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**Regional Review of the Status of Northern Shrimp (Pandalus borealis)
Resources in Areas off Newfoundland and Labrador (Divisions OB to 3K)**

by

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¹ This series documents the scientific basis for the evaluation of fisheries resources in Canada. As such, it addresses the issues of the day in the time frames required and the documents it contains are not intended as definitive statements on the subjects addressed but rather as progress reports on ongoing investigations.

Research documents are produced in the official language in which they are provided to the Secretariat.

¹ La présente série documente les bases scientifiques des évaluations des ressources halieutiques du Canada. Elle traite des problèmes courants selon les échéanciers dictés. Les documents qu'elle contient ne doivent pas être considérés comme des énoncés définitifs sur les sujets traités, mais plutôt comme des rapports d'étape sur les études en cours.

Les documents de recherche sont publiés dans la langue officielle utilisée dans le manuscrit envoyé au secrétariat.

ABSTRACT

Data from the commercial fishery for northern shrimp were analyzed for four assessment/management areas: Division 0B, Division 2G, Hopedale + Cartwright Channels, and Hawke Channel + Division 3K. These correspond to shrimp fishing areas (SFAs) 2, 4, 5, and 6, respectively. Within each area, inference on the status of the resource was made by examining trends in catch, effort, catch per unit effort, fishing pattern and size/sex composition of the catches. Also, multispecies research trawl surveys in 1995 and 1996 provided valuable information on distribution and abundance of shrimp over a wide area, particularly in Hawke Channel + Division 3K.

The northern shrimp fishery continued to perform well in 1996. Catch rates in the Hopedale + Cartwright and Hawke + 3K areas were as high as or higher than those observed since the fishery began. Research surveys showed that abundance/biomass was high in both areas, particularly in Hawke + 3K. In Division 2G, there was some concern for a decline in catch rates between 1994 and 1996 but the level still remains high compared to other fishing areas and a healthy spawning stock has been maintained. The status of the resource in Division 0B remains uncertain.

It was concluded that substantial increases in TACs could be considered for the Hopedale + Cartwright and Hawke + 3K areas, based on fishery performance and research survey indices. A higher TAC also was advocated for Division 0B as a continuation of the "experimental" approach to fisheries development. There was no basis on which to advise an appropriate TAC for Division 2G.

RÉSUMÉ

On a analysé des données sur la pêche commerciale de la crevette nordique dans les quatre secteurs d'évaluation ou de gestion suivants : division 0B, division 2G, chenaux Cartwright et Hopedale, et chenal Hawke et division 3K. Ces secteurs correspondent aux zones de pêche de la crevette (ZPC) 2, 4, 5 et 6, respectivement. Pour chaque région, on a déduit des données l'état de la ressource en examinant les tendances des prises, de l'effort, des prises par unité d'effort, des régimes de pêche et de la composition des prises selon le sexe et la taille. En outre, des relevés plurispécifiques de recherche au chalut menés en 1995 et 1996 ont permis d'obtenir de l'information précieuse sur la répartition et l'abondance de la crevette sur une grande étendue, en particulier dans le chenal Hawke et la division 3K.

La pêche de la crevette nordique a continué de donner de bons résultats en 1996. Les taux de capture dans le secteur Cartwright - Hopedale et le secteur Hawke - 3K étaient aussi bons ou meilleurs que ceux observés depuis le début de la pêche de la crevette. Les relevés de recherche ont démontré que l'abondance et la biomasse étaient élevées dans les deux secteurs, en particulier dans Hawke - 3K. La baisse des taux de capture dans 2G entre 1994 et 1996 cause une certaine inquiétude, bien que le niveau demeure élevé par rapport à d'autres secteurs de pêche et que le stock reproducteur soit en bon état. L'état de la ressource de la division 0B demeure incertain.

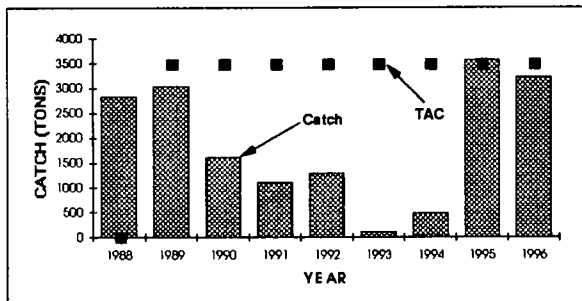
On conclut que l'on pourrait nettement augmenter les TAC dans les secteurs Cartwright - Hopedale et Hawke - 3K d'après le rendement de la pêche et les indices des relevés de recherche. Un TAC plus élevé a aussi été recommandé pour la division 0B comme suite de l'approche « expérimentale » au développement de la pêche. La base scientifique n'était pas suffisante pour recommander un TAC approprié pour la division 2G.

