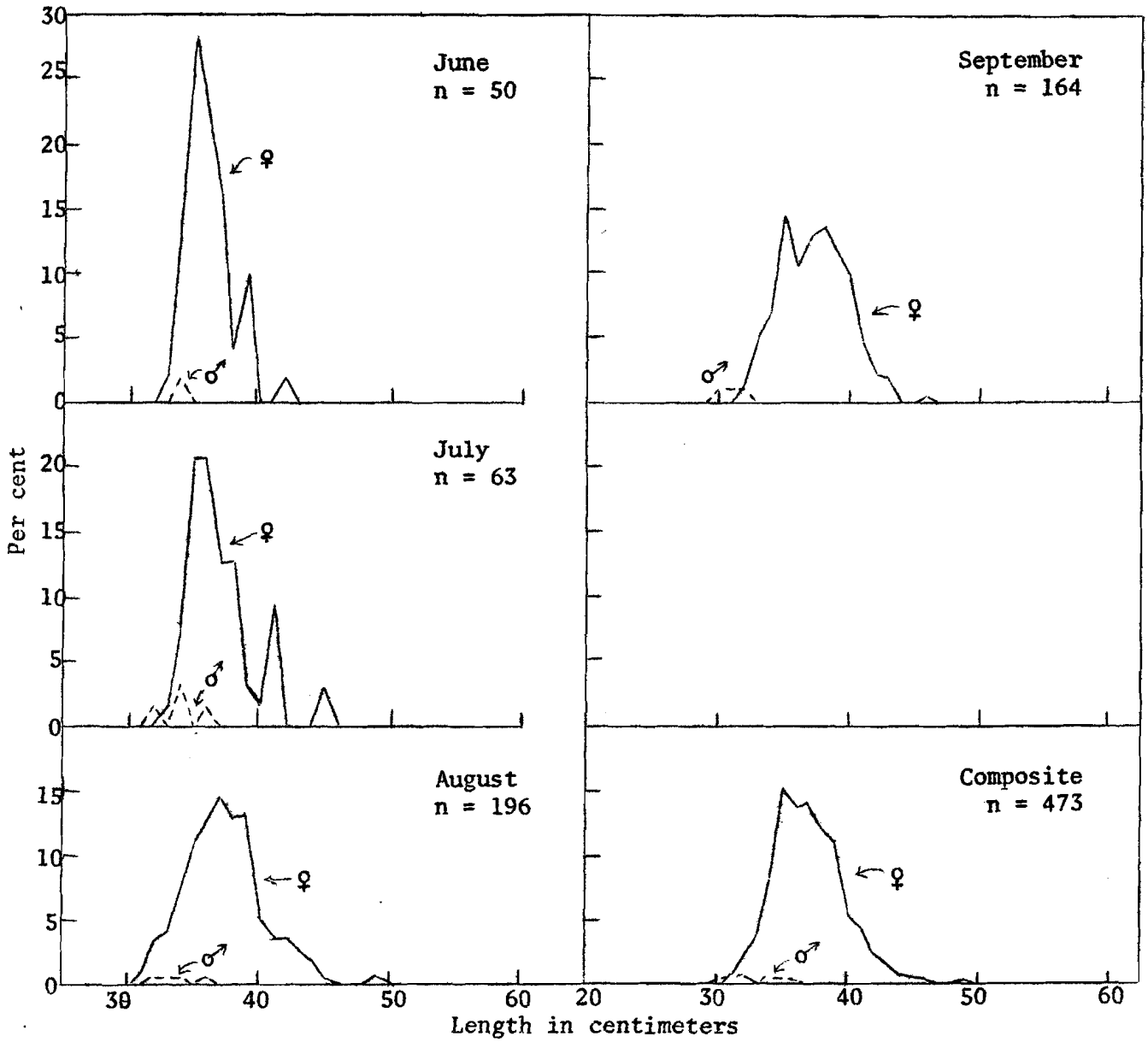


Figure 4. English sole length-frequency by sex by month in 1968 Newport market samples

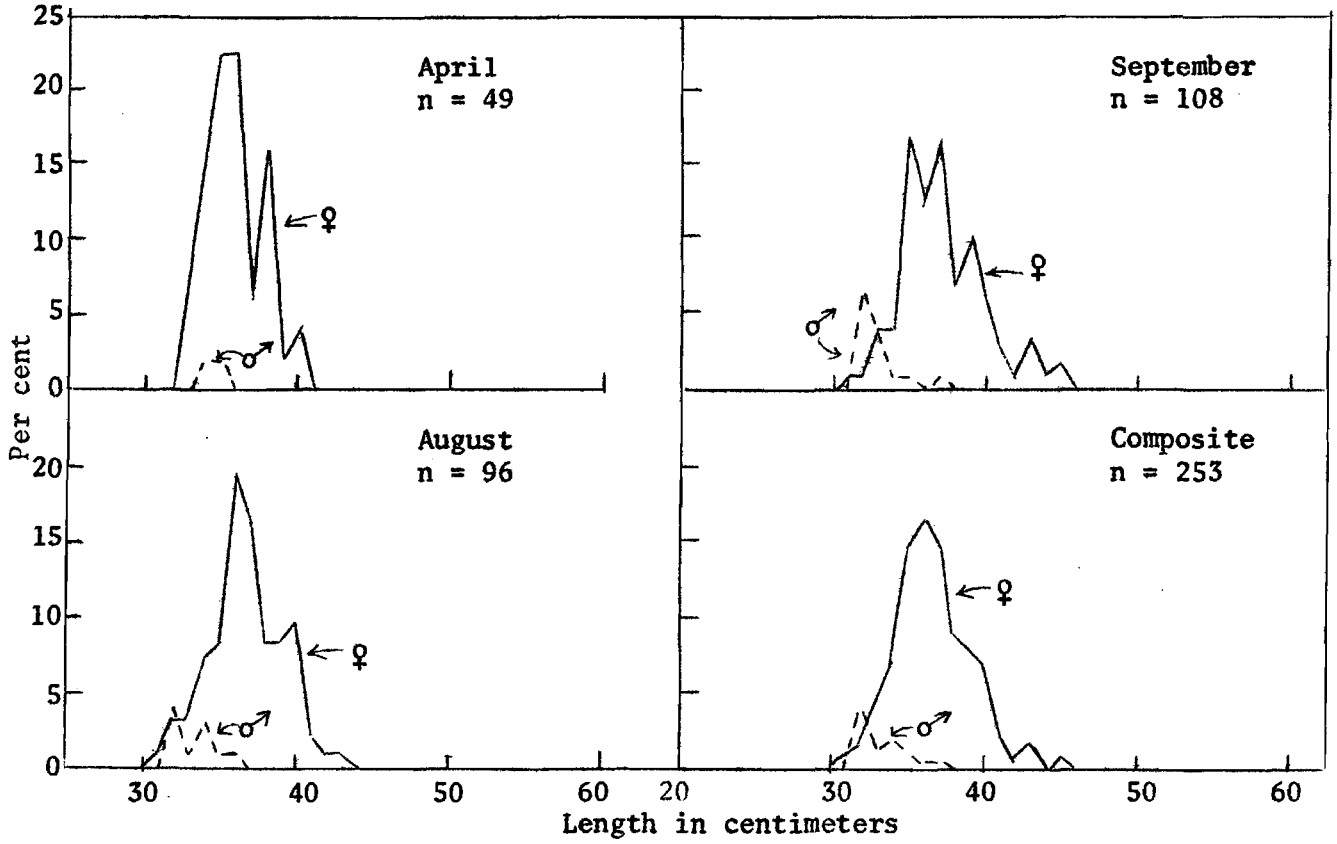


Figure 5. English sole length-frequency by sex, by month in 1968 Coos Bay market samples

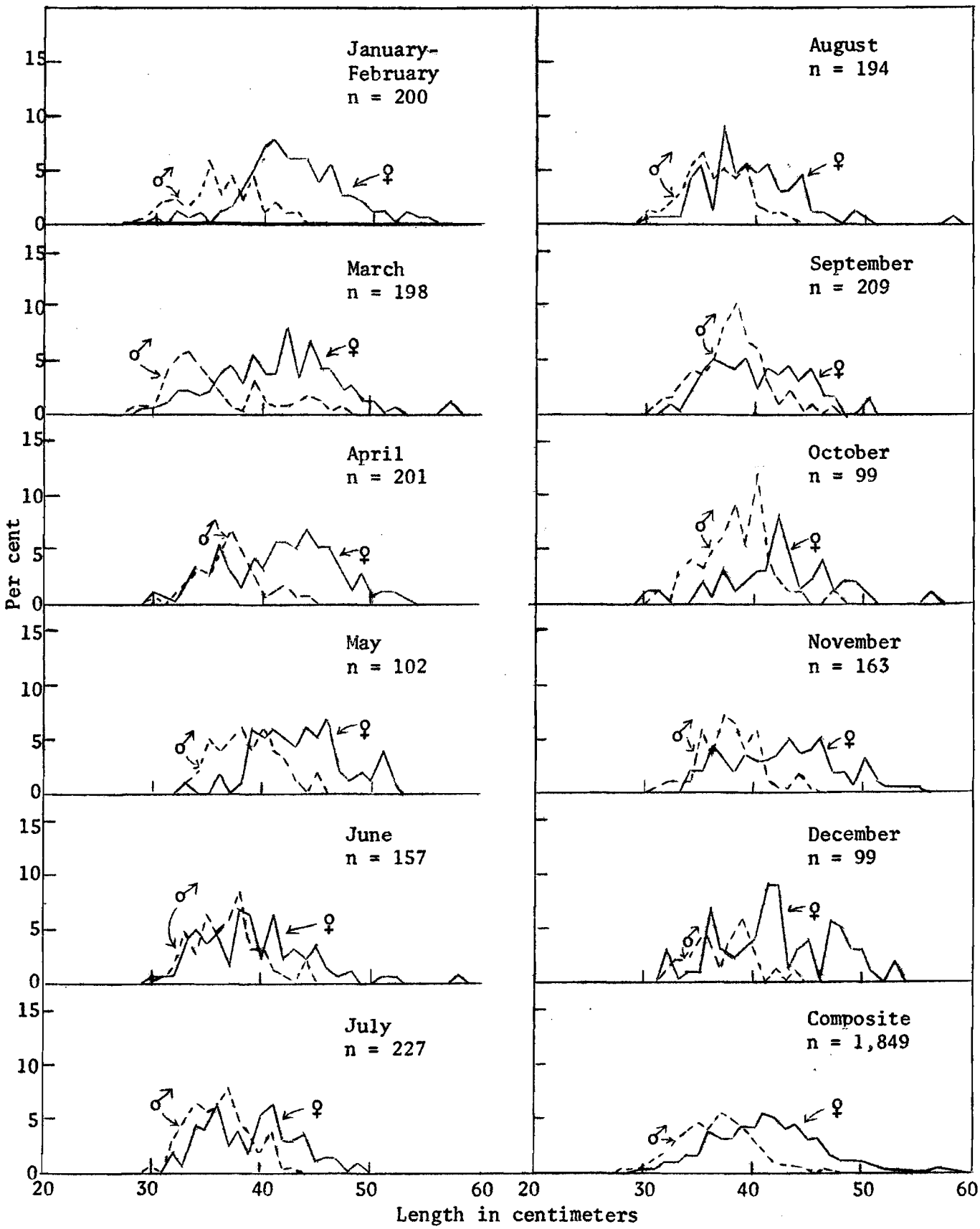


Figure 6. Petrale sole length-frequency by sex, by month in 1967 Astoria market samples

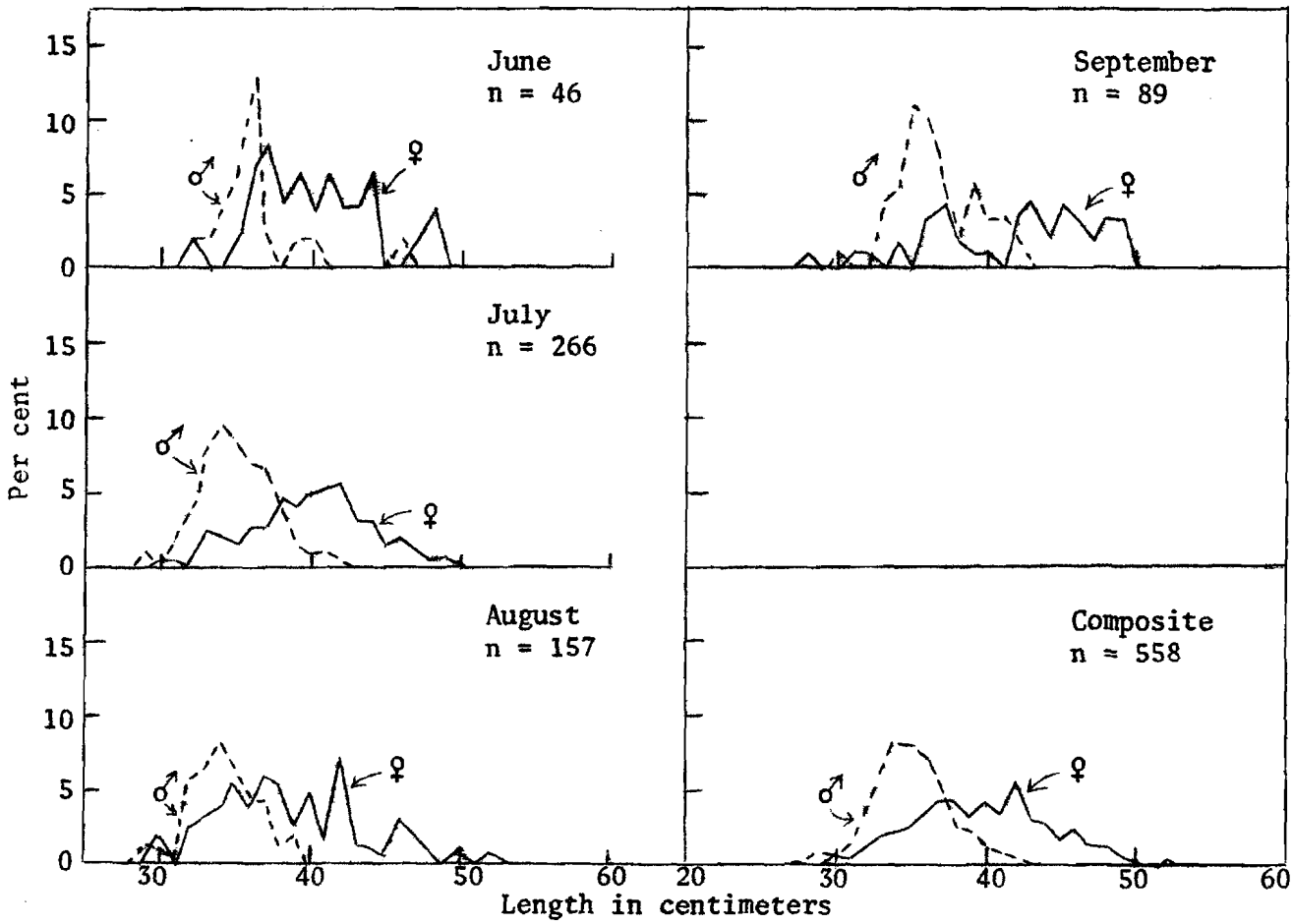


Figure 7. Petrale sole length-frequency by sex, by month in 1967 Coos Bay market samples

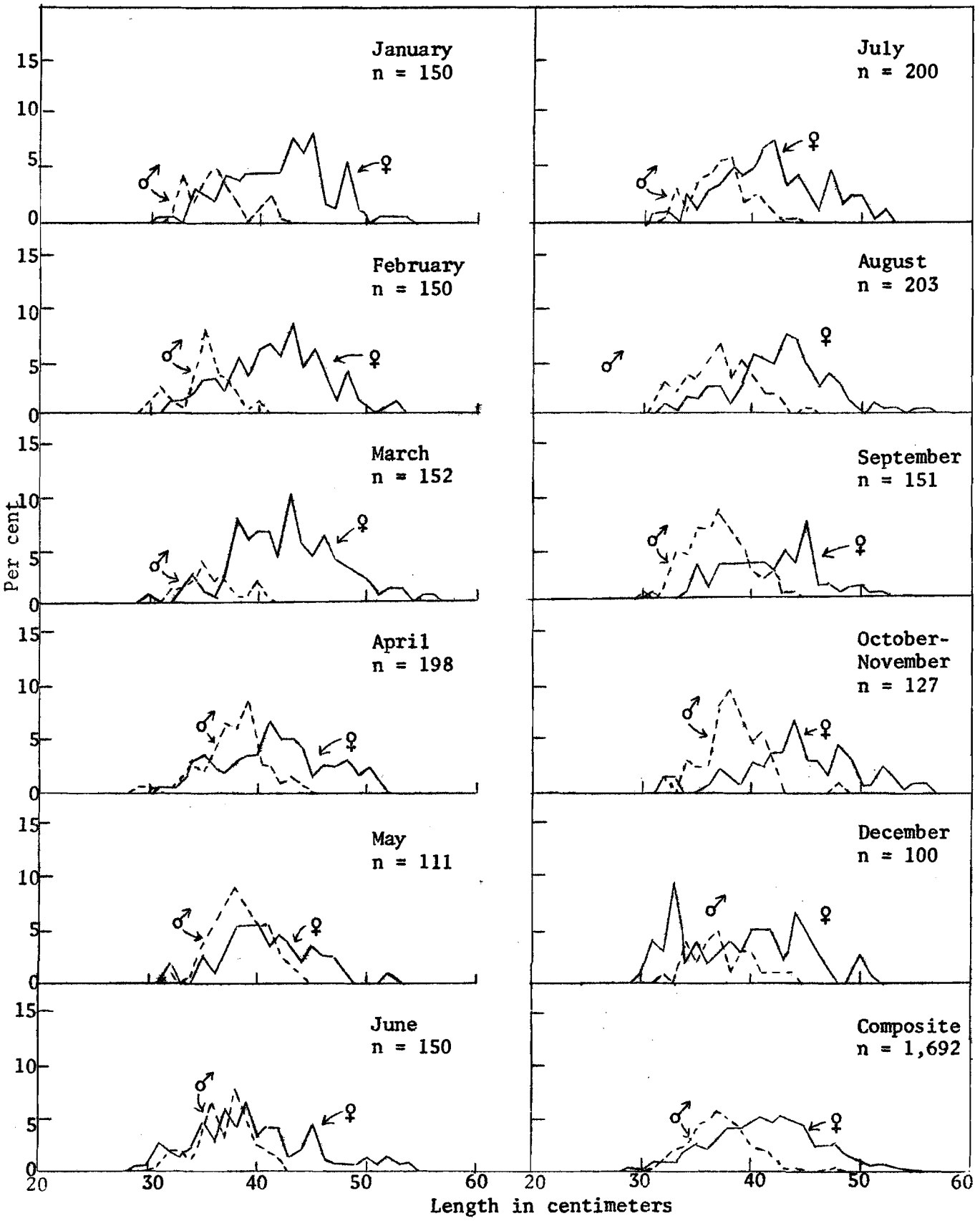


Figure 8. Petrale sole length-frequency by sex, by month in 1968 Astoria market samples

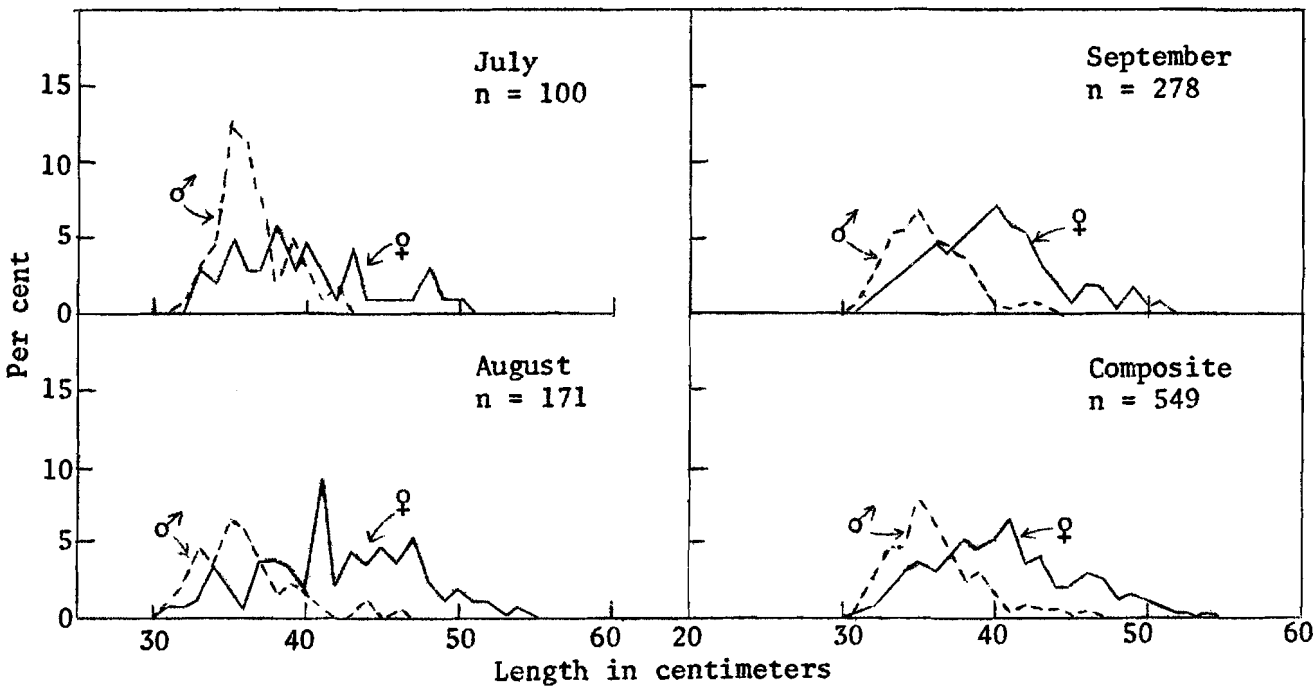


Figure 9. Petrale sole length-frequency by sex, by month in 1968 Newport market samples

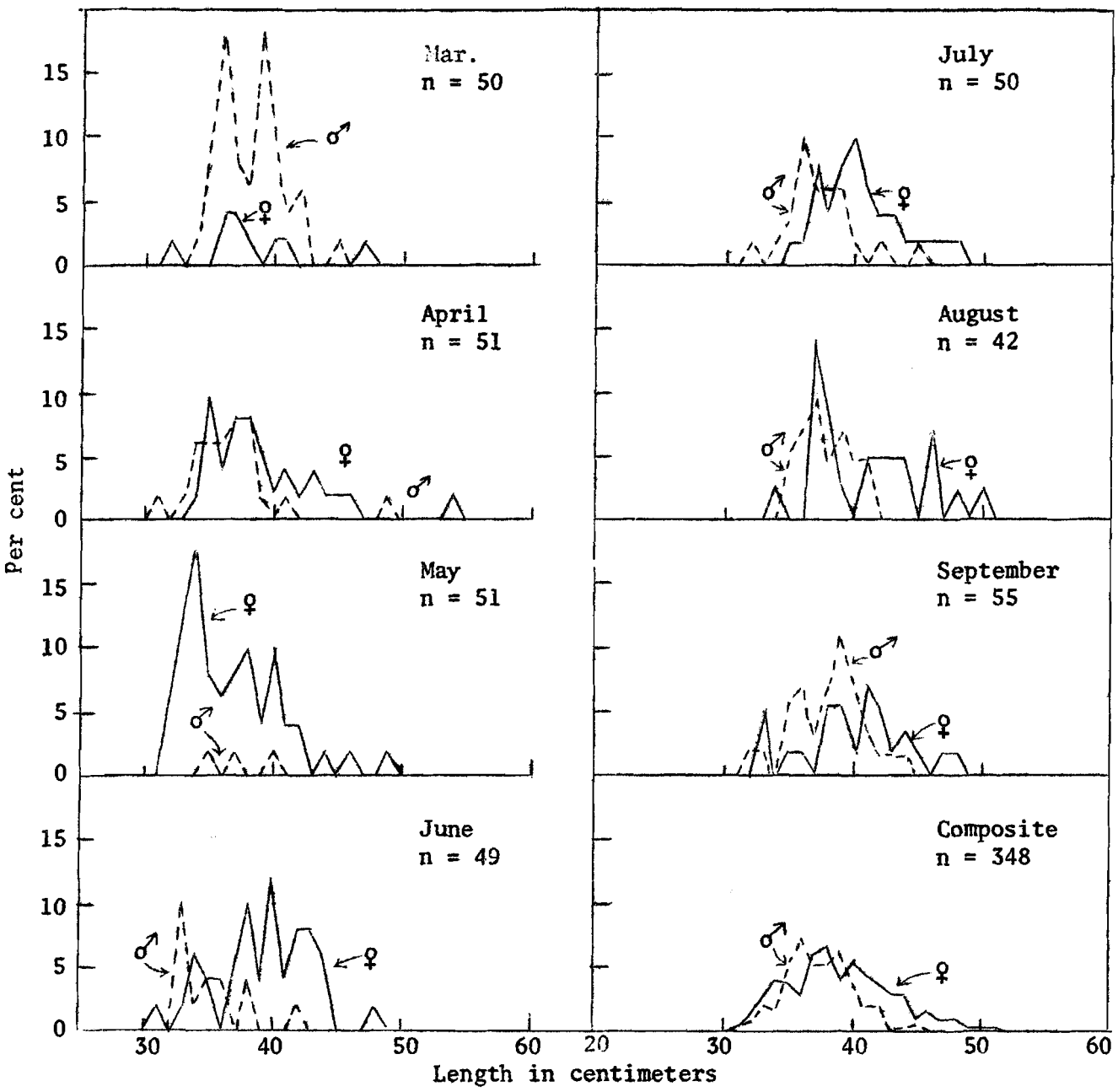


Figure 10. Petrale sole length-frequency by sex, by month in 1968 Coos Bay market samples

Dover sole

Dover sole sampling has been carried on during the summer months for the past 13 years and throughout the year for the past 5 years. The mean lengths of males and females, as well as the sex ratios, for these time periods are shown in Table 3. The monthly and yearly length frequencies are plotted by sex for 1967 in Figures 11 and 12 and for 1968 in Figures 13 and 14.

Table 3. Mean lengths and sex ratios of Dover sole in market samples at Astoria, 1956-68

| | Mean length in cm | | | | | |
|---|---|---|---|---|---|---|
| | Males | | Females | | Per cent males | |
| Year | June-Sept. | Jan.-Dec. | June-Sept. | Jan.-Dec. | June-Sept. | Jan.-Dec. |
| 1956 | 40.7 | | 44.8 | | 46.3 | |
| 1957 | 40.3 | | 44.6 | | 39.6 | |
| 1958 | 39.7 | | 43.4 | | 34.8 | |
| 1959 | 40.8 | | 44.1 | | 34.3 | |
| 1960 | 40.2 | | 45.0 | | 33.6 | |
| 1961 | 39.8 | | 43.4 | | 37.6 | |
| 1962 | 39.6 | | 43.1 | | 27.8 | |
| 1963 | 39.6 | | 43.3 | | 28.6 | |
| 1964 | 38.0 | 38.6 | 42.3 | 41.7 | 37.7 | 43.3 |
| 1965 | 38.5 | 38.5 | 41.6 | 41.9 | 38.8 | 42.1 |
| 1966 | 38.0 | 38.1 | 40.9 | 40.9 | 39.8 | 40.0 |
| 1967 | 38.3 | 37.9 | 41.3 | 40.9 | 35.5 | 34.7 |
| 1968 | 37.0 | 36.8 | 39.8 | 40.3 | 31.5 | 32.2 |

Pacific ocean perch

Samples of market landings in Astoria taken during 1967 are depicted in Figure 15 by sex, by month and year. Length frequencies for 1968 Astoria perch samples by sex, by month and year are shown in Figure 16.

## BOTTOMFISH LANDINGS

Annual Oregon landings from 1959 to 1968 by species are shown in Table 4. Table 5 presents the total catch for 1964-68 by international

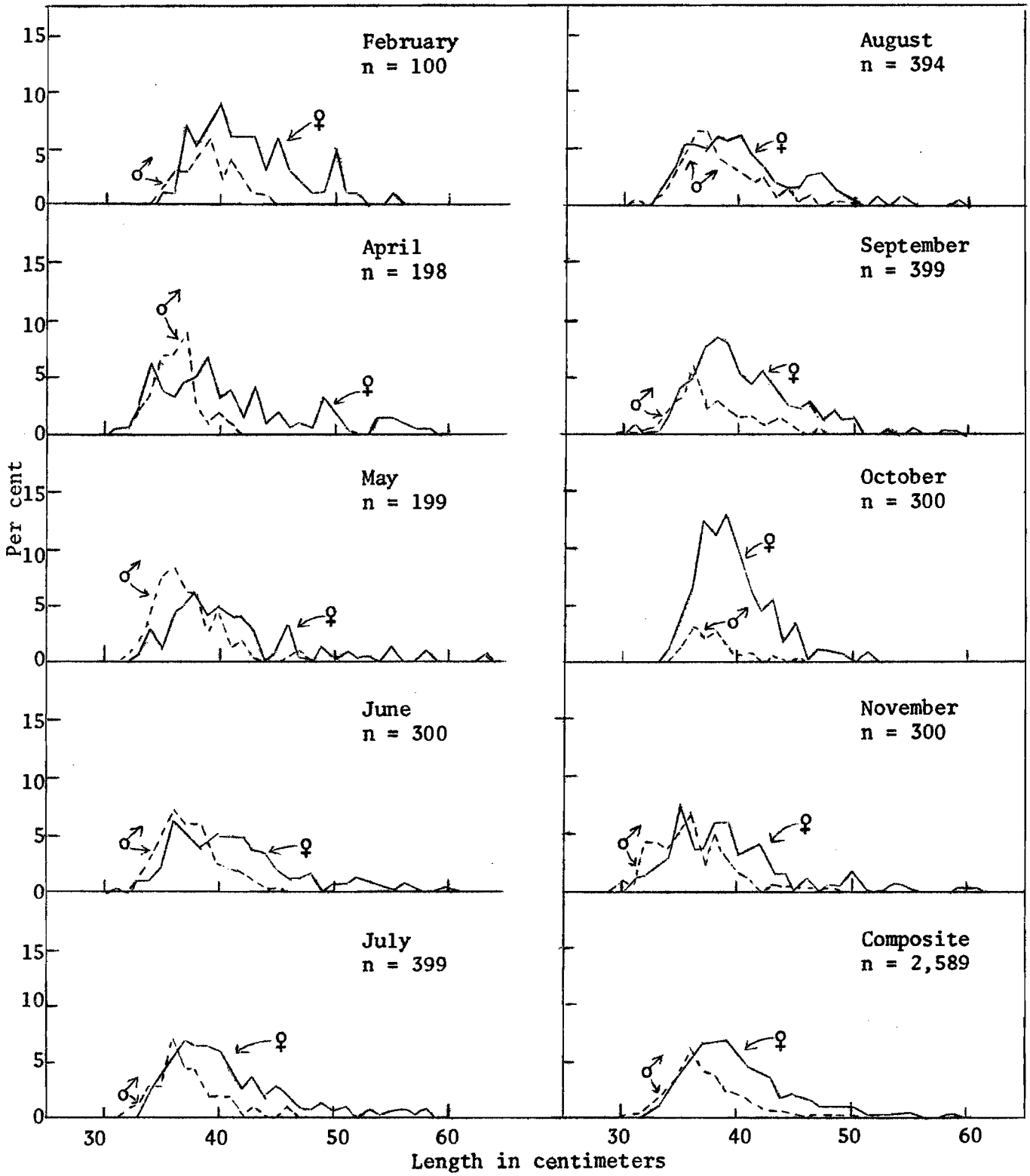


Figure 11. Dover sole length-frequency by sex, by month in 1967 Astoria market samples

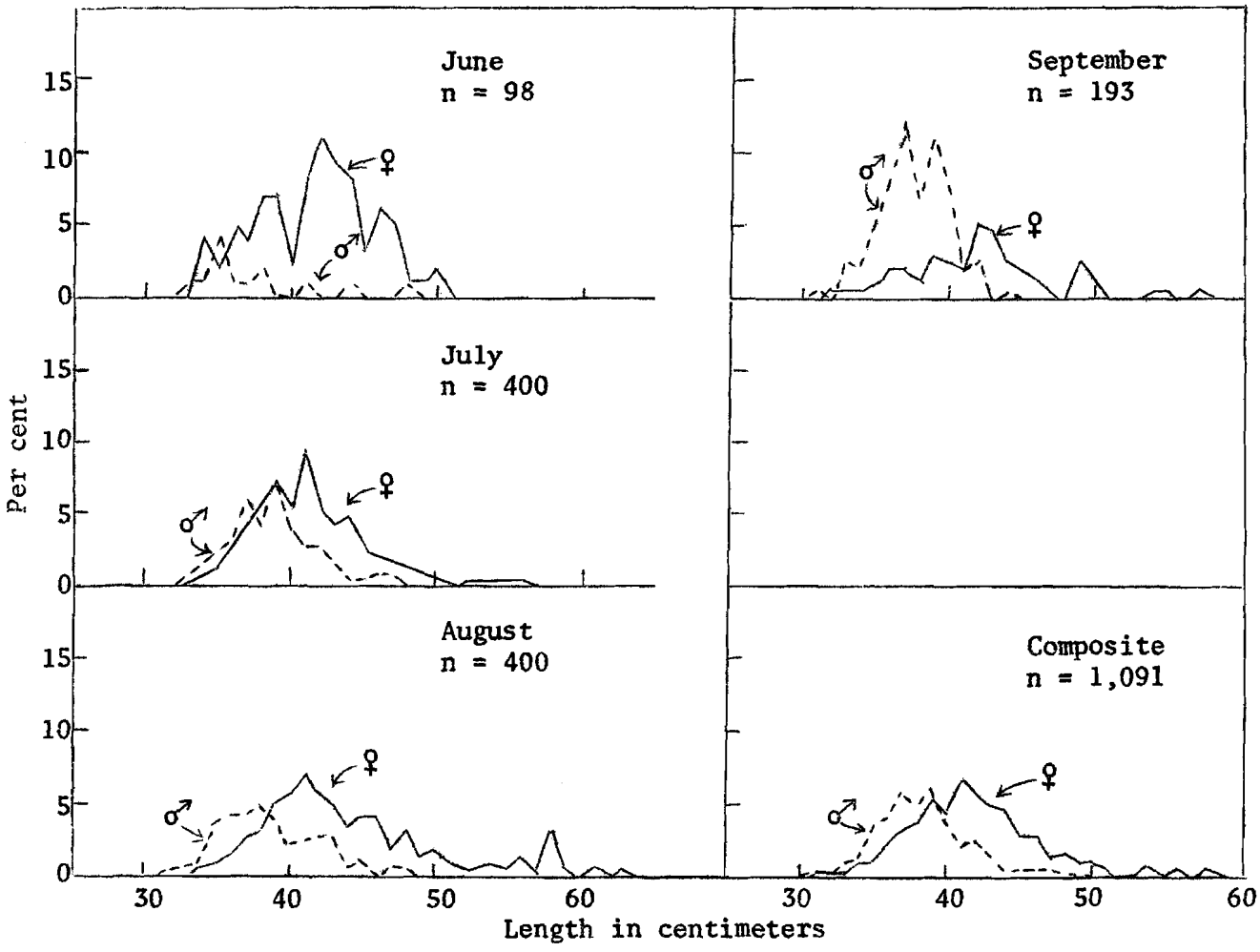


Figure 12. Dover sole length-frequency by sex, by month in 1967 Coos Bay market samples