ASSESSMENT OF SHRIMP IN NAFO DIVISION 0B (SFA 2)

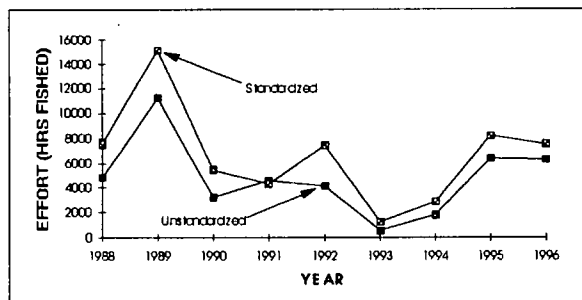
FISHERY DATA

Catch and effort

The northern shrimp fishery in Division 0B began in October, 1988. Catches increased from about 2800 tons that year to 3000 tons in 1989 but subsequently declined to 100 tons in 1993. Catches increased, thereafter, to 476 tons in 1994, 3564 tons in 1995 and 3220 tons in 1996. The 1995 and 1996 catch estimates are preliminary and likely inflated by the inclusion of catches of *Pandalus montagui* from the area east of Resolution Island. The catch estimates used here are based on vessel logbook data which must be corroborated with observer records. The TAC's have remained at 3500 tons since 1989.



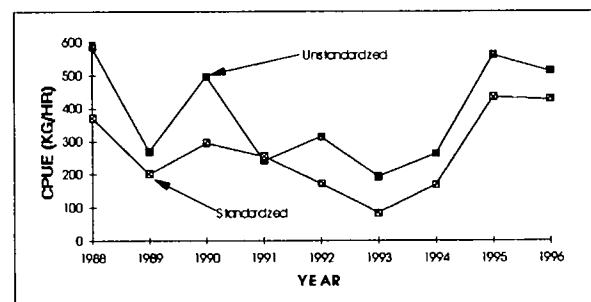
Effort about doubled from 1988 to 1989, decreased to 1993, increased to 1995 and stabilized in 1996.



In 1988, the fishery occurred north of 64° N with occasional tows near 66° N (Fig. 1). Effort in 1989 was concentrated between 64° and 65° N but extended as far south as 62° N. Proportionately more effort was distributed south of 64° N during the 1990 - 1994 period while total effort declined. The areas fished extensively in the southwest in both 1995 and 1996 reflect the targeting of *P. montagui* east of Resolution Island.

Catch per unit effort (CPUE)

Unstandardized, annual CPUE's decreased from 585 kg/hr in 1988 to 271 in 1989 and increased to 497 in 1990. Catch rates decreased during 1991 - 1994 to the 200 - 300 kg/hr range and increased to over 500 kg/hr in 1995 and 1996. The data were analyzed by multiple regression for year and vessel effects. The model showed that the standardized, 1996 catch rate of 427 kg/hr was similar to the 1995, 1990 and 1988 estimates ($P > 0.15$) and significantly higher ($P < 0.05$) than those from 1991 to 1994 and 1989 (Table 1). Both series showed an overall declining trend to 1993 and an increase to 1995 - 1996. Although there was no significant month effect, more effort has occurred during the summer since 1994.



Catch, effort and CPUE all show approximately the same trend during the 1990's. Historical fishery data for this management-assessment area are summarized in Table 2.

Size composition

Catches in most years were composed primarily of large, female shrimp (Fig. 2) with a modal length of about 27 mm carapace length (CL). Occurrence of higher proportions of the male component (<25 mm) after 1988 was coincident with the southward shift in fishing effort. The sampling data showed that the occurrence of smaller/younger male shrimp (i.e. < 22 mm) declined from 1990 to 1993 but increased thereafter. In 1994, catches comprised mostly large males (23 - 24 mm) and females whereas, in 1995 and 1996, the female component (27 mm) was dominant. Several size/age groups of males were evident in 1996 and most females occurred within a smaller size range compared to previous years.