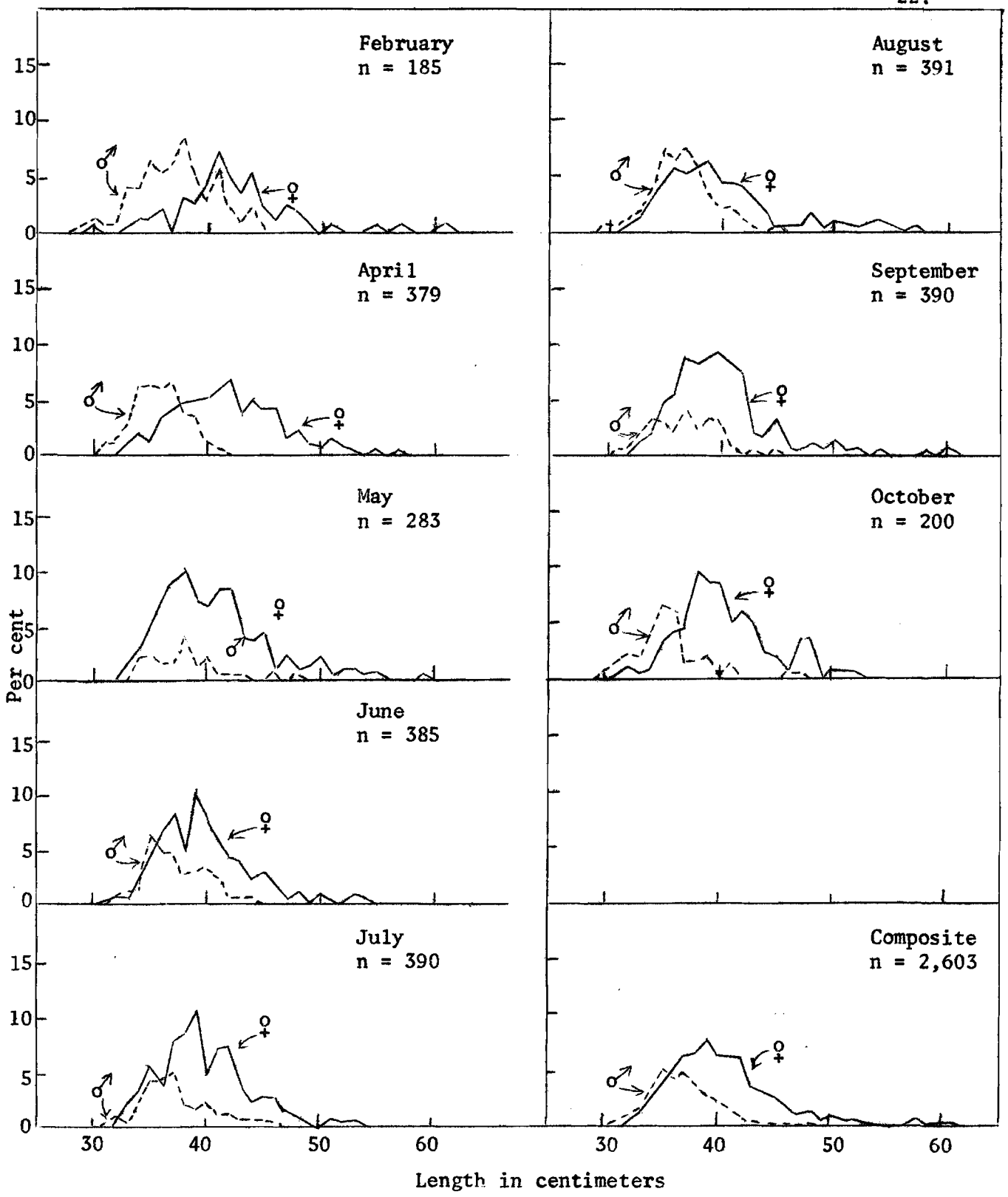


Figure 13. Dover sole length-frequency by sex, by month in 1968 Astoria market samples

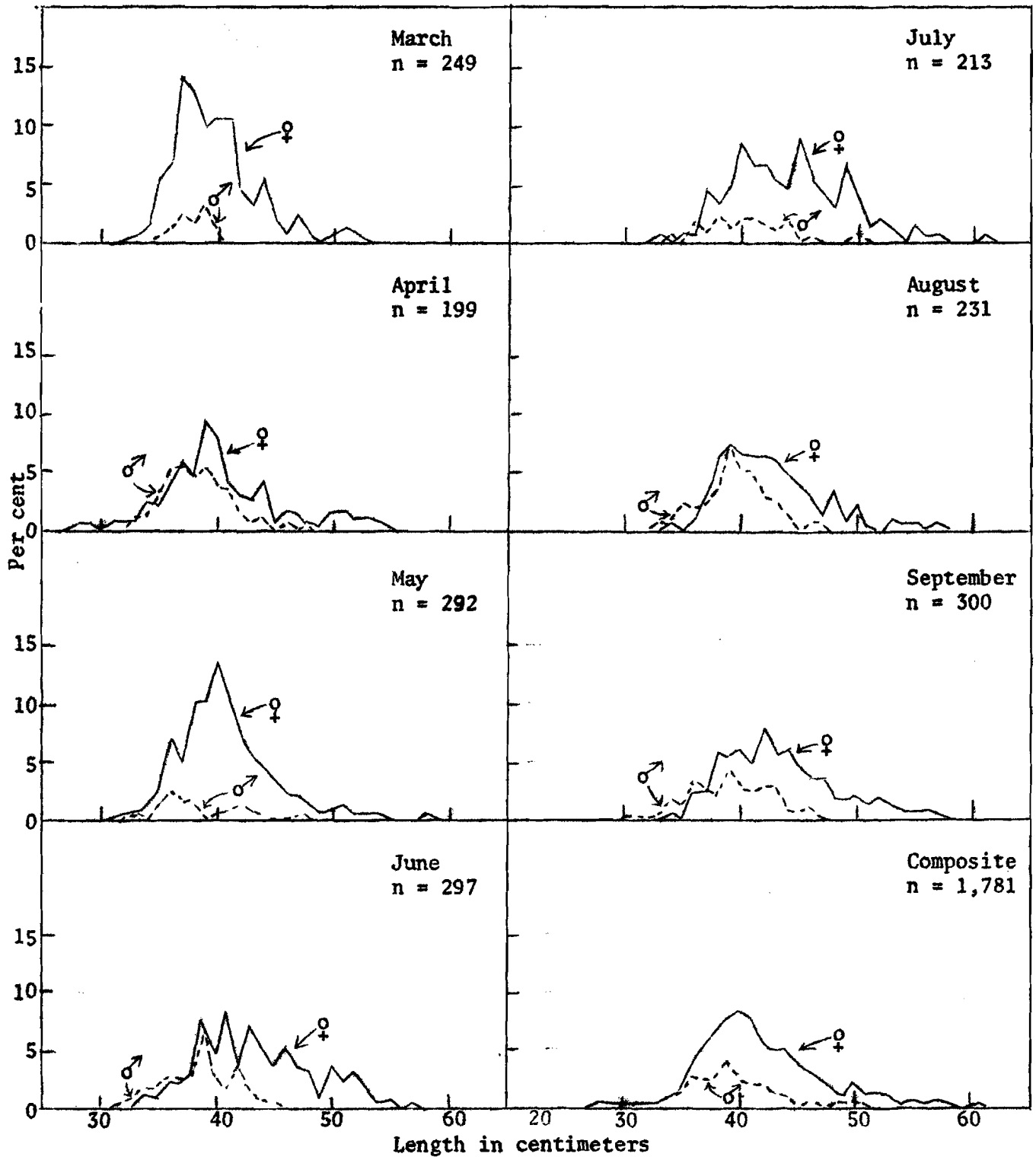


Figure 14. Dover sole length-frequency by sex, by month in 1968 Coos Bay market samples

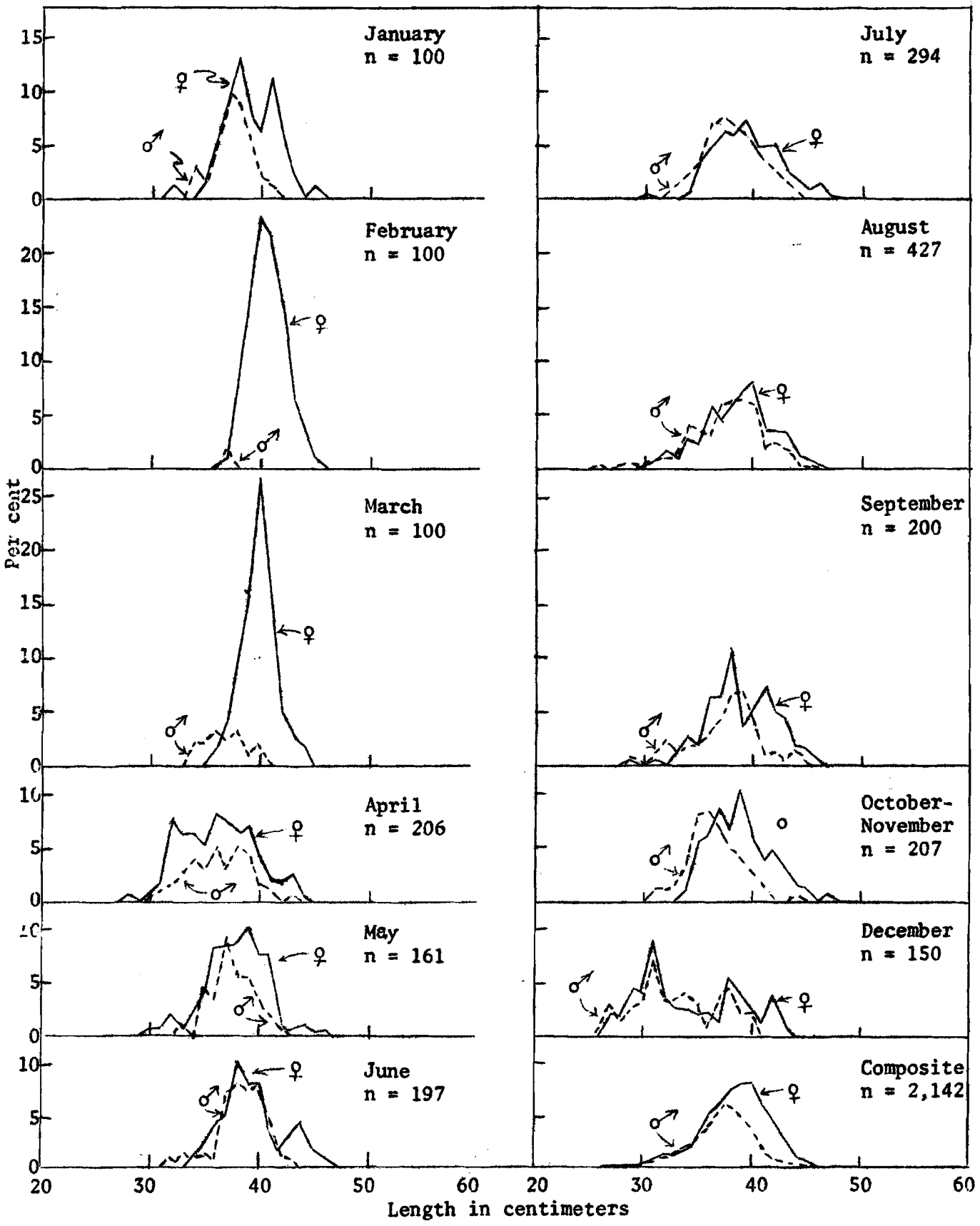


Figure 15. Pacific ocean perch length-frequency by sex, by month in 1967 Astoria market samples

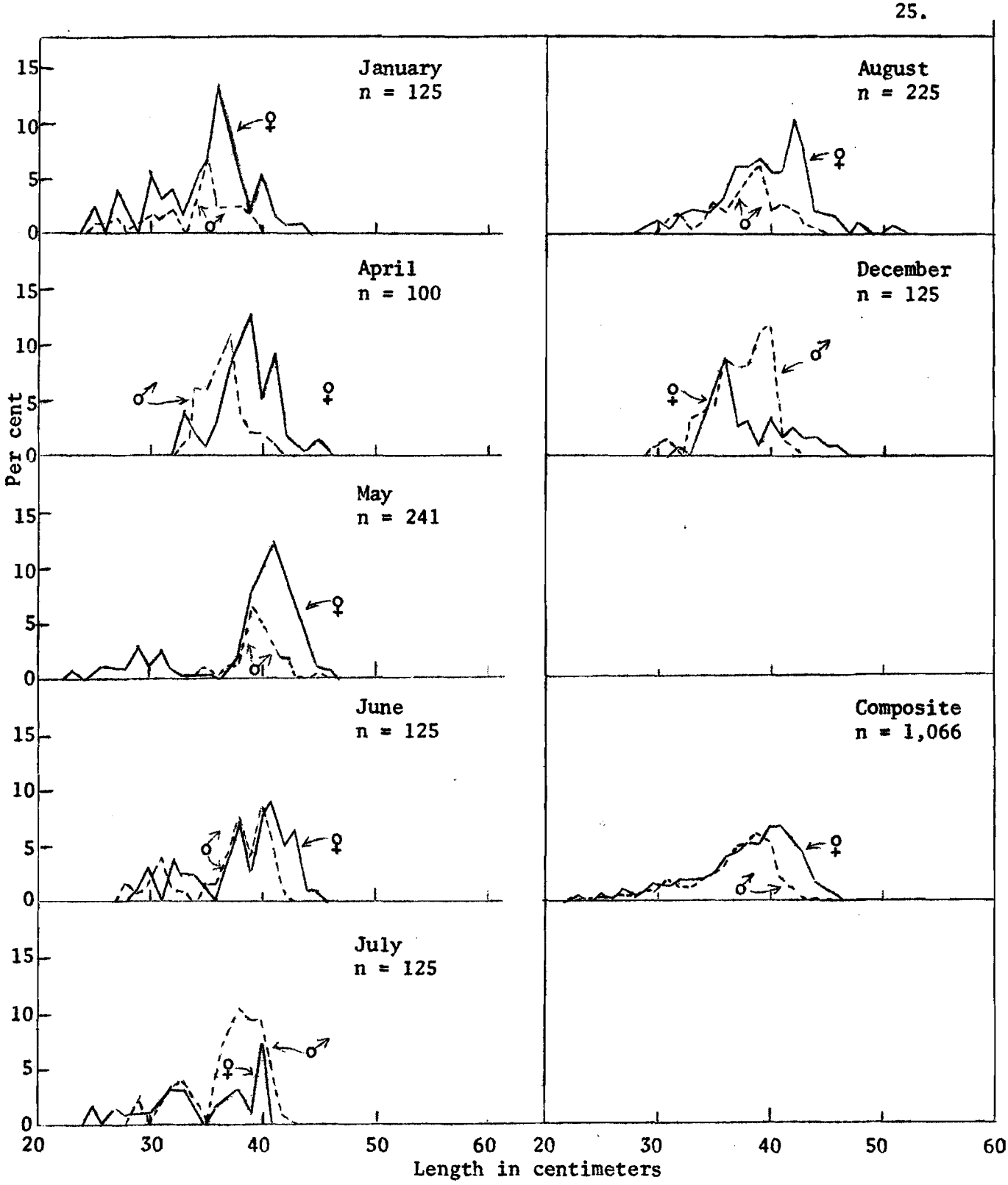


Figure 16. Pacific ocean perch length-frequency by sex, by month in 1968 Astoria market samples

Table 4. Yearly Oregon trawl landings from 1959 to 1968 (landings in thousands of pounds)

| Species | Year | | | | | | | | | | Mean |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1959 | 1960 | 1961 | 1962 | 1963 | 1964 | 1965 | 1966 | 1967 | 1968 | 1959-68 |
| English sole | 1,451 | 2,454 | 1,789 | 2,295 | 1,948 | 1,562 | 1,678 | 3,537 | 2,304 | 2,306 | 2,139 |
| Rock sole | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 18 | 8 | 51 | 9 |
| Petrale sole | 1,275 | 2,143 | 1,838 | 2,607 | 2,295 | 1,877 | 1,838 | 1,838 | 1,771 | 1,653 | 1,913 |
| Dover sole | 4,543 | 5,208 | 4,054 | 4,454 | 5,345 | 5,529 | 3,631 | 3,492 | 3,565 | 4,325 | 4,460 |
| Rex sole | 856 | 1,280 | 988 | 1,333 | 1,033 | 806 | 985 | 1,498 | 1,219 | 1,075 | 1,108 |
| Starry flounder | 288 | 234 | 403 | 706 | 273 | 528 | 410 | 477 | 277 | 454 | 405 |
| Other flatfish | 78 | 204 | 138 | 216 | 73 | 143 | 62 | 205 | 255 | 215 | 158 |
| Pacific cod | 344 | 224 | 103 | 19 | 67 | 200 | 194 | 628 | 430 | 385 | 259 |
| Lingcod | 327 | 664 | 619 | 756 | 493 | 736 | 852 | 993 | 1,067 | 1,526 | 803 |
| Sablefish | 75 | 172 | 159 | 150 | 188 | 183 | 130 | 68 | 67 | 56 | 124 |
| Pac. ocean perch | 2,471 | 2,734 | 4,568 | 5,789 | 7,982 | 9,548 | 13,647 | 4,518 | 1,706 | 1,649 | 5,461 |
| Other rockfish | 3,696 | 5,392 | 4,832 | 7,125 | 4,681 | 4,147 | 4,121 | 5,069 | 4,061 | 4,253 | 4,738 |
| Misc. species | 249 | 413 | 117 | 65 | 6 | 32 | 23 | 12 | 8 | 31 | 96 |
| Dogfish | 67 | 45 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 2 | 12 |
| Animal food | 7,134 | 4,435 | 5,790 | 6,176 | 5,540 | 5,990 | 4,152 | 3,357 | 3,999 | 2,815 | 4,939 |
| Reduction use 1/ | - | - | - | - | - | - | 1,498 | 79 | 18 | 49 | 164 |
| Total | 22,862 | 25,602 | 25,398 | 31,691 | 29,924 | 31,290 | 33,226 | 25,789 | 20,745 | 20,899 | 26,743 |
| Total hours | 22,769 | 30,005 | 29,429 | 35,254 | 32,412 | 31,312 | 29,254 | 23,676 | 20,183 | 24,456 | 27,875 |
| Catch/hour | 1,004 | 853 | 863 | 899 | 923 | 999 | 1,136 | 1,089 | 1,028 | 855 | 965 |

1/ *New category introduced in 1965, previously included with miscellaneous fish.*

Table 5. Total Oregon trawl landings (by area fished), calculated hours fished, and catch per hour by international statistical areas for 1964-68

| International statistical area | | Year | | | | | Mean |
|---|---|---|---|---|---|---|---|
| | | 1964 | 1965 | 1966 | 1967 | 1968 | 1964-68 |
| 5-A/5-B | Pounds | 127,000 | | 701,000 | 123,000 | 2,017,000 | 742,000 |
| | Hours | 78 | | 187 | 105 | 1,277 | 412 |
| | Lbs/hr | 1,628 | | 3,749 | 1,171 | 1,579 | 2,032 |
| 3-D | Pounds | | 25,000 | | | 190,000 | 103,000 |
| | Hours | | 40 | | | 114 | 77 |
| | Lbs/hr | | 625 | | | 1,667 | 1,146 |
| 3-C | Pounds | 265,000 | 373,000 | 637,000 | 47,000 | 45,000 | 275,000 |
| | Hours | 313 | 295 | 434 | 33 | 41 | 223 |
| | Lbs/hr | 847 | 1,264 | 1,468 | 1,727 | 1,098 | 1,281 |
| 3-B | Pounds | 1,451,000 | 249,000 | 258,000 | 1,061,000 | 2,203,000 | 1,044,000 |
| | Hours | 1,432 | 272 | 299 | 800 | 2,324 | 1,025 |
| | Lbs/hr | 1,013 | 915 | 863 | 1,326 | 948 | 1,013 |
| 3-A | Pounds | 14,885,000 | 12,217,000 | 13,911,000 | 11,848,000 | 9,311,000 | 12,434,000 |
| | Hours | 14,884 | 10,122 | 11,197 | 10,883 | 10,825 | 11,582 |
| | Lbs/hr | 1,000 | 1,207 | 1,242 | 1,809 | 860 | 1,080 |
| 2-C | Pounds | 7,348,000 | 14,011,000 | 5,622,000 | 3,646,000 | 2,382,000 | 6,602,000 |
| | Hours | 6,931 | 10,151 | 6,380 | 4,273 | 4,234 | 6,394 |
| | Lbs/hr | 1,060 | 1,380 | 881 | 853 | 563 | 974 |
| 2-B | Pounds | 6,669,000 | 5,540,000 | 3,870,000 | 3,590,000 | 3,994,000 | 4,733,000 |
| | Hours | 6,492 | 6,628 | 3,954 | 3,380 | 4,543 | 4,999 |
| | Lbs/hr | 1,027 | 836 | 979 | 1,062 | 879 | 957 |
| 2-A | Pounds | 445,000 | 523,000 | 511,000 | 140,000 | 339,000 | 392,000 |
| | Hours | 950 | 1,354 | 769 | 277 | 520 | 774 |
| | Lbs/hr | 468 | 386 | 664 | 505 | 652 | 535 |

Table 5. (Continued)

| International statistical area | | Year | | | | | Mean |
|---|---|---|---|---|---|---|---|
| | | 1964 | 1965 | 1966 | 1967 | 1968 | 1964-68 |
| 1-C | Pounds | 100,000 | 288,000 | 279,000 | 280,000 | 418,000 | 273,000 |
| | Hours | 272 | 392 | 456 | 432 | 572 | 425 |
| | Lbs/hr | 368 | 736 | 512 | 648 | 731 | 619 |
| State-wide total | Pounds | 31,290,000 | 33,226,000 | 25,789,000 | 20,745,000 | 20,899,000 | 26,390,000 |
| | Hours | 31,312 | 29,254 | 23,676 | 20,183 | 24,456 | 25,776 |
| | Lbs/hr | 999 | 1,136 | 1,089 | 1,028 | 855 | 1,021 |

statistical area, hours fished, and catch per hour. State-wide landings for 1967 are below the 10-year average. Petrale sole, English sole, rex sole, and rockfish landings decreased in 1967 while Dover sole and lingcod increased. The Pacific ocean perch catch continued its spectacular decrease in 1967 to a new low. The reduced availability of Pacific ocean perch was the primary cause of this decrease. Oregon landings stayed below the 10-year average in 1968. Petrale sole and rex sole landings continued their decrease. English sole, Dover sole, lingcod and rockfish landings increased. The Pacific ocean perch catch decreased slightly in 1968 even though increased landings from the Queen Charlotte Sound area increased. The state-wide catch per hour continued its decrease in 1967. This can be attributed partially to the small loads of Pacific ocean perch. The decrease in the catch-per-hour rate in 1968 can be attributed to continued low perch landings and a decrease in the mink food landings.

The catch rates and total landings of Dover sole, English sole, petrale sole, and Pacific ocean perch have been determined for the past 10 years by international statistical area. Tables 6 through 9 show the total pounds landed and pounds per hour per significant landing for the years 1959-68.

Table 6. Total pounds landed and pounds per hour per significant landing by international statistical area for English sole, 1959-68 (catch in thousands of pounds)

| Year of landing | Area of catch | | | | | | | | | | | | | | | | Annual landing | Mean C/E |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1-C | | 2-A | | 2-B | | 2-C | | 3-A | | 3-B | | 3-C | | 3-D | | 5-A-B | | | |
| | Catch | C/E | Catch | C/E | Catch | C/E | Catch | C/E | Catch | C/E | Catch | C/E | Catch | C/E | Catch | C/E | Catch | C/E | | |
| 1959 | 0 | - | 0 | - | 107 | 218 | 41 | 103 | 1,363 | 363 | 104 | 300 | 0 | - | 0 | - | 0 | - | 1,615 | 324 |
| 1960 | 0 | - | 0 | - | 234 | 284 | 380 | 179 | 1,627 | 368 | 198 | 372 | 3 | na | 12 | na | 0 | - | 2,454 | 309 |
| 1961 | 0 | - | 17 | 359 | 187 | 213 | 111 | 160 | 1,286 | 274 | 188 | 320 | 0 | - | 0 | - | 0 | - | 1,789 | 259 |
| 1962 | 11 | 203 | 80 | 83 | 496 | 386 | 241 | 183 | 1,411 | 278 | 57 | 391 | 0 | - | 0 | - | 0 | - | 2,296 | 257 |
| 1963 | 6 | 63 | 37 | 74 | 255 | 214 | 307 | 252 | 1,251 | 259 | 90 | 401 | 2 | na | 0 | - | 0 | - | 1,948 | 241 |
| 1964 | 34 | 124 | 115 | 99 | 124 | 132 | 309 | 233 | 904 | 301 | 64 | 389 | 12 | 141 | 0 | - | 0 | - | 1,562 | 225 |
| 1965 | 32 | 189 | 93 | 195 | 150 | 195 | 397 | 174 | 960 | 381 | 34 | 435 | 12 | na | 0 | - | 0 | - | 1,678 | 265 |
| 1966 | 74 | 273 | 75 | 279 | 455 | 460 | 406 | 212 | 2,424 | 502 | 86 | 590 | 18 | 252 | 0 | - | 0 | - | 3,538 | 420 |
| 1967 | 91 | 446 | 34 | 269 | 342 | 272 | 310 | 198 | 1,237 | 354 | 290 | 538 | 0 | - | 0 | - | 0 | - | 2,304 | 311 |
| 1968 | 102 | 434 | 57 | 317 | 280 | 240 | 293 | 207 | 993 | 280 | 615 | 268 | 0 | - | 1 | na | 19 | 359 | 2,360 | 292 |

Table 7. Total pounds landed and pounds per hour per significant landing by international statistical area for petrale sole, 1959-68 (catch in thousands of pounds)

| Year of landing | Area of catch | | | | | | | | | | | | | | | | | | Annual landing | Mean C/E |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1-C | | 2-A | | 2-B | | 2-C | | 3-A | | 3-B | | 3-C | | 3-D | | 5-A-B | | | |
| | Catch | C/E | Catch | C/E | Catch | C/E | Catch | C/E | Catch | C/E | Catch | C/E | Catch | C/E | Catch | C/E | Catch | C/E | | |
| 1959 | 0 | - | 0 | - | 538 | 330 | 187 | 600 | 528 | 291 | 22 | na | 0 | - | 0 | - | 0 | - | 1,275 | 334 |
| 1960 | 0 | - | 6 | na | 646 | 396 | 494 | 302 | 936 | 297 | 50 | na | 5 | na | 6 | na | 0 | - | 2,143 | 323 |
| 1961 | 0 | - | 8 | 120 | 315 | 185 | 511 | 344 | 919 | 239 | 54 | 162 | 31 | na | 0 | - | 0 | - | 1,838 | 243 |
| 1962 | 4 | na | 37 | na | 623 | 220 | 594 | 276 | 1,321 | 297 | 27 | 271 | 0 | - | 0 | - | 0 | - | 2,606 | 269 |
| 1963 | 11 | 108 | 26 | 82 | 534 | 234 | 321 | 195 | 1,361 | 246 | 39 | 226 | 3 | na | 0 | - | 0 | - | 2,295 | 228 |
| 1964 | 19 | 60 | 65 | 209 | 271 | 169 | 379 | 298 | 1,091 | 242 | 39 | 106 | 13 | na | 0.5 | na | 0 | - | 1,877 | 222 |
| 1965 | 27 | 183 | 53 | 243 | 369 | 214 | 644 | 243 | 684 | 300 | 9 | na | 52 | 536 | 0 | - | 0 | - | 1,838 | 257 |
| 1966 | 31 | 127 | 33 | 169 | 239 | 219 | 449 | 224 | 1,048 | 283 | 7 | na | 29 | na | 0 | - | 1 | na | 1,837 | 243 |
| 1967 | 25 | na | 18 | 183 | 213 | 129 | 365 | 215 | 1,061 | 300 | 80 | na | 7 | na | 0 | 1 | 2 | na | 1,771 | 257 |
| 1968 | 31 | 136 | 33 | 205 | 241 | 352 | 350 | 174 | 801 | 228 | 142 | na | 1 | na | 16 | 186 | 28 | na | 2,360 | 216 |

Table 8. Total pounds landed and pounds per hour per significant landing by international statistical area for Dover sole, 1959-68 (catch in thousands of pounds)

| Year of landing | Area of catch | | | | | | | | | | | | | | | | Annual landing | Mean C/E |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1-C | | 2-A | | 2-B | | 2-C | | 3-A | | 3-B | | 3-C | | 3-D | | 5-A-B | | | |
| | Catch | C/E | Catch | C/E | Catch | C/E | Catch | C/E | Catch | C/E | Catch | C/E | Catch | C/E | Catch | C/E | Catch | C/E | | |
| 1959 | 0 | - | 0 | - | 2,279 | 528 | 360 | 275 | 1,853 | 423 | 51 | 245 | 0 | - | 0 | - | 0 | - | 4,543 | 445 |
| 1960 | 2 | na | 3 | na | 2,326 | 412 | 534 | 262 | 2,220 | 369 | 94 | 336 | 27 | 204 | 2 | na | 0 | - | 5,208 | 369 |
| 1961 | 0 | - | 7 | 307 | 1,944 | 405 | 259 | 183 | 1,743 | 349 | 101 | 242 | 0 | - | 0 | - | 0 | - | 4,054 | 348 |
| 1962 | 5 | 956 | 98 | 60 | 1,937 | 440 | 478 | 246 | 1,893 | 345 | 41 | 289 | 3 | 81 | 0 | - | 0 | - | 4,455 | 326 |
| 1963 | 1 | 58 | 34 | 94 | 2,241 | 430 | 501 | 250 | 2,472 | 332 | 90 | 181 | 6 | na | 0 | - | 0 | - | 5,345 | 344 |
| 1964 | 29 | na | 163 | 126 | 2,281 | 555 | 722 | 232 | 2,210 | 316 | 90 | 312 | 31 | 306 | 0 | - | 3 | na | 5,529 | 346 |
| 1965 | 98 | 305 | 177 | 337 | 1,242 | 408 | 598 | 304 | 1,471 | 384 | 29 | 310 | 9 | 153 | 7 | na | 0 | - | 3,631 | 368 |
| 1966 | 82 | 382 | 270 | 473 | 1,069 | 379 | 346 | 247 | 1,683 | 448 | 6 | na | 37 | na | 0 | - | 0 | - | 3,491 | 405 |
| 1967 | 87 | 376 | 56 | 326 | 1,532 | 572 | 235 | 260 | 1,563 | 364 | 89 | 377 | 2 | na | 0 | - | 1 | na | 3,565 | 431 |
| 1968 | 177 | 457 | 178 | 480 | 1,985 | 649 | 261 | 271 | 1,532 | 315 | 140 | 213 | 1 | na | 1 | na | 50 | 352 | 4,325 | 448 |

Table 9. Total pounds landed and pounds per hour per significant landing by international statistical area for Pacific ocean perch, 1959-68 (catch in thousands of pounds)

| Year of landing | Area of catch | | | | | | | | | | | | | | | | | | Annual landing | Mean C/E |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1-C | | 2-A | | 2-B | | 2-C | | 3-A | | 3-B | | 3-C | | 3-D | | 5-A-B | | | |
| | Catch | C/E | Catch | C/E | Catch | C/E | Catch | C/E | Catch | C/E | Catch | C/E | Catch | C/E | Catch | C/E | Catch | C/E | | |
| 1959 | 0 | - | 0 | - | 446 | 376 | 1,435 | 823 | 587 | 587 | 4 | na | 0 | - | 0 | - | 0 | - | 2,472 | 628 |
| 1960 | 0 | - | 0 | - | 141 | 261 | 1,154 | 623 | 1,053 | 734 | 130 | 993 | 141 | 1,067 | 115 | na | 0 | - | 2,734 | 640 |
| 1961 | 0 | - | 0 | - | 408 | 554 | 2,165 | 692 | 1,968 | 774 | 28 | 268 | 0 | - | 0 | - | 0 | - | 4,569 | 702 |
| 1962 | 0 | - | 1 | 57 | 449 | 455 | 2,534 | 608 | 2,772 | 682 | 33 | 1,413 | 0 | - | 0 | - | 0 | - | 5,789 | 625 |
| 1963 | 0 | - | 2 | 589 | 931 | 537 | 3,610 | 1,009 | 3,267 | 630 | 167 | 429 | 5 | na | 0 | - | 0 | - | 7,982 | 733 |
| 1964 | 0 | - | 1 | na | 2,505 | 835 | 3,755 | 1,000 | 2,310 | 574 | 829 | 744 | 62 | 392 | 0 | - | 86 | 1,089 | 9,548 | 787 |
| 1965 | 0 | - | Tr. | - | 1,956 | 909 | 8,847 | 1,544 | 2,610 | 806 | 30 | 690 | 133 | 375 | 13 | 324 | 0 | - | 13,660 | 1,180 |
| 1966 | 0 | - | 21 | na | 420 | 926 | 2,177 | 922 | 1,132 | 1,221 | 22 | na | 138 | 605 | 0 | - | 608 | 4,780 | 4,518 | 1,098 |
| 1967 | 0 | - | 0 | - | 247 | 402 | 1,032 | 747 | 324 | 826 | 16 | na | 6 | na | 0 | - | 81 | 529 | 1,706 | 663 |
| 1968 | 0 | - | 0 | - | 170 | 423 | 450 | 320 | 120 | 353 | 55 | 1,129 | 2 | na | 1 | na | 851 | 1,095 | 1,649 | 891 |

## MINK FOOD FISHERY

This report depicts the status of the trawl fishery for mink food during the years 1967 and 1968.

The purpose of the study is to determine the species composition of whole fishes landed annually as animal food. These landings are of a multispecies nature and no prior segregation by fishes is listed in the landing records.

Species composition of mink food is determined by random sampling at each port. Several hundred fishes are drawn as a representative lot. Each species is weighed to indicate an average weight. The sample weight represents the species weight as a per cent of the total landings. We derive an estimated weight of the 14 most common species and three categories of fishes landed. These include approximately 40 species. Landings of whole fish as mink food by species taken by otter trawl and shrimp trawl are included in this report.

Landings of bottomfish for mink food for the years 1967 and 1968 are presented in Tables 10 and 11. The trend in overall landings for the 2 years indicates a decline. This is partly due to a low price of $.025 per pound for whole fish which has remained static for the past decade. Fluctuations in landings also reflect weak fillet market conditions.

Several species in the mink food fishery warrant special attention. Table 12 shows recent trends of selected species in mink food. English sole landings indicate a 474,000 pound average for the past 10 years. This sole is a relatively fast growing species becoming recruited to the market fishery limit of 13 inches in 5 years. In 1966 only 56,000 pounds were in the mink food landings. The market for fillet fish absorbed 3.5 million pounds of English sole in 1966. This was 1.5 million pounds above

Table 10. Total 1967 mink food landings in pounds by port with estimate of species composition derived by sampling

| Species | Astoria | Newport | Winchester Bay-Coos Bay | Total |
|---|---|---|---|---|
| English sole | 351,140 | 75,245 | 38,270 | 464,655 |
| Dover sole | 144,519 | 868 | 66,484 | 211,871 |
| Petrale sole | 63,934 | 72,570 | 10,665 | 147,169 |
| Rex sole | 173,078 | 8,703 | 124,088 | 305,869 |
| Butter sole | 33,920 | 60,836 | 6,382 | 101,138 |
| Sand dab | 116,714 | 647 | 61,688 | 179,049 |
| Sand sole | 8,648 | 647 | - | 9,295 |
| Starry flounder | 55,124 | - | - | 55,124 |
| Arrowtooth flounder | 1,521,815 | 444,556 | 241,177 | 2,207,548 |
| Miscellaneous sole | 4,042 | 4,545 | 2,280 | 10,867 |
| Skate | 26,754 | 61,783 | 42,565 | 131,102 |
| Sablefish | 25,191 | 2,178 | 724 | 28,093 |
| Lingcod | 62,830 | - | 247 | 63,077 |
| True cod | 21,042 | - | - | 21,042 |
| Rockfish | 16,543 | 56,481 | 6,576 | 79,600 |
| Pacific ocean perch | 943 | - | - | 943 |
| Miscellaneous fish | 68,003 | - | 2,099 | 70,102 |
| Total | 2,694,240 | 789,059 | 603,245 | 4,086,544 |
| % total landing | 65.9 | 19.3 | 14.8 | 100.0 |
| % sampled | 24.9 | 16.7 | 12.5 | |

Table 11. Total 1968 mink food landings in pounds by port with estimate of species composition derived by sampling

| Species | Astoria | Newport | Winchester Bay-Coos Bay | Total |
|---|---|---|---|---|
| English sole | 314,058 | 87,339 | 3,191 | 404,588 |
| Dover sole | 122,231 | 9,309 | 7,091 | 138,631 |
| Petrale sole | 33,920 | 33,898 | 4,137 | 71,955 |
| Rex sole | 144,844 | 5,827 | 4,728 | 155,399 |
| Butter sole | 73,104 | 11,157 | 3,309 | 87,570 |
| Sand dab | 132,953 | 3,909 | 3,546 | 140,408 |
| Sand sole | 23,783 | 19,401 | - | 43,184 |
| Starry flounder | 24,758 | - | - | 24,758 |
| Arrowtooth flounder | 707,651 | 303,308 | 78,006 | 1,088,965 |
| Miscellaneous sole | 5,458 | 2,061 | - | 7,519 |
| Skate | 51,466 | 215,612 | 99,282 | 366,360 |
| Sablefish | 16,570 | 1,066 | - | 17,636 |
| Lingcod | 1,170 | - | - | 1,170 |
| True cod | - | - | - | - |
| Rockfish | 256,353 | 17,563 | 33,093 | 306,999 |
| Pacific ocean perch | - | - | - | 41,346 |
| Miscellaneous fish | 41,133 | 213 | - | 2,896,488 |
| Total | 1,949,452 | 710,653 | 236,383 | 100.0 |
| % total landing | 67.3 | 24.5 | 8.2 | |
| % sampled | 16.5 | 15.2 | 3.4 | |

Table 12. Selected bottomfish species landed as animal food, 1965-68 (landings in thousands of pounds)

| Species | 1965 | 1966 | 1967 | 1968 | 1965-68 average |
|---|---|---|---|---|---|
| English sole | 565 | 56 | 465 | 405 | 373 |
| Dover sole | 78 | 54 | 212 | 139 | 121 |
| Petrale sole | 85 | 16 | 147 | 72 | 80 |
| Rex sole | 249 | 183 | 306 | 155 | 223 |
| Sand dab | 201 | 132 | 179 | 140 | 163 |
| Starry flounder | 70 | 66 | 55 | 25 | 54 |
| Butter sole | 96 | 109 | 101 | 88 | 99 |
| Arrowtooth flounder | 2,307 | 2,204 | 2,208 | 1,089 | 1,952 |
| Rockfish | 222 | 286 | 80 | 307 | 224 |
| Pacific ocean perch | 102 | 6 | 1 | - | 27 |
| Skate | 100 | 163 | 131 | 366 | 190 |
| Other | 76 | 77 | 202 | 110 | 116 |
| Total | 4,150 | 3,352 | 4,087 | 2,896 | 3,621 |

the 10-year average. In 1967 and 1968 the fillet market returned to a normal level and mink food landings of English sole increased to 400,000 pounds plus levels.