RESOURCE STATUS

This area is difficult to fish due to the presence of ice and/or the apparent sudden shifts in water masses that are believed by fishermen to affect shrimp distribution. They have observed that shrimp concentrations throughout the area are elusive. This contrasts the situation in several southern locations where areas of high concentration support substantial levels of effort and CPUE, and persist from year to year. Consultation with fishermen revealed that they believe this large management - assessment area can support higher annual catches and that the TAC of 3500 tons is restrictive.

The status of this resource remains uncertain. The CPUE and sampling data are not considered to be reliable indices of stock conditions. The fluctuations in both catch and catch rates are more likely a reflection of the degree of difficulty in locating concentrations of shrimp than they are indicators of significant

changes in the resource abundance. High catch rates still occur sporadically throughout the Division and, in both 1995 and 1996, were frequently encountered in the southwest, just east of Resolution Island in a *Pandalus borealis/montagui* mixture.

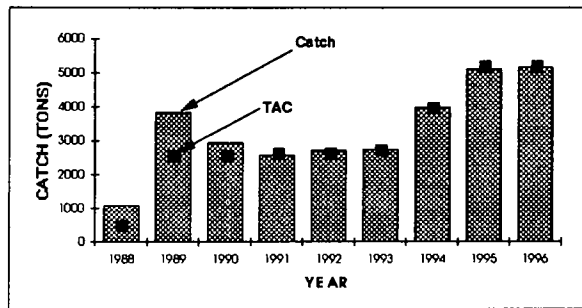
There is no biological basis on which to advise a change in the 1994 - 1996 Management Plan which set the TAC at 3500 tons. This level was established in 1989 as a precautionary level in an exploratory area and is still considered in this context. No research vessel surveys have been conducted or are planned for this management area.

ASSESSMENT OF SHRIMP IN NAFO DIVISION 2G (SFA 4)

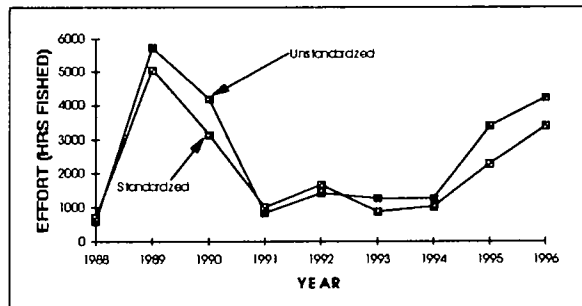
FISHERY DATA

Catch and effort

The northern shrimp fishery in Division 2G began in 1988, only incidental catch and effort having been reported from previous years. Catches increased from 1083 tons in 1988 to 3842 tons in 1989 and remained within the 2500 - 3000 ton range up to 1993. The 1994 catch increased to about 4000 tons with an increase in TAC to that level in the first year of the 1994 - 1996 Management Plan. A second, planned increase in the TAC to 5200 tons for 1995 and 1996 resulted in catches of about 5100 tons in both years.



Fishing effort increased substantially from 1988 to 1989, decreased to 1991 and remained relatively stable up to 1994 before increasing again in 1995 and 1996.



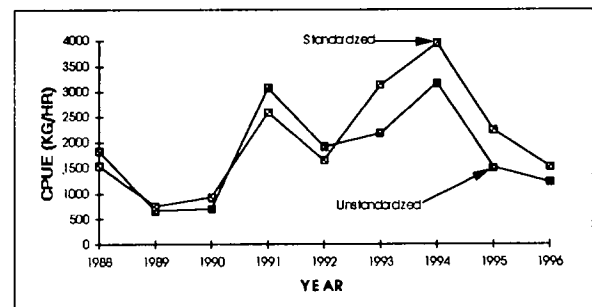
From 1988 to 1990, the fishery occurred throughout the Division which, during that period, was split into two management zones, north and south of 60° N. The 1991 - 1993 Management Plan combined the two zones and, since then, effort has concentrated in the north (Fig. 3). Some substantial by-catches of *P. montagui* were encountered at some locations both in 1995 and 1996.

Catch per unit effort (CPUE)

The area is noted for producing high catch rates of large shrimp, especially north of 60° N. Unstandardized, annual CPUE's for the whole management area declined from 1823 kg/hr in 1988 to about 700 in 1989 and 1990. In 1991, catch rate increased substantially to over 3000 kg/hr as fishing effort concentrated in the northern grounds. High CPUE's in the

range of 2000 to 3000 kg/hr were maintained up to 1994. The 1995 and 1996 catch rates declined to 1500 and 1200 kg/hr, respectively.