English sole is limited in landings of mink food by law. A size restriction was imposed on landings of English, Dover, and petrale sole less than 11 inches in total length. Since 1955 no more than 100 fish in the aggregate of these species could be legally landed in a single delivery. In 1968 the law was amended to allow not more than 250 fish in a single delivery if the single wall cod-end and intermediate mesh size

was less than 4-1/2 inches between knots. If the net used meets the 4-1/2-inch mesh single-wall requirement or a 5-inch double wall coinciding mesh for mesh, there is no landing restriction on these species. Gear research indicates that such a legal net will greatly reduce the catch of under 11-inch fish. Consequently, most fishermen have adopted the 5-inch double-wall net to avoid sorting. Undersize Dover and petrale sole were not a problem in mink food landings. The use of larger mesh nets also reflects the reduced catch of rex sole in mink food in 1968.

Arrowtooth flounder or turbot is the mainstay of the animal food fishery. It is not filleted. The 10-year average has been 2.2 million pounds. This species shows a drastic decline to 1,089 million pounds in 1968, the lowest point in the entire history of the fishery. The data substantiate fishermen's concern for the drop in catches of this species.

Rockfish landings in mink food also illustrate a decline from a 0.458 million 10-year average. The 1968 data do show a rise over the past 3 years; however, this includes sizable landings of widow rockfish rejected by the fillet market due to its short shelf life before deterioration sets in.

Skate landings as animal food indicate a gradual acceptance of this species which I believe is partially forced by the fishermen and because of a general lack of other fish being supplied to the producers of animal food.

## TAGGING STUDIES

A total of 1,494 Dover sole were tagged off the Columbia River during November 1967 and April 1968. Returned fish will provide information on scale-age interpretation. A total of 21 tags was recovered from the area of tagging. Recoveries made from several prior tagging studies are treated

individually below. The international statistical areas referred to are shown in Figure 17.

Petrale sole, February 1960

A total of 5,026 petrale sole was tagged in 170-200 fathoms at Hecata Bank during February and March 1960. A total of 353 tags had been returned by the end of 1968. Dispersion from the point of tagging ranged from Vancouver Island to Eureka, California. The recaptures by year and international statistical area are shown in Table 13.

Dover sole, May 1961 to May 1964

During the period from May 1961 to May 1964, 9,013 Dover sole were tagged and released at approximately 25-fathom intervals from 50 to 450 fathoms in a 35-mile long area southwest of the Columbia River. A total of 979 tags had been recovered through December 31, 1968. Table 14 lists these recoveries by year of tagging.

## SHRIMP LANDINGS

Total state-wide landings of pink shrimp, Pandalus jordani, were 10,373,956 and 10,976,258 pounds in 1967 and 1968, respectively. These landings were nearly double the old record of 5,477,427 pounds set in 1964 and more than double the 1966 total of 4,751,300 pounds. As shown in Table 15, number of vessels engaged increased from 26 in 1966 to 45 and 41, respectively, in 1967 and 1968--also records. The total landings probably would have been even greater had the Coos Bay area not been hampered in 1967 by small shrimp and a soft market for hand peeled shrimp in 1968. The soft market in midsummer of 1968 also depressed Newport and Garibaldi deliveries. The increased landings in 1967 resulted from a

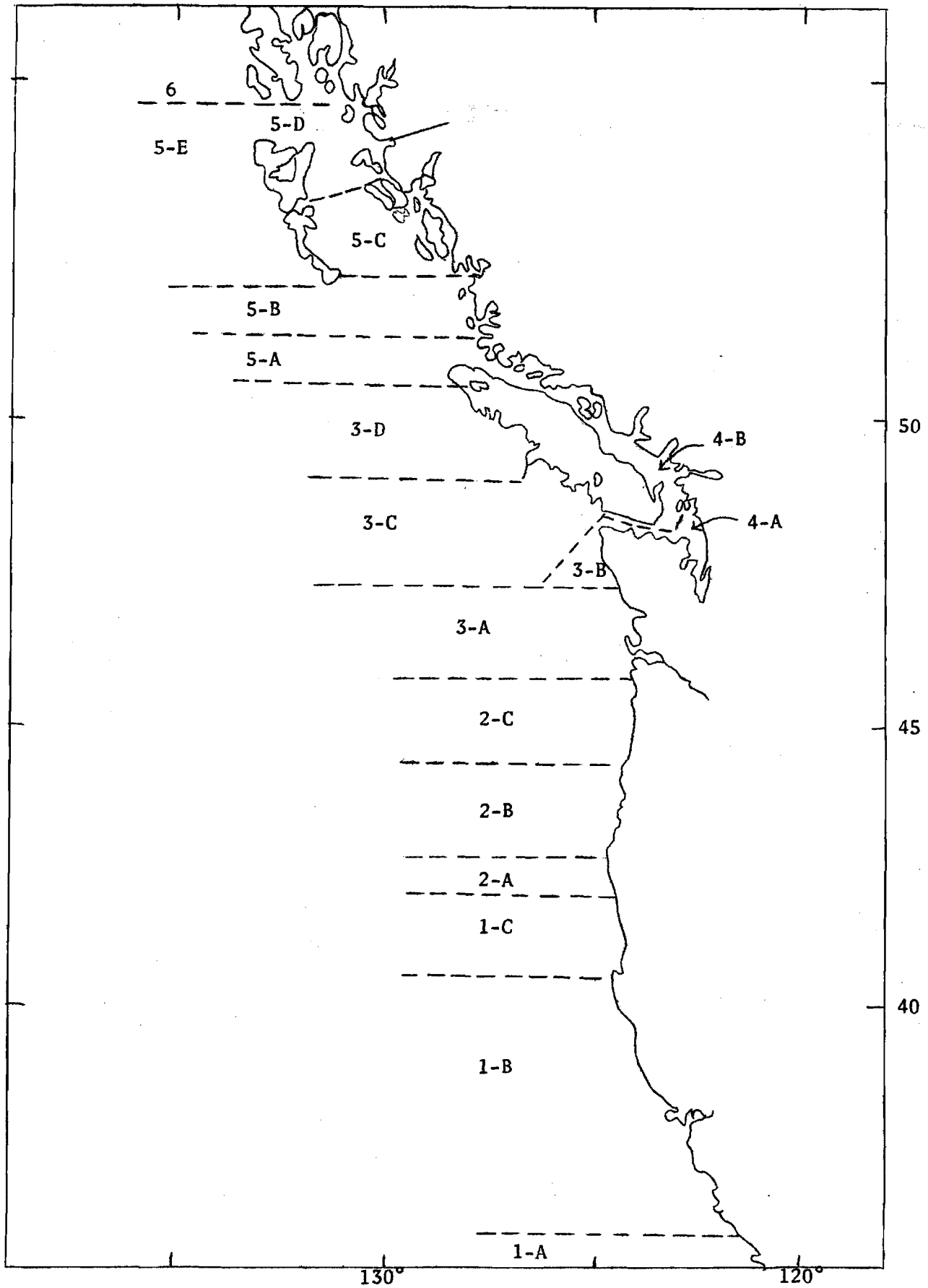


Figure 17. Chart of Pacific Coast showing international statistical areas

Table 13. Recoveries of petrale sole by year by international statistical area (February-March 1960, Heceta Bank tagging)

| International statistical area | Recoveries by year | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1960 | 1961 | 1962 | 1963 | 1964 | 1965 | 1966 | 1967 | 1968 |
| 3-C | 5 | 1 | | | | | | | |
| 3-B | 5 | 11 | 3 | | | | | | |
| 3-A | 8 | 9 | 3 | | | | | 1 | 2 |
| 2-C | 27 | 21 | 18 | 7 | | 1 | 1 | | |
| 2-B 1/ | 104 | 30 | 46 | 14 | 4 | 1 | 2 | | |
| 2-A | 1 | 2 | | | | | | | |
| 1-C | 1 | 4 | 9 | 3 | | | | | |
| Unknown | 4 | | 1 | 2 | | 2 | | | |
| Total | 155 | 78 | 80 | 26 | 4 | 4 | 3 | 1 | 2 |

1/ *Area of tagging*

Table 14. Number of Dover sole recovered by year of tagging and recovery (AEC study)

| Year of tagging | Number tagged | Recoveries by year | | | | | | | | Total |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 1961 | 1962 | 1963 | 1964 | 1965 | 1966 | 1967 | 1968 | |
| 1961 | 1,585 | 7 | 14 | 9 | 10 | | 4 | | 1 | 47 |
| 1962 | 2,808 | | 66 | 78 | 46 | 30 | 7 | 5 | 5 | 237 |
| 1963 | 1,902 | | | 26 | 23 | 13 | 5 | 1 | 3 | 71 |
| 1964 | 2,718 | | | | 270 | 176 | 84 | 62 | 34 | 626 |
| Total | 9,013 | 7 | 80 | 113 | 349 | 219 | 100 | 68 | 43 | 979 |

Table 15. Annual Oregon shrimp landings (lbs.), number of vessels, and catch per effort (lbs/hr) by port, 1959-68

| Year | | Warrenton | Garibaldi | Newport | Winchester Bay-Coos Bay | Port Orford | Brookings | Total |
|---|---|---|---|---|---|---|---|---|
| 1959 | C | 2,368,140 | 0 | 0 | 5,676 | 0 | 390,311 | 2,764,127 |
| | V | 15 | 0 | 0 | 1 | 0 | 9 | 24 1/ |
| | C/E | 530 | - | - | - | - | 487 | 524 |
| 1960 | C | 589,778 | 0 | 0 | 83,550 | 0 | 459,178 | 1,132,506 |
| | V | 5 | 0 | 0 | 2 | 0 | 5 | 12 |
| | C/E | 313 | - | - | 500 | - | 492 | 380 |
| 1961 | C | 767,523 | 0 | 0 | 431,126 | 0 | 257,263 | 1,455,912 |
| | V | 6 | 0 | 0 | 4 | 0 | 2 | 11 |
| | C/E | 342 | - | - | 462 | - | 806 | 417 |
| 1962 | C | 395,056 | 0 | 0 | 885,627 | 18,935 | 1,450,820 | 2,750,438 |
| | V | 4 | 0 | 0 | 11 | 1 | 17 | 31 |
| | C/E | 342 | - | - | 340 | 728 | 562 | 434 |
| 1963 | C | 1,072,030 | 0 | 0 | 1,569,929 | 0 | 472,868 | 3,114,827 |
| | V | 10 | 0 | 0 | 13 | 0 | 8 | 27 |
| | C/E | 564 | - | - | 584 | - | 532 | 548 |
| 1964 | C | 233,425 | 0 | 31,096 | 4,413,621 | 405,020 | 394,265 | 5,477,427 |
| | V | 3 | 0 | 1 | 24 | 7 | 6 | 29 |
| | C/E | 578 | - | 362 | 649 | 749 | 580 | 644 |
| 1965 | C | 73,422 | 0 | 20,523 | 924,727 | 180,130 | 551,838 | 1,750,640 |
| | V | 2 | 0 | 3 | 14 | 4 | 10 | 23 |
| | C/E | 358 | - | 185 | 307 | 467 | 330 | 324 |
| 1966 | C | 102,208 | 0 | 621,669 | 2,799,923 | 665,275 | 562,225 | 4,751,300 |
| | V | 2 | 0 | 4 | 14 | 7 | 9 | 26 |
| | C/E | 587 | - | 583 | 520 | 702 | 444 | 538 |
| 1967 | C | 1,721,638 | 1,290,187 | 3,092,327 | 2,653,013 | 784,326 | 832,465 | 10,373,956 |
| | V | 6 | 6 | 21 | 22 | 7 | 15 | 45 |
| | C/E | 690 | 605 | 604 | 370 | 660 | 511 | 527 |
| 1968 | C | 2,339,675 | 559,225 | 2,047,998 | 4,121,932 | 1,270,728 | 636,710 | 10,976,258 |
| | V | 5 | 4 | 10 | 22 | 7 | 11 | 41 |
| | C/E | 806 | 589 | 588 | 582 | 1,083 | 706 | 661 |

*1/ Vessel totals may differ from sum of vessels by port due to several vessels making landings in more than one port.*

unique combination of factors--unusually good weather, availability of shrimp, good shrimp market, and a poor bottomfish market. This induced many new vessels into the fishery for shrimp. Despite relatively poor weather and shrimp market conditions in midsummer 1968, the stimulus from 1967 plus record availability (or actual abundance) of shrimp in all areas off Oregon stimulated an even better 1968 season. Catch per effort in 1968 was the highest ever in Oregon with record or near-record C/E in all areas off Oregon.

Table 16 shows annual catch and catch per effort by area of catch. Figures reflect those in Table 15 in that areas adjacent to the respective ports supported most of their deliveries. Record catch per effort was recorded in area 20 (off Port Orford) in 1968 of 1,087 pounds per hour tow. Fishing was good as shallow as 38 fathoms. This was the shallowest shrimp fishing recorded off Oregon. New records for C/E were also set in area 28 (1968), 24 (1967), 22 (1968), 19 (1968), and 18 (1968). Area 18 (northern California) catch per effort was second only to that in area 20 and exceeded 1,000 pounds-per-hour tow in June. Catch per effort in area 26 was second only to that recorded in 1966.

Tables 17 and 18 show monthly catch and C/E by area of catch for 1967 and 1968. The fishery in 1967 began in March in areas 22, 21, and 19 (out of Coos Bay and Brookings). Only 300,939 pounds were taken. Subsequent months saw monthly landings exceeding 1 million pounds in April, May, July, and September. Over 2 million pounds per month were taken in June and August. All areas off Oregon were being fished by April. In 1968 fishing again began in March in areas 21 and 22 and in areas 24 and 26 (Coos Bay and Newport). A total of 747,336 pounds was delivered in March, 6.8% of the total 1968 landing. All but one area was being fished

Table 16. Annual Oregon shrimp landings and catch per effort by area of catch, 1959-68

| FCO-PMFC area | | 1959 | 1960 | 1961 | 1962 | 1963 | 1964 | 1965 | 1966 | 1967 | 1968 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 32-72 | C | 2,034 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Destruction Island | C/E | 120 | - | - | - | - | - | - | - | - | - |
| 30-74 | C | 165,205 | 2,000 | 363,738 | 86,400 | 14,186 | 10,140 | 3,784 | 0 | 102,596 | 4,636 |
| Grays Harbor | C/E | 542 | 250 | 358 | 392 | 366 | 422 | 172 | - | 672 | 236 |
| 29-75 | C | 26,500 | 0 | 3,700 | 15,300 | 700 | 1,180 | 0 | 0 | 300 | 20,572 |
| Willapa Bay | C/E | 349 | - | 308 | 403 | 140 | 131 | - | - | 300 | 649 |
| 28-82 | C | 980,051 | 339,847 | 214,863 | 183,056 | 441,223 | 77,690 | 8,765 | 24,382 | 1,636,455 | 1,771,601 |
| Tillamook Head | C/E | 526 | 300 | 311 | 325 | 615 | 600 | 231 | 469 | 677 | 792 |
| 26-84 | C | 1,149,911 | 249,134 | 185,222 | 110,300 | 588,750 | 145,475 | 83,390 | 226,317 | 2,705,700 | 2,660,829 |
| Cape Lookout | C/E | 523 | 345 | 354 | 380 | 511 | 582 | 311 | 680 | 625 | 635 |
| 24-84 | C | 0 | 0 | 0 | 0 | 0 | 2,010 | 0 | 473,178 | 1,656,496 | 325,856 |
| Depoe Bay | C/E | - | - | - | - | - | 183 | - | 553 | 580 | 556 |
| 22-86 | C | 50,115 | 82,345 | 431,126 | 681,510 | 1,205,343 | 2,639,875 | 739,937 | 1,928,800 | 1,678,192 | 4,062,750 |
| Coos Bay | C/E | 501 | 445 | 562 | 336 | 540 | 549 | 309 | 502 | 321 | 581 |
| 21-86 | C | 0 | 0 | 0 | 223,052 | 421,127 | 1,894,148 | 181,637 | 837,826 | 1,028,157 | 238,926 |
| Bandon | C/E | - | - | - | 640 | 820 | 837 | 367 | 562 | 512 | 636 |
| 20-88 | C | 0 | 0 | 0 | 6,400 | 3,600 | 496,059 | 212,625 | 862,227 | 733,595 | 1,302,728 |
| Port Orford | C/E | - | - | - | - | 360 | 771 | 450 | 729 | 655 | 1,087 |
| 19-88 | C | 16,100 | 136,680 | 74,860 | 151,420 | 112,975 | 0 | 446,052 | 350,850 | 744,630 | 307,185 |
| Brookings | C/E | 240 | 318 | 550 | 470 | 286 | - | 315 | 368 | 482 | 554 |
| 18-92 | C | 374,211 | 322,500 | 182,403 | 1,293,000 | 326,923 | 210,850 | 74,450 | 45,720 | 87,835 | 281,175 |
| California Area A | C/E | 510 | 644 | 839 | 574 | 495 | 518 | 386 | 401 | 794 | 895 |
| Total | C | 2,764,127 | 1,132,506 | 1,455,912 | 2,750,438 | 3,114,827 | 5,477,427 | 1,750,640 | 4,751,300 | 10,373,956 | 10,976,258 |
| | C/E | 524 | 380 | 412 | 434 | 545 | 641 | 327 | 538 | 527 | 661 |