The CPUE data were analyzed by multiple regression for year, month and vessel effects. The model showed that the annual, standardized catch rate in 1996 for the whole area was lower than those of the previous three years and 1991 ($P < 0.05$) and significantly higher than the 1989 and 1990 estimates (Table 3). The 1988 and 1992 estimates were similar to the 1996 value ($P > 0.70$). Both series showed an overall increase from 1989 to 1994, followed by a decrease to 1996.



Catch rates within the preferred fishing area (north of 60° N) also were examined. The trend in the unstandardized CPUE in this area was similar to that for the whole area. Standardizing showed that the 1995 and 1996 catch rates were substantially lower than the 1993 and 1994 estimates.

Historical fishery data for this management-assessment area are summarized in Table 4.

Size composition

Catch-at-length data showed variable size distributions between years (Fig. 4). High proportions of male shrimp (< 25 mm CL) and overall lower catch rates in 1989 and 1990 reflect the fishing activity south of 60° N in

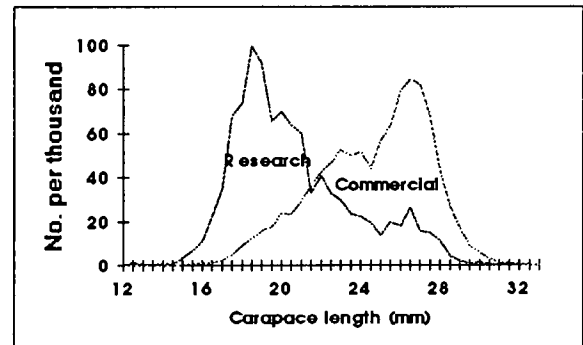
those years. Large, female shrimp dominated in 1991 when effort shifted to the northern grounds. Since then, the female component dominated the catches by number and weight in most years. In 1996, two distinct size groups of females at roughly 24 and 27 mm were evident in the sampling data. The larger is typical for the preferred fishing area while the smaller is characteristic of more southerly fishing areas.

RESEARCH SURVEY DATA

The 1996 fall multi-species research survey in Div. 2G did not provide sufficient sampling for a reliable estimation of shrimp biomass. Only 44 fishing stations were occupied and coverage was sparse in depths > 300 m in southern and central areas. The preferred fishing area to the north also was poorly sampled.

Length distributions showed a predominance of male shrimp (73% by number) and two size groups of females at 23 and 27 mm CL. Males were encountered most frequently in depths between 200 and 300 m (Fig. 5). The occurrence of the smaller female component, particularly in depths between 250 and 300 m, is consistent with the commercial sampling data for 1996.

Fall research surveys, with increased sampling, can provide estimates of minimum biomass and show potential for the development of a recruitment index.



RESOURCE STATUS

The occurrence of high densities of large, female shrimp in the northern grounds of this management area is likely to attract most of the effort in future, with little or no fishing south of 60° N. Although it is clear that a healthy spawning biomass is being maintained, some fishermen are concerned about the recent decline in CPUE. It is noted that this decline occurred after catches (and TAC's) increased from about 2700 tons in 1993 to over 5000 tons in 1995. Nevertheless, the lower catch rates of 1995 and 1996 still compare favourably with those from other management areas (e.g. SFA's 1 and 5) which have sustained fisheries for about 20 years.

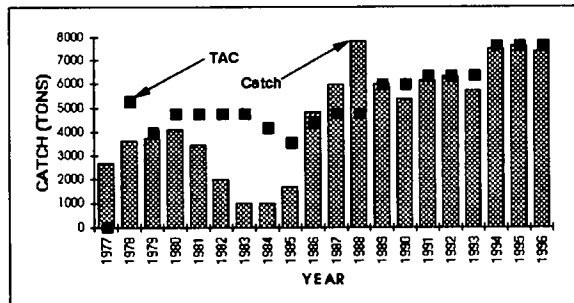
No biomass estimate is available from which inference can be made on the recent level of exploitation and there is no basis on which to advise an appropriate level of TAC.