Table 17. Oregon monthly shrimp landings and catch per effort by area of catch in pounds, 1967

| Area | | March | April | May | June | July | August | September | October | Total |
|---|---|---|---|---|---|---|---|---|---|---|
| Cape Elizabeth | C | 0 | 0 | 0 | 0 | 0 | 102,596 | 0 | 0 | 102,596 |
| to Willapa Bay | C/E | - | - | - | - | - | 672 | - | - | 672 |
| Willapa Bay | C | 0 | 0 | 0 | 0 | 0 | 300 | 0 | 0 | 300 |
| to Columbia R. | C/E | - | - | - | - | - | 300 | - | - | 300 |
| Columbia R. | C | 0 | 14,965 | 305,662 | 700,624 | 240,430 | 286,798 | 87,976 | 0 | 1,636,455 |
| to Cape Falcon | C/E | - | 880 | 903 | 756 | 509 | 564 | 607 | - | 677 |
| Cape Falcon to | C | 0 | 245,427 | 703,041 | 228,014 | 399,551 | 669,730 | 396,995 | 62,942 | 2,705,700 |
| Cascade Head | C/E | - | 940 | 662 | 597 | 502 | 563 | 735 | 646 | 625 |
| Cascade Head to | C | 0 | 43,961 | 166,517 | 603,465 | 518,336 | 150,669 | 170,978 | 2,570 | 1,656,496 |
| Cape Perpetua | C/E | - | 493 | 574 | 675 | 536 | 516 | 548 | 232 | 580 |
| Cape Perpetua | C | 142,391 | 427,375 | 204,521 | 167,777 | 167,930 | 268,017 | 252,370 | 47,811 | 1,678,192 |
| to Cape Arago | C/E | 447 | 399 | 258 | 251 | 236 | 364 | 342 | 259 | 321 |
| Cape Arago to | C | 133,998 | 239,015 | 221,497 | 297,075 | 61,405 | 64,641 | 4,426 | 6,100 | 1,028,157 |
| Cape Blanco | C/E | 616 | 492 | 510 | 525 | 465 | 455 | 316 | 476 | 512 |
| Cape Blanco | C | 0 | 28,440 | 96,005 | 114,300 | 140,900 | 198,400 | 96,650 | 58,900 | 733,595 |
| to Rogue R. | C/E | - | 499 | 457 | 631 | 758 | 686 | 720 | 1,033 | 655 |
| Rogue R. to | C | 24,550 | 92,375 | 23,525 | 89,500 | 83,875 | 302,455 | 104,405 | 23,945 | 744,630 |
| 42°00' N. Lat. | C/E | 509 | 538 | 300 | 443 | 365 | 562 | 337 | 461 | 482 |
| 42°00' N. Lat. | C | 0 | 0 | 275 | 0 | 0 | 87,560 | 0 | 0 | 87,835 |
| and south | C/E | - | - | 47 | - | - | 357 | - | - | 794 |
| Total | C | 300,939 | 1,091,558 | 1,721,043 | 2,200,755 | 1,612,427 | 2,131,166 | 1,113,800 | 202,268 | 10,373,956 |
| | C/E | 508 | 511 | 546 | 581 | 466 | 536 | 515 | 498 | 527 |

Table 18. Oregon monthly shrimp landings and catch per effort by area of catch in pounds, 1968

| Area | | March | April | May | June | July | August | September | October | Total |
|---|---|---|---|---|---|---|---|---|---|---|
| Cape Elizabeth | C | 0 | 0 | 0 | 2,300 | 2,336 | 0 | 0 | 0 | 4,636 |
| to Willapa Bay | C/E | - | - | - | 228 | 312 | - | - | - | 236 |
| Willapa Bay | C | 0 | 0 | 0 | 0 | 2,300 | 0 | 18,272 | 0 | 20,572 |
| to Columbia R. | C/E | - | - | - | - | 303 | - | 758 | - | 649 |
| Columbia R. | C | 0 | 270,803 | 135,665 | 237,758 | 444,099 | 421,287 | 217,094 | 44,895 | 1,771,601 |
| to Cape Falcon | C/E | - | 1,251 | 1,022 | 691 | 591 | 823 | 902 | 1,336 | 792 |
| Cape Falcon to | C | 24,369 | 541,023 | 875,545 | 657,016 | 235,331 | 281,238 | 46,307 | 0 | 2,660,829 |
| Cascade Head | C/E | 752 | 760 | 755 | 614 | 461 | 456 | 406 | - | 635 |
| Cascade Head to | C | 161,110 | 34,028 | 15,590 | 7,068 | 29,558 | 44,977 | 4,246 | 29,279 | 325,856 |
| Cape Perpetua | C/E | 817 | 503 | 408 | 214 | 390 | 386 | 193 | 707 | 556 |
| Cape Perpetua | C | 560,304 | 873,964 | 411,310 | 488,154 | 485,865 | 545,230 | 465,302 | 232,621 | 4,062,750 |
| to Cape Arago | C/E | 912 | 663 | 612 | 568 | 490 | 442 | 500 | 623 | 580 |
| Cape Arago to | C | 1,553 | 148,134 | 40,230 | 23,734 | 15,441 | 9,117 | 717 | 0 | 238,926 |
| Cape Blanco | C/E | 370 | 950 | 420 | 610 | 368 | 372 | 51 | - | 636 |
| Cape Blanco | C | 0 | 131,993 | 155,000 | 316,200 | 222,900 | 208,650 | 184,950 | 83,035 | 1,302,728 |
| to Rogue R. | C/E | - | 1,524 | 1,620 | 1,966 | 1,366 | 695 | 625 | 764 | 1,087 |
| Rogue R. to | C | 0 | 0 | 0 | 6,985 | 66,845 | 227,480 | 1,650 | 4,225 | 307,185 |
| 42°00' N. Lat. | C/E | - | - | - | 1,318 | 635 | 530 | - | 379 | 554 |
| 42°00' N. Lat. | C | 0 | 0 | 13,150 | 80,000 | 99,450 | 42,050 | 45,875 | 650 | 281,175 |
| and south | C/E | - | - | 632 | 1,504 | 910 | 724 | 506 | 114 | 895 |
| Total | C | 747,336 | 1,999,945 | 1,646,490 | 1,819,215 | 1,604,125 | 1,780,029 | 984,413 | 394,705 | 10,976,258 |
| | C/E | 881 | 783 | 743 | 691 | 569 | 536 | 564 | 689 | 661 |

by April, all areas off Oregon by June. Catch rate exceeded 1,000 pounds per hour in area 28 during April and May (records) and in area 20 from April through July.

The low catch per hour in area 22 during 1967 was due largely to the dominant 1966 year class (mostly too small to economically process) and the resultant necessity of fishermen to fish on the fringes of concentrations of this year class attempting to catch larger older shrimp. This has been a problem at Coos Bay in odd years since 1963. The same year class, however, was responsible for the much improved 1968 catch and C/E in area 22.

Landings in 1967 were dominated in all areas by the very strong 1966 and 1964 year classes. The only areas in which the 1964 year class was not strong all year were 18, 19, and 20 where apparently the life span is shorter than in more northerly waters. Landings in 1968 were dominated by the 1966 year class in all areas, with the 1967 year class showing well in areas 22, 21, 20, and 19, but weakly in areas 24-28. The 1965 year class showed surprisingly well in areas 26 and 28, although a part of this year class was merged with the very strong 1964 year class and its apparent strength may actually have been due to misidentification of age. It is rare, however, for even a strong year class to show up in much more than trace amounts as IV-group shrimp.

## SHRIMP SAMPLING

### Market studies

Figure 18 shows length-frequency distribution by sex and month in 1967 and 1968 for area 19 (18 in May 1968). The strong 1966 year class showed rapid growth and more than half of it changed sex by October to

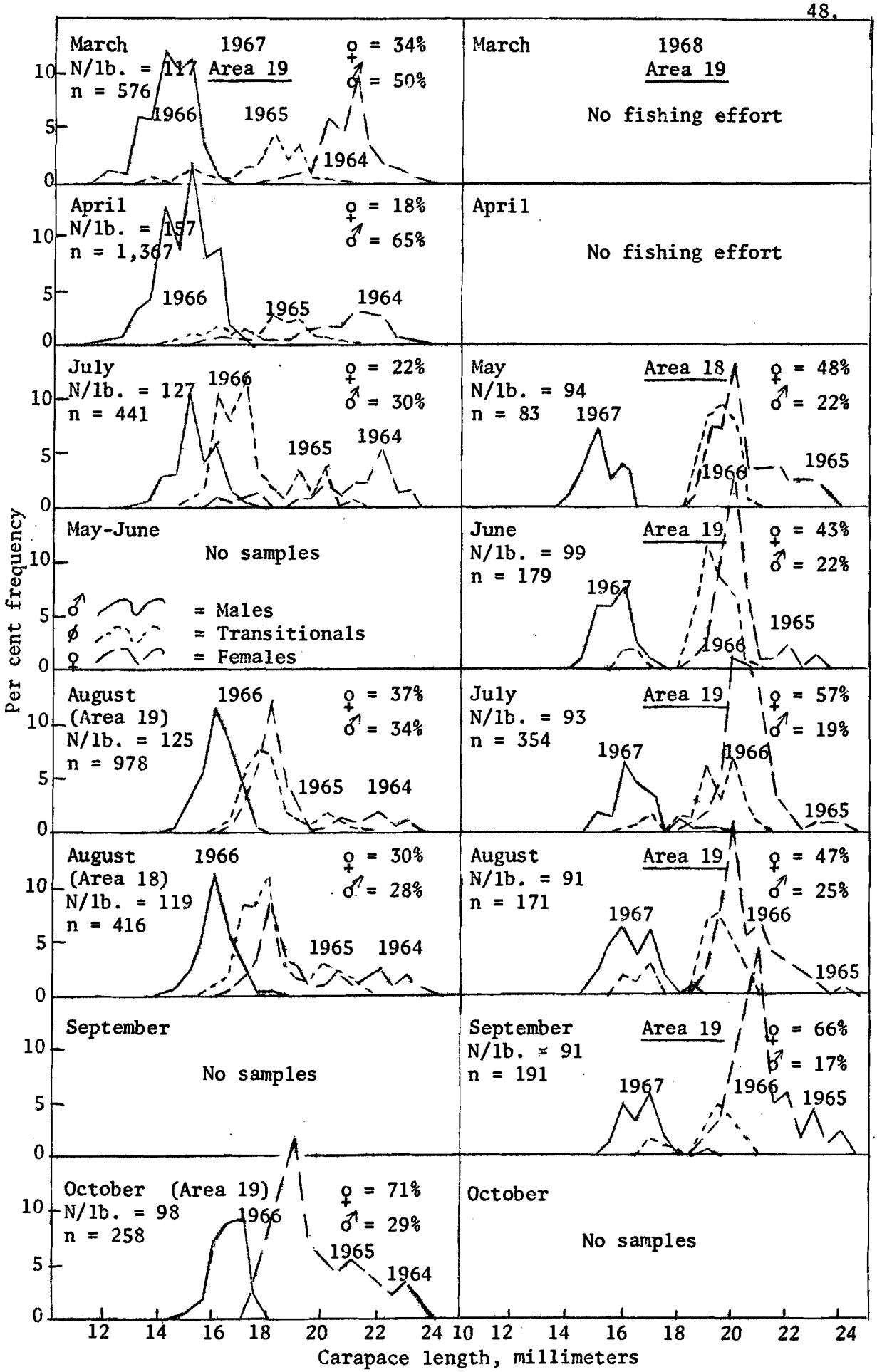


Figure 18. Monthly length-frequency distribution by sex, Area 19, 1967-68 (Area 18 in May 1968 and August 1967)

early maturing I-group females. In 1968 the remainder of the 1966 year class (now II-group) matured as females by September and a small part of the so-so 1967 year class also showed early maturing females. Sex change in I-group shrimp is a normal occurrence in this area.

Figure 19 shows length-frequency distribution for area 20 in 1967 and 1968. Age composition, growth, and sex change were similar to that in area 19 (Figure 18) except that a smaller proportion of early maturing (I-group) females of the 1966 year class was evident in 1967. Less than half of the 1966 year class changed to females. A fair proportion of I-group (1967 year class) shrimp also matured early as females in 1968, more than in area 19. (Transitional males usually make the change to mature females by late October.)

Figure 20 shows length-frequency distribution by sex in areas 21 and 22 in 1967. Figure 21 shows length frequency for the same areas in 1968. In March 1967 dissimilar age composition is evident between areas 21 and 22 with the 1965 year class dominate in area 22. The 1966 year class was strong in both areas throughout the remainder of the year as was the 1964 year class. About a third of the 1966 year class shows early maturing I-group females in both areas in July. The incidence of early maturing females in area 22 was lower in October than previous months--reasons unknown. Unfortunately, no market samples were obtained during the period in area 21. In 1968 virtually no early maturing females were evident in either area. A small proportion of the 1966 year class (II-group) also apparently failed to mature as females and remained males. The 1966 year class was dominant in both areas; the 1967 year class showed fairly strongly.

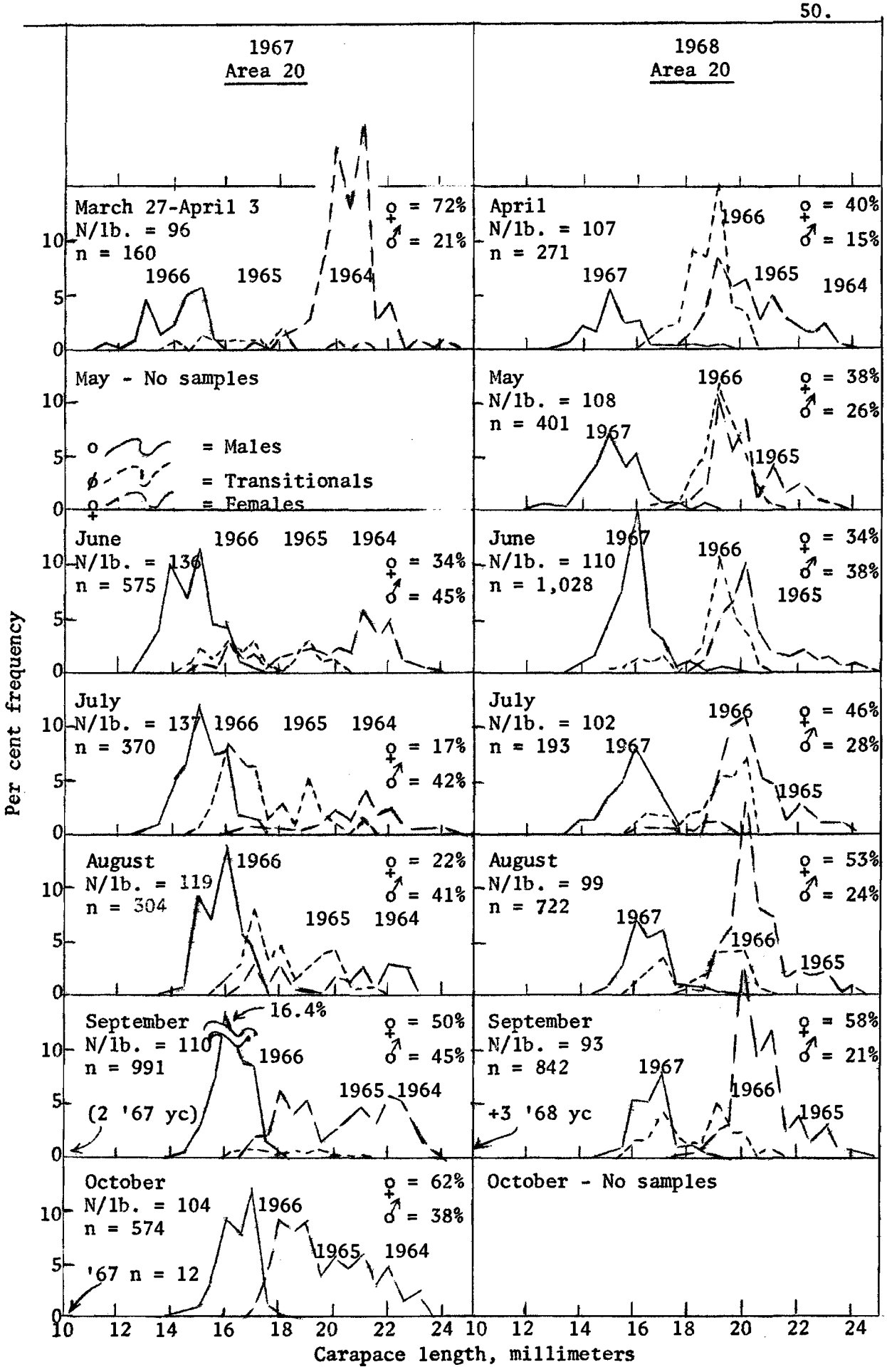


Figure 19. Monthly length-frequency distribution by sex, Area 20, 1967 and 1968

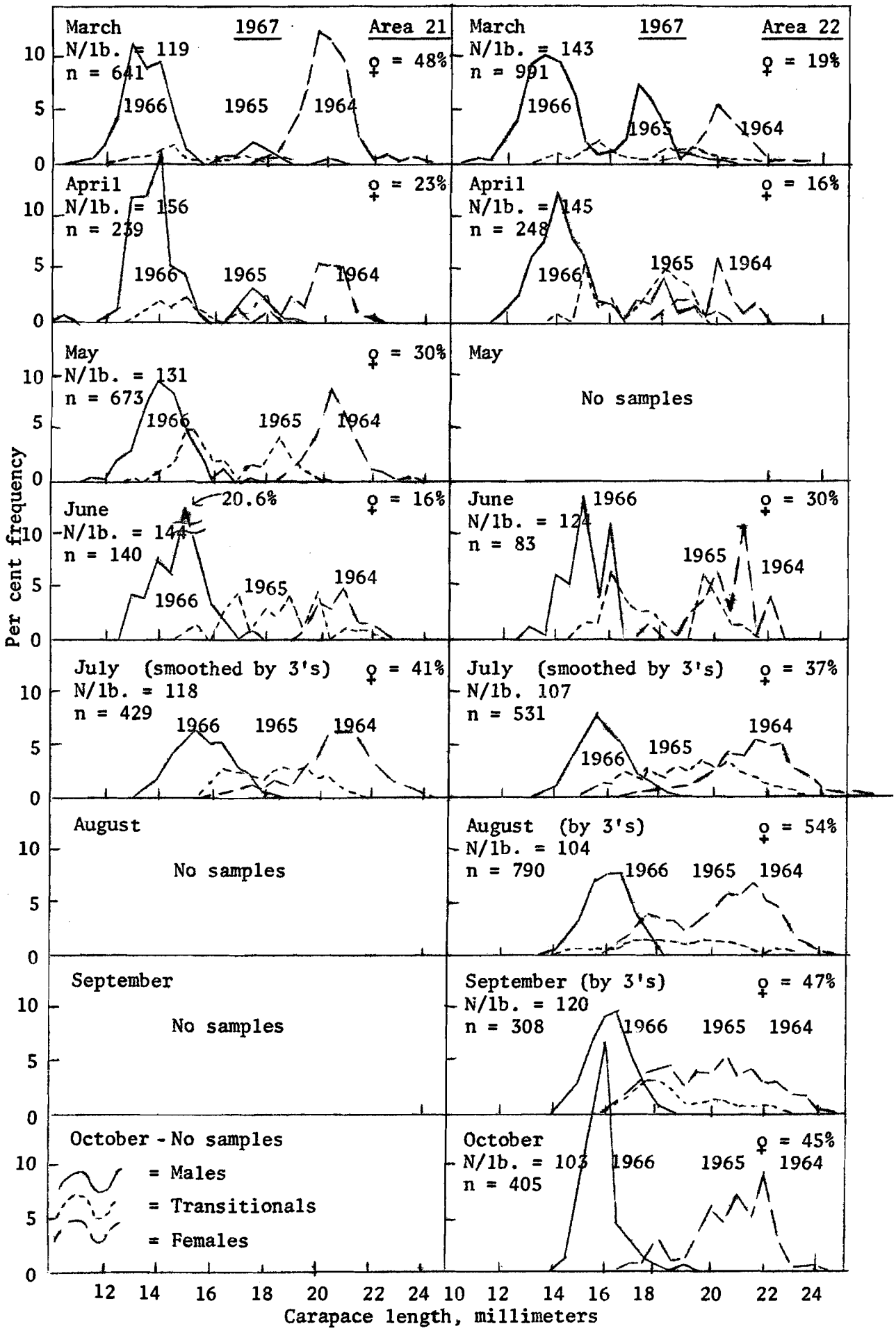


Figure 20. Monthly length-frequency distribution by sex in 1967 for Areas 21 and 22