ASSESSMENT OF SHRIMP IN HOPEDALE & CARTWRIGHT CHANNELS (SFA 5)

FISHERY DATA

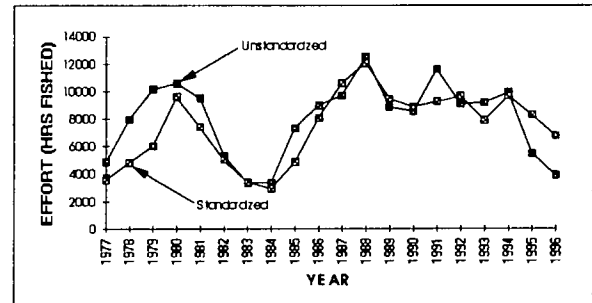
Catch and effort

The northern shrimp fishery in Hopedale and Cartwright Channels began in 1977, following experimental fishing in the previous two years. Catches increased from about 2700 tons in 1977 to 4100 tons in 1980, declined to 1000 tons in 1983 and 1984, increased again to 7800 tons in 1988 and then stabilized at roughly 6000 tons during the 1989 - 1993 period. The TAC's for the 1994 - 1996 Management Plan, which combined the two channels as a single management area, were increased by 20% to 7650 tons annually and catches subsequently increased, averaging 7500 tons during that period.



The proportion of the annual catch taken near Cartwright Channel, in the south, has increased from about 25% during the 1991 - 1993 period to 42% in 1994, 78% in 1995 and 90% in 1996.

Fishing effort showed approximately the same trends over time as catch. In recent years, however, effort has decreased while catches have increased.

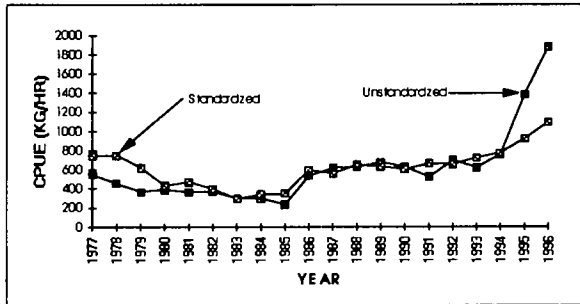


Traditionally, effort has concentrated in four main areas: northern, eastern and southern Hopedale Channel and Cartwright Channel (Fig. 6). In the 1990's, however, more effort was reported from the slopes of the shelf - north and east of Cartwright Channel. From 1994 to 1996, substantial effort occurred on the eastern slope during winter and spring. Historically, a summer - fall fishery, in 1995 and 1996 it has become mainly a winter - spring operation.

Catch per unit effort (CPUE)

Unstandardized, annual CPUE's declined from 552 kg/hr in 1977 to 230 in 1985, increased substantially in 1986 and stabilized around a mean level of 615 kg/hr during the 1986 - 1993 period. Catch rates increased, thereafter, to 757 kg/hr in 1994, 1387 kg/hr in 1995 and 1887 kg/hr in 1996.

The CPUE data were further analyzed by multiple regression for year, month, vessel and area effects. The standardized 1996 catch rate of 1094 kg/hr was the highest in the time series and was significantly higher ($P < 0.05$) than the estimates in all years of the fishery except 1978 (Table 5). Both series show approximately the same trend: a decline to the mid 1980's, a substantial increase in 1986 followed by stability to the early 1990's and an increase since then.



Historical fishery data for this management-assessment area are summarized in Table 6.

Size composition

Catch-at-length data from 1988 to 1996 (Fig. 7) showed a modal group of females at 24 - 25 mm CL occurring each year. Recruitment of males between 16 and 23 mm has been consistent from year to year and males have contributed substantially to the catch in numbers in most years. Both the male and female components showed increases in catch rates from 1994 to 1996. The length at which females begin to dominate in the size distributions was smaller in 1995 and 1996 than seen in previous years.

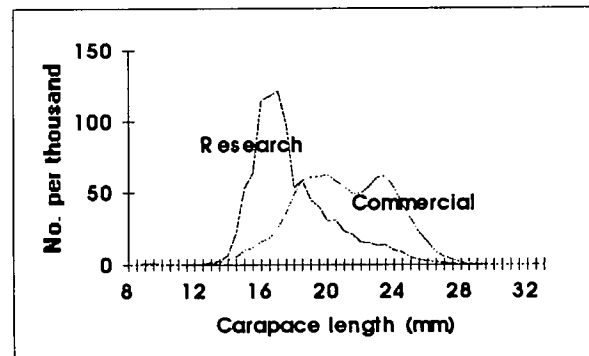
RESEARCH SURVEY DATA

The 1996 fall multi-species research survey provided data on stock size and composition for shrimp in the Hopedale + Cartwright management area. The preliminary biomass estimate was 235,000 tons with 95% confidence intervals of 0 and 609,000 tons (Table 7). Two trawl stations which produced large catches were highly influential to the biomass estimate. By omitting these stations from the analysis, a minimum biomass of 82,000 tons was estimated with confidence intervals of 51,000 and 112,000 tons.

Length distributions showed a predominance

of male shrimp (about 90% by number) throughout the survey area but particularly in depths between 200 and 400 m (Fig. 8). The modal size structure did not conform to the growth model for this area but was consistent with the model for the southern management area. Using the latter, most males are thought to belong to the 1993 year class (Fig. 9). This implies either a change in growth within the area or immigration from the south. The change in the length at which females begin to dominate the size distribution, noted above for the commercial data, is consistent with the alternative growth model.

Fall research trawl surveys can provide reliable estimates of minimum biomass and show potential for the development of a recruitment index. However, a time series of estimates is required before such information can be used quantitatively in the assessment process.



RESOURCE STATUS

The northern shrimp resource in the Hopedale and Cartwright Channels remains healthy with commercial catch rates stable over the late 1980's and increasing in recent years. The increase is evident in both the male and female catch components. Data from the research survey and commercial fishery in 1996 suggest that year classes produced in the early 1990's will maintain high catch rates for the next few

years. Preliminary data from daily vessel hauls show that the 1997 fishery has performed well in January and February, with monthly catch rates similar to those for the same months in 1995 and 1996.

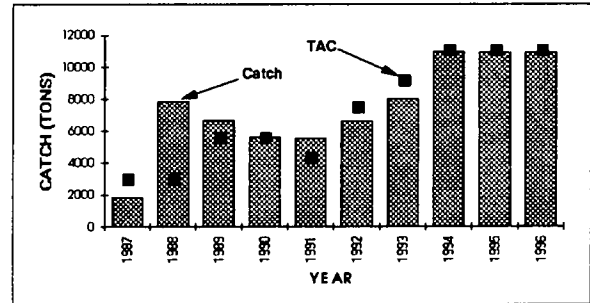
The 1996 catch of 7400 tons, when compared to either estimate of minimum biomass, reinforces the view that the impact of past fishing has been minimal. Given the current, positive view of the state of the resource and evidence of continued good recruitment in the next few years, an increase in the TAC for the next three years should be considered.

ASSESSMENT OF SHRIMP IN HAWKE CHANNEL + DIV. 3K (SFA 6)

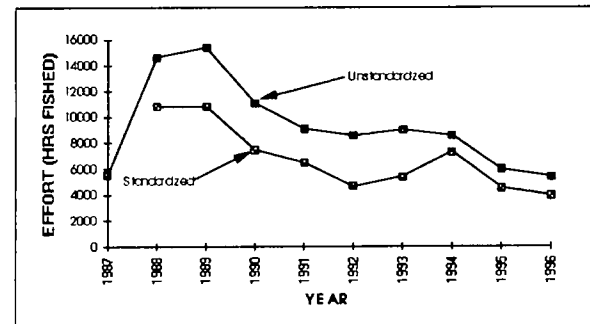
FISHERY DATA

Catch and effort

The shrimp fishery in Hawke Channel + Division 3K began in 1987 when about 1800 tons were caught. Previously, only a few tons had been reported from Hawke Channel in some years. Catches increased to more than 7800 tons in 1988 and ranged between 5500 and 8000 tons from 1989 to 1993, inclusive. The annual TAC for the 1994 - 1996 Management Plan was set at 11,050 tons (20% more than the 1993 TAC) to include Hawke Channel, St. Anthony Basin, east St. Anthony, Funk Island Deep as well as three exploratory areas on the seaward slope of the shelf. Catches increased to 11,000 tons in each of the three years. Logbook data show that more than 80% of the catch in 1995 and 1996 was taken from the Hawke Channel area.



Fishing effort declined from 1989 to 1992, stabilized or increased slightly to 1994 and declined from 1994 to 1996. The fishery occurs, primarily, during the first five months of the year.