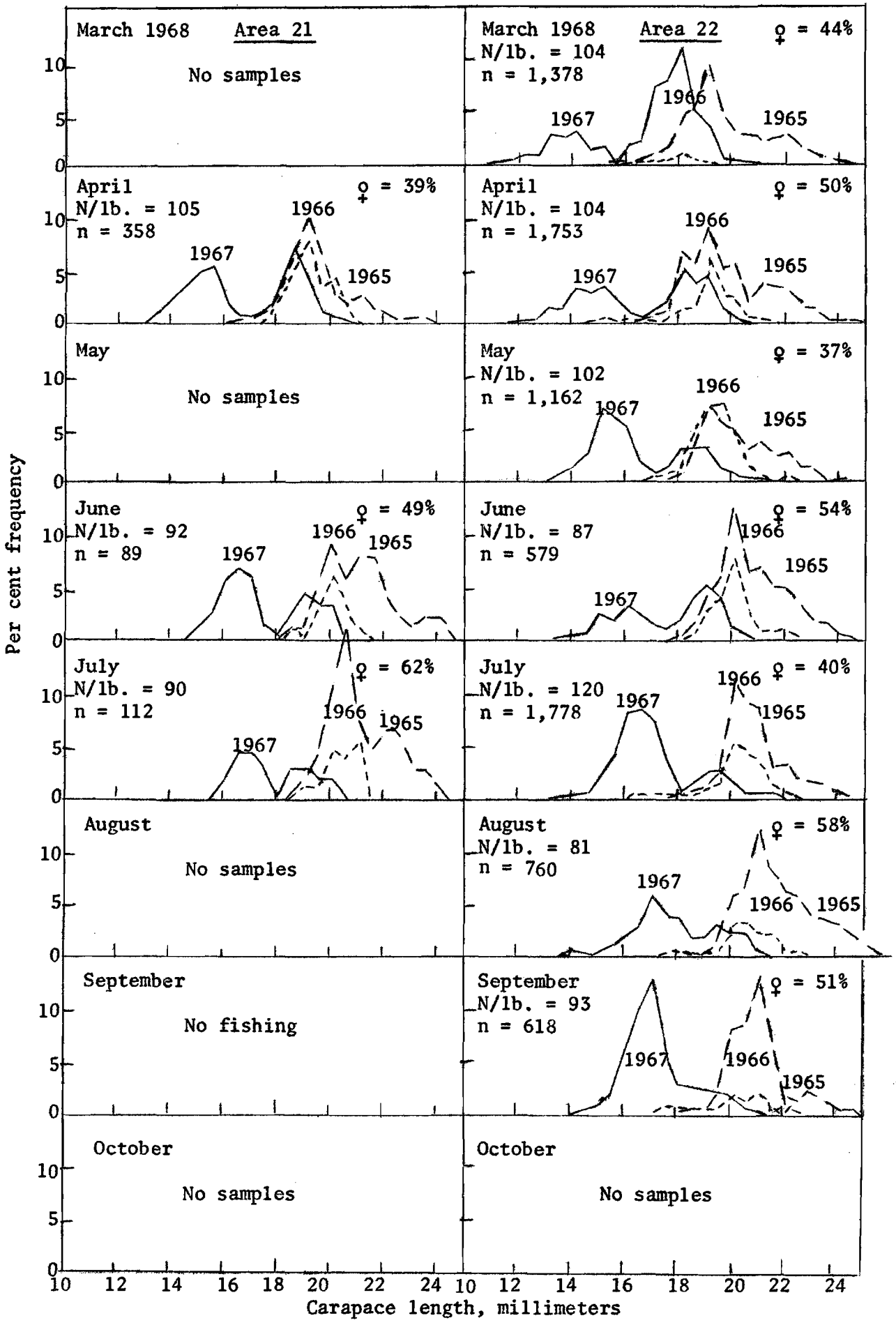


Figure 21. Monthly length-frequency distribution by sex in 1968 for Areas 21 and 22

Figure 22 shows 1967 and 1968 length-frequency distribution of sampled catches in area 24. Here the 1966 and 1964 year classes were strong in 1967, but the 1966 year class dominated the 1968 catch. About one-fourth of the 1966 year class changed sex as early maturing females in 1967. Virtually no early maturing females were present in 1968 and about a third of the 1966 year class failed to change sex also.

Figure 23 shows length-frequency distributions for 1967 in areas 26 and 28. As in area 24, the 1966 and 1964 year classes were dominant. About one-third of the 1966 year class were early maturing females in area 26, perhaps one-fifth in area 28. In Figure 24 areas 26 and 28 length-frequency distributions for 1968 are shown. The 1966 year class was dominant in both areas, and a large proportion of the 1965 year class shows up after a weak showing in 1967 (Figure 23). No early maturing females are evident and about half the 1966 (II-group now) year class remained males. By October (area 28) and September (area 26) most females are 1956-64 year class and 1966 year-class shrimp. In Figure 23, length-frequency for area 30 (Grays Harbor) in 1967 are shown for August. Here the 1965 year class was fairly strong in comparison to areas 26 and 28.

In all areas, the 1966 year class showed a bimodal distribution due to the apparent differential growth between males and early maturing females in 1967. The bimodal distribution was largely eliminated in 1968 by reduced growth of the female fraction and faster growth of males and transitional males of the 1966 year class. However, in areas 26 and 28 the bimodal distribution continued apparently due to the large proportion of the year class which remained males.

The Pacific Marine Fisheries Commission-financed port sampler at Brookings and Port Orford, Oregon, and Crescent City, California, furnished

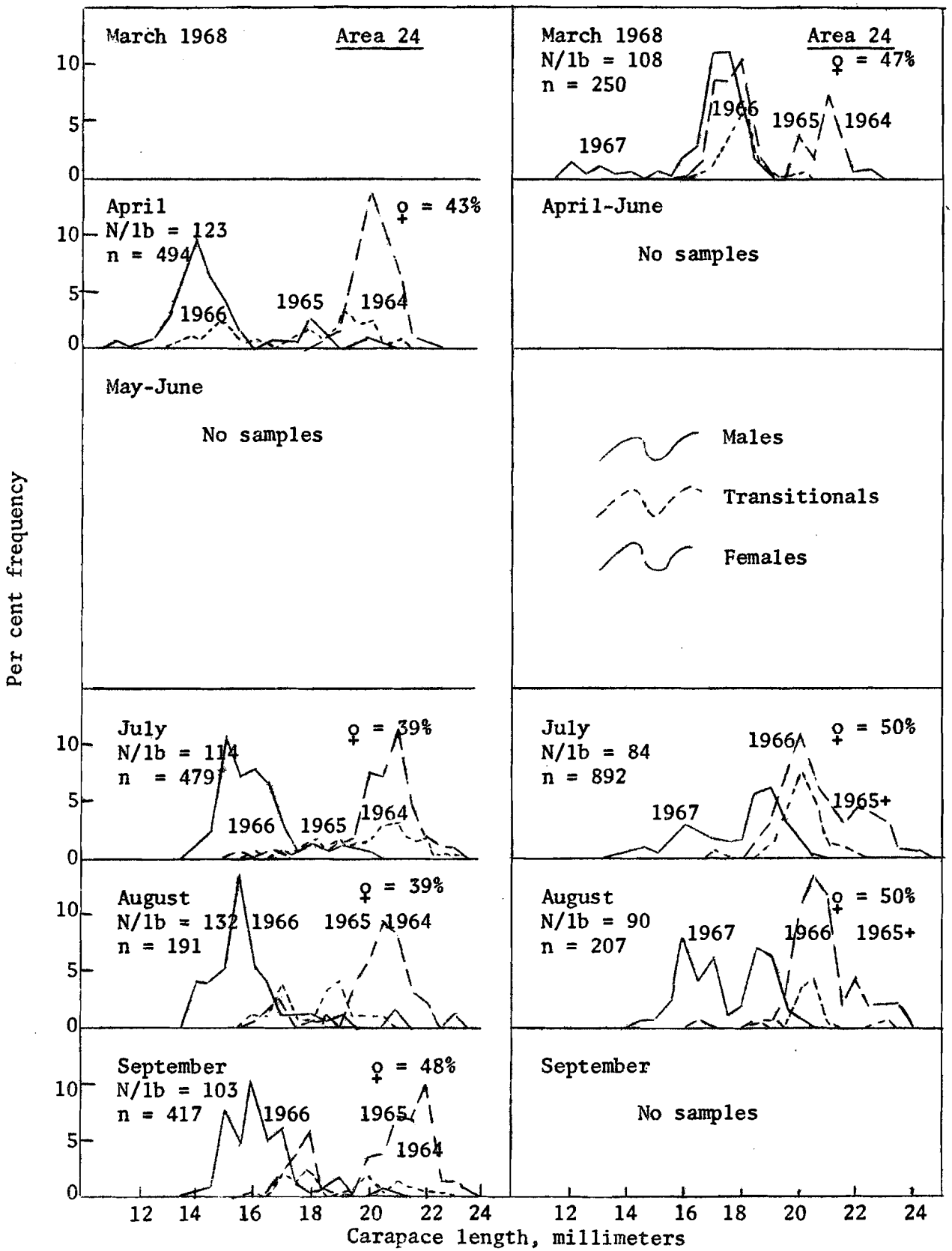


Figure 22. Monthly length-frequency distribution by sex in Area 24, 1967-68

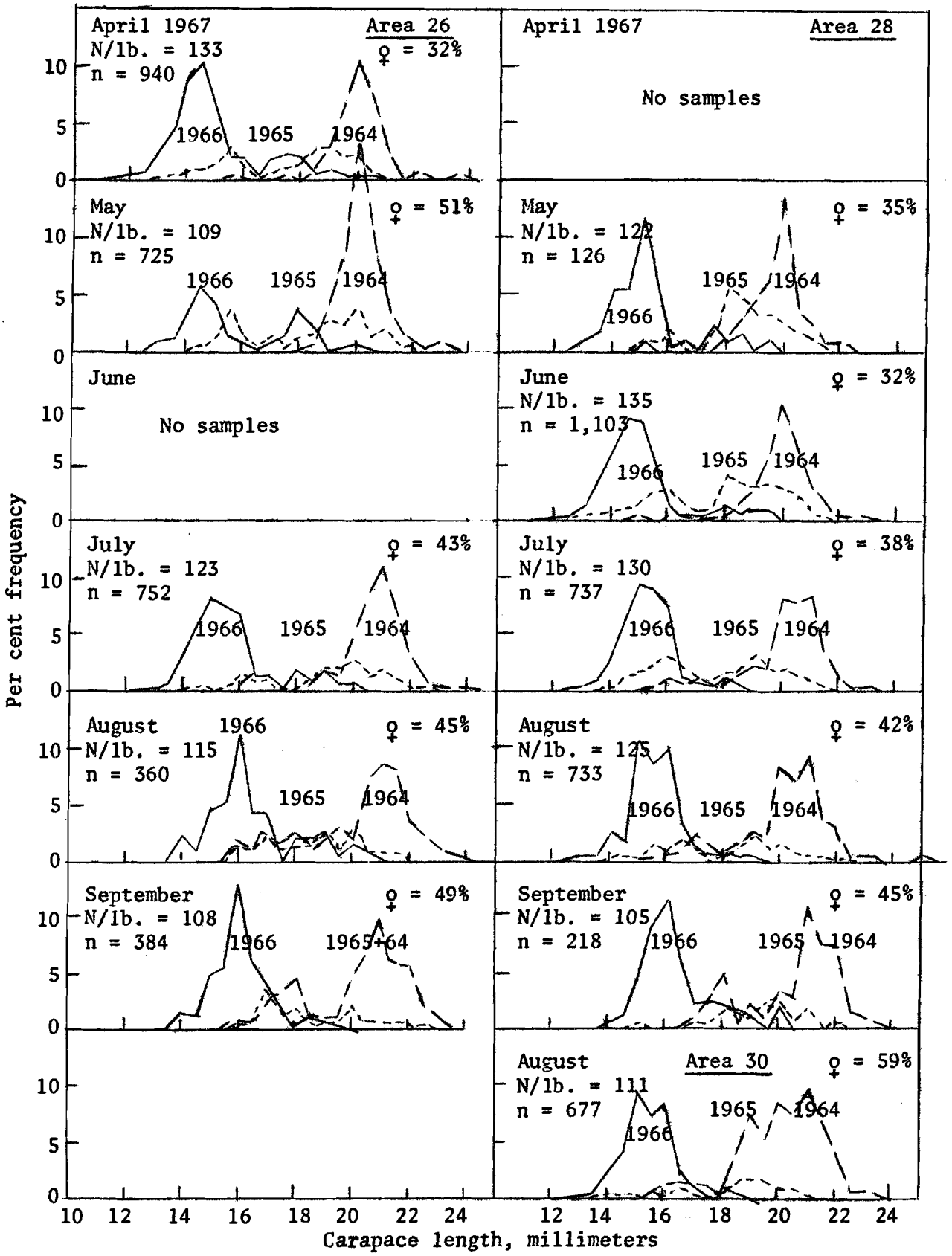


Figure 23. Length-frequency distribution by sex in 1967 for Areas 26 and 28 and Area 30 (Grays Harbor) for August 1967

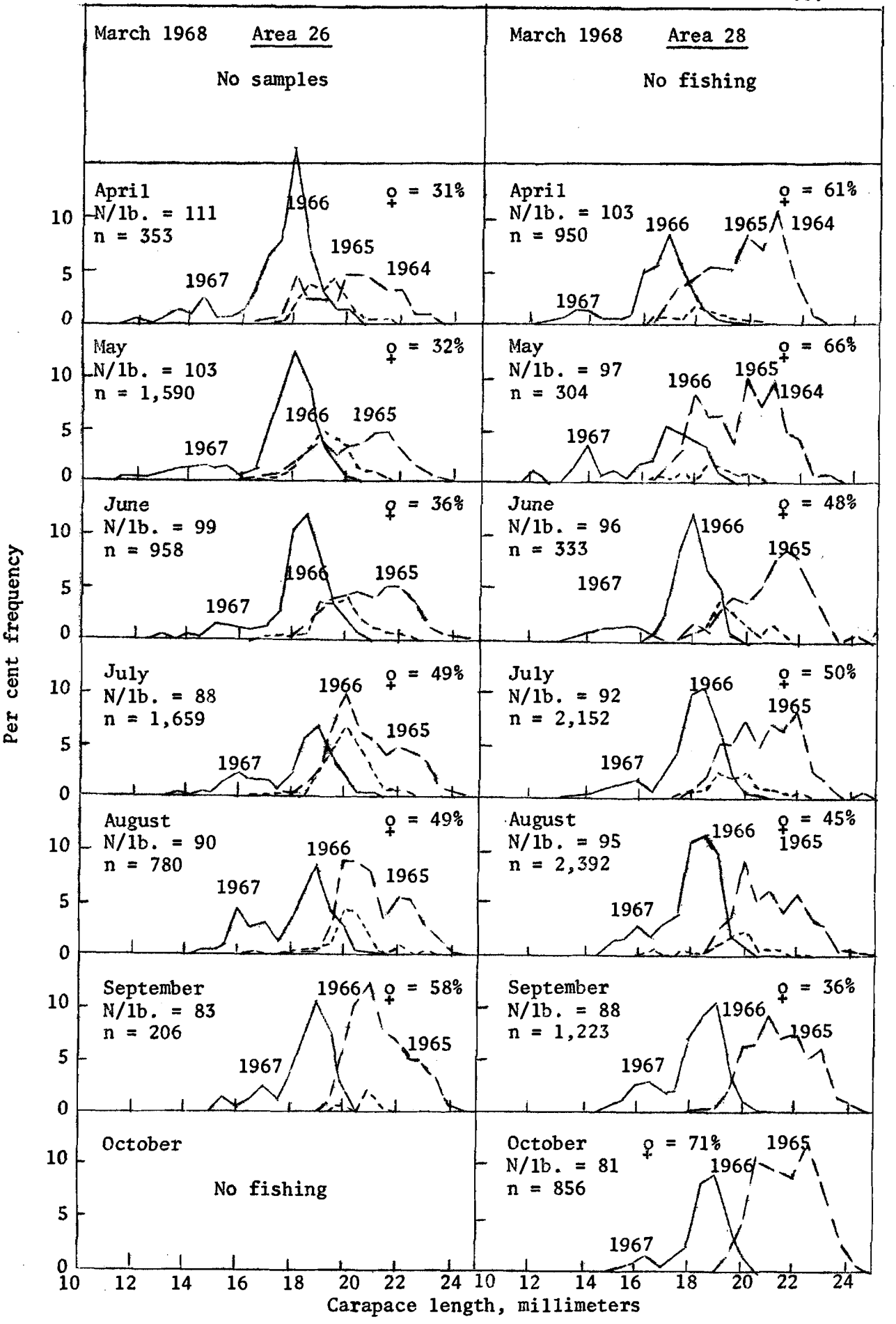


Figure 24. Monthly length-frequency distribution by sex in 1968 for Areas 26 and 28

data for areas 20, 19, and 18. This program was discontinued in late 1968.