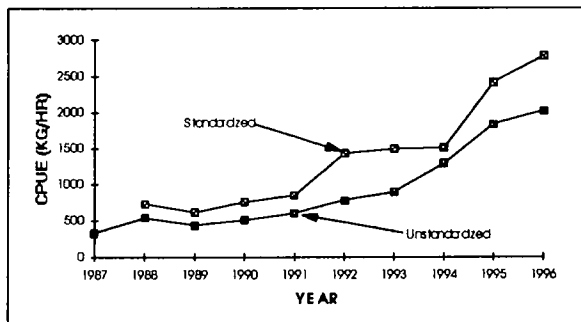


A displacement of fishing effort to the east occurred after 1991 due to several factors: the establishment of exploratory areas on the shelf slope in 1992 and 1993, the discovery of concentrations of shrimp in these areas, the occurrence of ice in winter and spring each year and the flexibility to fish recent TAC's anywhere within the large management area. This displacement was particularly evident in St. Anthony Basin where both catch and effort declined markedly since 1992 (Fig. 10).

Catch per unit effort (CPUE)

Unstandardized, annual CPUE's decreased from 536 kg/hr in 1988 to 432 in 1989 and increased steadily thereafter to 2020 kg/hr in 1996. The CPUE data also were analyzed by multiple regression for year, month, vessel and area effects to standardize the catch rates

(Table 8). The analysis showed that the 1996 CPUE was significantly higher ($P < 0.05$) than those for all previous years except 1995. Standardized values revealed approximately the same overall increasing trend as the unstandardized series. However, the 1992 to 1994 standardized rates were relatively stable whereas the raw data indicated a continual increase.



Despite the high catches taken in the Hawke Channel area during the 1994 - 1996 period, compared to previous years, catch rates from that area alone continued to increase. The 1997 fishery, to date, also has concentrated in the Hawke Channel area and catch rates for January and February have remained high, at or above the 1995 and 1996 levels.

Historical fishery data for this management-assessment area are summarized in Table 9.

Size composition

Catch-at-length data from 1988 to 1996 showed dominance of the female component around 24 mm CL in most years and an abundance of males during the 1994 - 1996 period (Fig. 11). The relatively strong size group at approximately 16 mm in 1994 (the 1991 year class) dominated the male component at 18 mm in 1995 and at 20 mm in 1986. The 1992 and 1993 year classes are also well represented at 18 and 16 mm, respectively, in the 1996 samples.

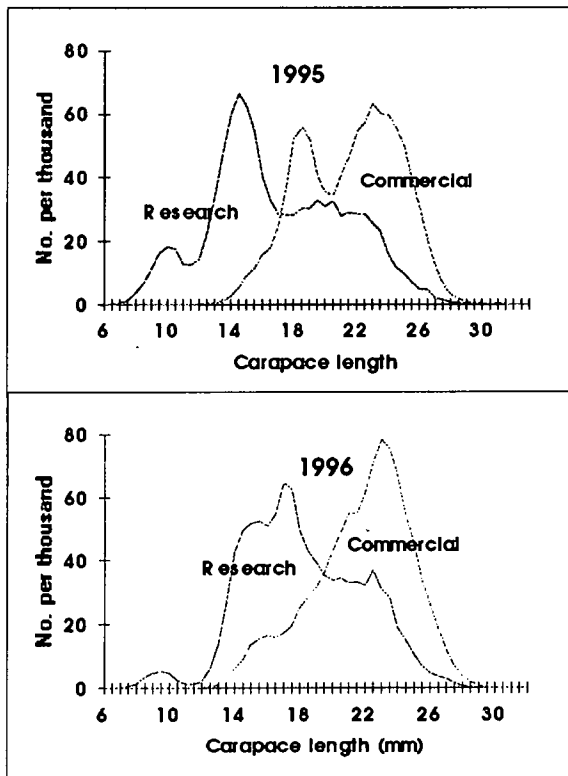
RESEARCH SURVEY DATA

The 1995 and 1996 fall multi-species research surveys provided excellent data on stock size and composition for shrimp within the management area. Shrimp were widely distributed and abundant throughout Hawke Channel + Div. 3K in both years with catches over much of the area exceeding 50 kg per 15 minute tow (Fig. 12 and 13). The minimum trawlable biomass estimated in 1995 was 308,000 tons with 95% confidence intervals of 235,000 - 381,000 tons (Table 10). The 1996 preliminary estimate (Table 11) was 580,000 tons (457,000 - 703,000 tons). About 46% of the 1995 estimate was due to male shrimp compared to 60% in 1996.

Length distributions from the 1995 survey showed the dominance (in numbers) of the 1993 year class at approximately 14 mm CL and clear representation of the 1994 year class at 10 mm in depths between 200 and 350 m (Fig. 14). Interpretation of the age structure is given in Fig. 15.