Peeler machines were installed at Garibaldi (1) and Astoria (3) in 1968, adding to the capacity at those ports to handle shrimp landings. These machines were of the new presteam blanch variety which yields a product of better appearance than the conventional (old type) peeler machines. Capacity is about a third of the old type machine, about 500 pounds of raw shrimp per hour compared to 1,500 for the old machine. Including an additional old type machine installed at Warrenton in 1968, the total machine-peeled fraction of the Oregon catch increased from about 29% in 1967 to 42% of the catch in 1968. Some of the machine-peeled (new type) production was sold on the fresh-frozen shrimp market, marking the first time machine-peeled pink shrimp have competed directly with hand-peeled shrimp. The rising costs of hand-peel labor, due to increases in the federal minimum wage law and labor difficulties present in the Astoria area, were largely responsible for introduction of the new type machines. Two Coos Bay area processors have ordered machines and will install them in 1969. Prices paid to fishermen increased from 10 and 7 cents per pound to 11 and 8.5 cents per pound, respectively, in 1967 and 1968 for hand-peeled and machine-peeled shrimp. Value of the 1967 and 1968 fisheries to the fishermen totaled $1,060,000 and $1,120,000, respectively, compared to an average of $334,000 (1958-67).

Interagency shrimp studies

Cooperative work with the Bureau of Commercial Fisheries in 1968 resulted in design and testing of an experimental shrimp-trash fish separator trawl by October. Three weeks in July and September were spent on the John N. Cobb observing work by BCF gear specialists and taking

biological samples of catches off Newport. Biological samples were taken from experimental separator trawl and standard commercial trawl catches off northern Oregon in October. The trawl design and results were summarized in the March 1969 issue of Commercial Fisheries Review by High, Ellis, and Lusz. Briefly, the separator trawl resulted in catch of 95-98% pure shrimp with catch rates ranging from good to only fair and overall less than catch rates obtained with standard commercial trawls. BCF was working on increasing catch efficiency of the separator trawl at last report.

A short report summarizing present and potential shrimp fisheries and resources off Oregon was sent to T. E. Butler, FRBC, for inclusion in the UN-FAO indicative world plan report.

## PL 88-309 STUDIES

### Bottomfish distribution and abundance

Activities during the report period were in four main categories: (1) reports; (2) aging studies; (3) depth distribution of juvenile sole; and (4) establishing a measure of catch per effort for Dover sole.

Reports. Two papers were written and submitted for editing. These were on the development of the scale aging method for Dover sole and depth distribution of juvenile sole.

In addition to two annual progress reports, six quarterly progress reports and eight cruise reports were written. Two other reports were written and published by the Commission. These were Investigational Reports Nos. 6 and 7 covering age-length and length-frequency distributions of Dover, English, and petrale sole and Pacific ocean perch.

Aging studies. Primary effort on aging studies went into refining the existing scale aging methods. This project was started in November

1964 and completed during the winter of 1967-68. A resume' of results follows. Readability was acceptable. Agreement with three readings was 80%. Agreement of ±1 year was 87%. Reliability is open to some question for mature males. Validity of the first annulus was determined by three methods: (1) agreement between the mean length of aged fish and a corresponding length-frequency mode; (2) consistency in circuli counts to the first check of different aged fish; and (3) consistency in measurements to the first check of different aged fish.

Other aging studies include a tagging cruise and an aquarium study. The tagging cruise was made in two parts--November 1967 and April 1968. The November portion was largely unsuccessful because of a lack of fish. However, between the two tagging trips 1,494 fish were tagged. Scales were taken at tagging from each fish. The size of fish tagged ranged from 16 to 58 cm but 75% were 28 cm or less in size. Age composition of these fish, as determined by scales, is shown in Table 19. Since two-thirds of the fish tagged are age V or less, it will be some time before good returns will be realized.

The aquarium study involves the study of scales of 12 Dover sole residing in an artificial sea-water aquarium with a capacity of 150 gallons. The fish range in size from 130 to 247 mm. The age range is 2 to 6 years. Scales are collected monthly. As of December 31, 1968, two fish have been in residence since February 1968, the others since June 1968.

Eight of the 12 fish have shown an increase in length ranging from 3 to 57 mm. Seven of the eight showed scale growth. The fish growing only 3 mm did not show scale growth. An interesting feature of this experiment was the appearance of a mark on the scales, apparently associated with handling. For one particular fish this mark is so well defined that had not the life history been known, the mark would have been called an annulus.

Table 19. Age composition in per cent of Dover sole tagged, November 1967 and April 1968

| Age | Number | Per cent |
|---|---|---|
| 3 | 171 | 11.4 |
| 4 | 411 | 27.5 |
| 5 | 393 | 26.3 |
| 6 | 240 | 16.1 |
| 7 | 102 | 6.8 |
| 8 | 47 | 3.1 |
| 9 | 35 | 2.3 |
| 10 | 23 | 1.5 |
| 11 | 11 | 0.7 |
| 12 | 8 | 0.5 |
| 13 | 4 | 0.3 |
| 14 | 4 | 0.3 |
| 15 | 1 | 0.1 |
| 16 | 4 | 0.3 |
| 17 | 0 | 0.0 |
| 18 | 1 | 0.1 |
| Subtotal | 1,455 | 97.3 |
| Regenerate scale | 38 | 2.5 |
| Scales missing | 1 | 0.1 |
| Grand total | 1,494 | 99.9 |

Depth distribution of juvenile sole. Beginning in July 1966 a series of cruises were started to obtain data on the depth distribution of juvenile Dover sole. On subsequent cruises in May and August 1967 and February 1968, English, rex, and slender sole and Pacific sand dab juveniles were sampled. Some data for Dover sole were also obtained from shrimp cruises.

Depth distribution of juvenile sole varies with the season. English sole and sand dabs inhabit a shallow inshore zone extending seaward to a maximum depth of about 60 fathoms. Greatest abundance for both species was between 20 and 29 fathoms. Dover, rex, and slender sole occupied a much broader zone from about 20 fathoms to nearly 100 fathoms. Major

abundance of Dover sole was at 30-39 fathoms and 90-99 fathoms. Most rex sole were caught at 60-69 fathoms while most slender sole were caught at 90-99 fathoms. Depth distribution of juvenile Dover sole varies with the season. In February most juveniles occurred at 90-99 fathoms (deepest depth fished). During the summer months most juveniles occur between 20 and 39 fathoms. During the fall most juveniles were found at 50-59 fathoms. The other species showed less seasonal depth distribution, however. Rex and slender sole are found further inshore during summer months than at any other time of the year.

Dover sole catch-per-unit effort. A measure of Dover sole catch per effort is available back to 1948. The unit is called a significant landing (a landing in which Dover sole comprise 30% or more of the landed catch). This measure has one serious disadvantage in that market and weather conditions can influence the length of a trip, thus the quantity caught on a trip. The measure of effort finally arrived at is the pounds caught per hour per significant landing. This measure removes the influence of market and weather conditions.

Catch per effort has shown a general decline since 1948, ranging from a high of 680 pounds per hour in 1950 to a low of 288 pounds per hour in 1964 (Table 20). Not enough data are available to determine whether or not the decline is due to fishing or is part of a natural long-term cycle.

## Shrimp distribution and migration

During 1967-68 distribution-abundance studies begun in 1966 were continued. One shrimp survey cruise was run in 1967 (cruise 67-2) during February 20-May 4, covering five areas off Oregon. Results of this work have been reported in the July 1, 1966-June 30, 1967, annual progress report.

Table 20. Pounds of Dover sole caught per hour per significant landing 1948-68

| Year | Pounds per hour |
|---|---|
| 1948 | 634 |
| 1949 | 671 |
| 1950 | 680 |
| 1951 | 603 |
| 1952 | 455 |
| 1953 | 496 |
| 1954 | 517 |
| 1955 | 440 |
| 1956 | 381 |
| 1957 | 449 |
| 1958 | 433 |
| 1959 | 422 |
| 1960 | 373 |
| 1961 | 309 |
| 1962 | 332 |
| 1963 | 312 |
| 1964 | 288 |
| 1965 | 362 |
| 1966 | 441 |
| 1967 | 371 |
| 1968 | 317 |

During the period July 1, 1967-June 30, 1968, a series of cruises were made, to study vertical distribution and abundance of shrimp off Tillamook Head, utilizing baited traps, midwater trawl, and 41-foot semi-balloon (bottom) trawl. Results of this work have been reported in the annual progress report. This work found pink shrimp leave the bottom at night. During November 1967 shrimp were mostly distributed in the mid to bottom depths while they were concentrated largely in the upper one-third or one-fourth of the water column during February-March 1968. Pot catches declined drastically in May-June 1968, but catches indicated the shrimp were off bottom and distributed throughout the water column. Trap catches were made during hours of darkness only. Interesting differences in age and sex composition of trap-trawl catches during

October 28, 1967, and June 20, 1968, were noted. Catches were dominated by young males in November 1967, older females during February-March 1968 (mostly gravid), and a balance of age and sex classes in May-June 1968. These catches are thought to reflect actual age-sex composition in the study area during each respective period rather than differential vertical movement between age and sex. Shrimp catches from OFC research cruises during 1968 were delivered to the Oregon Game Commission hatchery division for experimental feeding of Atlantic salmon brood stock. About 4,000 pounds were delivered overall.

The period July 1-December 31, 1968, was devoted to compilation, analysis, and write-up of two publications on the work done in 1967-68. Besides these two publications, a data report was written.

Vessel charter

Experience gained in vessel chartering in 1966 indicated that long-term chartering might be less costly and/or provide more sea time than several short-term charters. During the first 6 months of 1967, a program was developed for using a trawl vessel for a full year. The M/V Sunrise was chartered for the entire July 1, 1967, to July 15, 1968, period for a cost of $33,990.00 During the year the vessel made 15 cruises totaling 28 trips to sea. A total of 97 days were spent at sea for an average cost of $350.41 per day. Delays in equipment delivery and extremely poor winter weather restricted the number of useful fishing days. Using average charter rates, however, it would have cost $38,100.00 for an equivalent amount of time on an individual cruise basis. Table 21 lists the cruise trips, number of days at sea, and purpose of trips. The activities undertaken were reported in standard cruise reports and the annual progress reports.

Table 21. Charter cruises of the M/V Sunrise, July 1, 1967, to July 15, 1968

| Cruise no. | Trip no. | Purpose | Inclusive dates | No. of days at sea |
|---|---|---|---|---|
| 67-5 | - | Preseason albacore cruise | 7/3-12/67 | 10 |
| Unnumbered | - | Test salmon longline gear | 8/10 & 15/67 | 2 |
| 67-6 | - | Albacore tagging cruise | 7/24-28/67 | 5 |
| 67-7 | - | Dover sole age analysis | 8/2-6/67 | 5 |
| 67-8 | - | Shrimp composition | 8/28-30/67 | 3 |
| 67-9 | - | Pacific ocean perch survey | 9/14-18/67 | 5 |
| 67-10 | - | Shrimp midwater trawling | 9/26-28/67 | 3 |
| 67-11 | 1 | Shrimp vertical distribution | 10/26-27/67 | 2 |
| 67-11 | 2 | Shrimp vertical distribution | 11/1-2/67 | 2 |
| 67-11 | 3 | Shrimp vertical distribution | 11/3-5/67 | 3 |
| 67-11 | 4 | Shrimp vertical distribution | 11/16-18/67 | 3 |
| 67-12 | - | Dover sole tagging | 11/21-22/67 | 2 |
| 68-1 | 1 | Shrimp vertical distribution | 1/23-24/68 | 2 |
| 68-1 | 2 | Shrimp vertical distribution | 2/7-8/68 | 2 |
| 68-2 | - | Dover sole juvenile distribution | 2/14-16/68 | 3 |
| 68-1 | 3 | Shrimp vertical distribution | 2/28-29/68 | 2 |
| 68-1 | 4 | Shrimp vertical distribution | 3/8-10/68 | 3 |
| 68-1 | 5 | Shrimp vertical distribution | 3/19-21/68 | 3 |
| 68-3 | - | Shrimp south coast survey | 4/3-13/68 | 5 |
| 68-4 | - | Dover sole tagging | 4/17-29/68 | 5 |
| 68-5 | 1 | Shrimp vertical distribution | 5/7-9/68 | 3 |
| 68-5 | 2 | Shrimp vertical distribution | 5/11-12/68 | 2 |
| 68-5 | 3 | Shrimp vertical distribution | 5/18-20/68 | 3 |
| 68-5 | 4 | Shrimp vertical distribution | 5/28-30/68 | 3 |
| 68-5 | 5 | Shrimp vertical distribution | 6/4-5/68 | 2 |
| 68-5 | 6 | Shrimp vertical distribution | 6/11-12/68 | 2 |
| 68-5 | 7 | Shrimp vertical distribution | 6/16-19/68 | 4 |
| 68-6 | - | Preseason albacore cruise | 7/1-8/68 | 8 |

## FOREIGN FISHING

The otter trawl investigations of the Fish Commission of Oregon has a four-point program involving foreign fishing activities. They are (1) surveillance of the foreign fleet, (2) coordination and exchange of information with other fishery agencies and industry, (3) preparation of materials for use by the U. S. State Department in unilateral negotiations with the USSR, Japan, and Canada, and (4) collection and compilation of biological and statistical information for exchange with USSR scientists.

Between May and August 1967, six patrol flights from Port Angeles, Washington, were made with the BCF on U.S. Coast Guard planes. In September 1967, it was decided that this was a duplication of effort with the BCF Branch of Enforcement and Surveillance and FCO participation on Coast Guard flights was suspended at that time.

Personnel from this investigation attended four meetings of the BCF Ad hoc Surveillance Committee in 1967 and two meetings in 1968.

Background material for unilateral negotiations with the USSR and Japan was prepared in January, September, and October 1967 and during February and August 1968. Material for unilateral negotiations with Canada was compiled and supplied in December 1967 and 1968.

In 1967 fishery scientists of the U.S. and USSR agreed to exchange biological and statistical data for their respective fisheries in the northeast Pacific Ocean. Otter Trawl Investigations collected two special Pacific ocean perch samples in November-December 1967 and 10 special samples in 1968. Biological and statistical information for exchange with scientists of the USSR were prepared and submitted during February 1968.

A 5-day survey of Pacific ocean perch stocks off Oregon was carried out on September 14-18, 1967, aboard the chartered vessel M/V Sunrise.

## MEETINGS ATTENDED

During 1967 otter trawl personnel attended 30 meetings concerned with fisheries on the west coast. In 1968 staff members attended 17 such meetings. Tables 22 and 23 list the meetings attended, the location, date, and explanatory remarks for 1967 and 1968, respectively.

Table 22. Meetings attended by Otter Trawl personnel in 1967

| Meeting | Location | Dates | Remarks |
|---|---|---|---|
| American Fisheries Society | Corvallis | 1/13-14 | Oregon Chapter |
| Oregon Wildlife Federation | Corvallis | 1/21 | Talk presented |
| PL 88-309 Staff | Astoria | 1/6 | Progress report to industry |
| Commission Meeting | Portland | 2/8 | |
| OSU Fur Farm Day | Corvallis | 2/11 | Mink ranchers |
| Commission Meeting | Portland | 3/8 | Regular monthly meeting |
| Bottomfish Planning Committee | Portland | 3/16-17 | Sponsored by PMFC |
| Interagency | Eureka, Calif. | 3/15 | Calif.-Oregon shrimp staffs |
| PMFC | Portland | 3/27-28 | Spring research staff meeting |
| PFB | Gearhart | 3/29-31 | |
| OSU-FCO | Corvallis | 4/24 | Coordinating meeting with Oceanography Dept. |
| Ad hoc Surveillance Committee | Olympia, Wash. | 4/27 | BCF Committee |
| Otter Trawl Commission | Astoria | 4/28 | Semiannual meeting |
| Commission Meeting | Portland | 5/3 | Delay Area A opening |
| Commission Meeting | Portland | 5/10 | |
| Soil & Water Conservation District | Astoria | 5/18 | Recreation & Wildlife Subcommittee |
| Technical Subcommittee | Nanaimo, B. C. | 6/27-29 | International Trawl Fishery Committee |
| World Shrimp Conference | Mexico City | 6/11-22 | FAO sponsored |
| Ad hoc Surveillance Committee | Aberdeen, Wash. | 8/3 | BCF Committee |
| Interagency | Olympia, Wash. | 8/30 | FCO, WDF, BCF, planning meeting for U.S.-USSR scientific information exchange |
| Ad hoc Surveillance Committee | Astoria | 9/14 | BCF Committee |
| Otter Trawl Commission | Astoria | 9/15 | Budget meeting |
| Otter Trawl Commission | Astoria | 10/27 | Semiannual meeting |
| Ad hoc Surveillance Committee | Seattle, Wash. | 10/30-31 | BCF Committee |
| Oregon Advisors to PMFC | Portland | 11/1 | |
| Commission Meeting | Portland | 11/16 | Status report |
| International Trawl Fishery Committee | Glenedon Beach | 11/29 | Annual Meeting |
| PMFC | Glenedon Beach | 11/29-12/1 | Annual Meeting |
| Commission Meeting | Portland | 12/21 | Regulation Hearing |
| PL 88-309 | Clackamas | 12/22 | Planning session |

Table 23. Meetings attended by Otter Trawl personnel in 1968

| Meeting | Location | Dates | Remarks |
|---|---|---|---|
| American Fisheries Society | Corvallis | 1/19-20 | Oregon Chapter |
| The Wildlife Society | Newport | 2/2-3 | Oregon Chapter |
| OSU Fur Farm Day | Corvallis | 2/10 | Mink ranchers |
| National Fishermen & Wives | Seattle, Wash. | 3/8-9 | Annual Meeting |
| PFC | Ocean Shores, Wash. | 3/20 | Annual Meeting |
| Aquaculture Conference | Newport | 5/23 | |
| Ad hoc Surveillance Committee | Astoria | 6/20 | BCF Committee |
| Technical Subcommittee | San Francisco, Calif. | 6/25-27 | International Trawl Fishery Committee |
| National Fishermen & Wives | Warrenton | 9/30 | Lower Columbia River Chapter |
| Oregon Advisors to PMFC | Portland | 10/29 | |
| Fishery Industry Liaison Meeting | Newport | 10/30 | Report by BCF, OSU, FCO on research since 1951 |
| Fishery Industry Liaison Meeting | Charleston | 10/31 | Report by BCF, OSU, FCO on research since 1951 |
| International Trawl Fishery Committee | Coeur d'Alene, Idaho | 11/20 | Annual Meeting |
| PMFC | Coeur d'Alene, Idaho | 11/20-22 | Annual Meeting |
| Hydroacoustic Workshop | Seattle, Wash. | 11/25-27 | BCF sponsored |
| Otter Trawl Commission | Astoria | 12/6 | Semiannual Meeting |
| Ad hoc Surveillance Committee | Seattle, Wash. | 12/20 | BCF Committee |