In 1996, over a broad depth range, the 1993 year class was prominent at 17 mm, the 1994 strongly represented at 14 mm and the 1995 apparent at 10 mm (Fig. 16 and 17). Unlike the anomalous growth noted in the Hopedale and Cartwright channels, there was no indication of a change in growth for this area.

Survey coverage in both 1995 and 1996 was extensive resulting in biomass estimates that can be interpreted with confidence. The potential for a time series of surveys to provide a reliable recruitment index is even more apparent for this area with the representation of juveniles at age 1.



RESOURCE STATUS

The northern shrimp resource in Hawke Channel + Div. 3K is healthy and commercial catch rate data indicate that abundance has increased in recent years. Although the fall research survey time series is short, the level of biomass observed in both 1995 and 1996 (preliminary) confirms that shrimp are widely distributed and highly abundant. The recent level of catch is very low compared to minimum trawlable biomass estimates.

Given the evidence for high abundance, a healthy spawning biomass and prospects for good recruitment to the fishery for the next few years, this resource can support a substantial increase in TAC. Three years is still considered an appropriate time frame for multi-year advice.

TABLE 1. STANDARDIZATION OF CPUE - DIV. 0B - MULTIPLICATIVE, YEAR VESSEL MODEL, 1988 - 1996

General Linear Models Procedure						
Class Level Information						
Class	Levels	Values				
YEAR	9	88	89	90	91	92
VESSEL	27	12	13	21	29	30
		32	33	34	36	37
		38	39	40	41	42
		44	46	47	57	58
		59	67	68	69	70
		99				
Number of observations in data set = 260						
Dependent Variable: LNCPUE						
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F	
Model	34	91.58667955	2.69372587	3.93	0.0001	
Error	225	154.22687518	0.68545278			
Corrected Total	259	245.81355474				
	R-Square	C.V.	Root MSE	LNCPUE Mean		
	0.372586	15.12504	0.82792076	5.47384104		
Source	DF	Type I SS	Mean Square	F Value	Pr > F	
YEAR	8	56.68202811	7.08525351	10.34	0.0001	
VESSEL	26	34.90465144	1.34248659	1.96	0.0050	
Source	DF	Type III SS	Mean Square	F Value	Pr > F	
YEAR	8	49.06814043	6.13351755	8.95	0.0001	
VESSEL	26	34.90465144	1.34248659	1.96	0.0050	
Parameter	Estimate	T for H0: Parameter=0	Pr > T	Std Error of Estimate	Retransformed Estimate	
INTERCEPT	5.740523140 B	23.95	0.0001	0.23967932	426.63	
YEAR 88	-0.117081087 B	-0.37	0.7138	0.31888713	372.62	
89	-0.753931007 B	-3.12	0.0021	0.24191324	201.24	
90	-0.367371145 B	-1.42	0.1556	0.25785613	295.81	
91	-0.513202544 B	-2.02	0.0449	0.25451617	255.39	
92	-0.904171628 B	-3.63	0.0003	0.24878877	172.93	
93	-1.605962579 B	-5.90	0.0001	0.27213432	85.23	
94	-0.927333069 B	-4.04	0.0001	0.22960348	168.99	
95	0.011512726 B	0.06	0.9559	0.20782431	434.48	
96	0.000000000 B	.	.	.	426.63	

**TABLE 3. STANDARDIZATION OF CPUE - DIV. 2G - MULTIPLICATIVE, YEAR
MONTH VESSEL MODEL, 1988 - 1996**

General Linear Models Procedure
Class Level Information

Class	Levels	Values
YEAR	9	88 89 90 91 92 93 94 95 96
MONTH	10	1 2 5 7 8 9 10 11 12 99
VESSEL	27	5 12 21 29 30 32 33 34 36 37 38 39 40 42 43 44 46 47 48 57 58 66 67 68 69 70 99

Number of observations in data set = 212

Dependent Variable: LNCPUE

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	43	99.25521176	2.30826074	9.24	0.0001
Error	168	41.98869441	0.24993270		
Corrected Total	211	141.24390617			

R-Square	C.V.	Root MSE	LNCPUE Mean
0.702722	6.922011	0.49993270	7.22236214

Source	DF	Type I SS	Mean Square	F Value	Pr > F
YEAR	8	72.34769787	9.04346223	36.18	0.0001
MONTH	9	14.07653535	1.56405948	6.26	0.0001
VESSEL	26	12.83097854	0.49349917	1.97	0.0056

Source	DF	Type III SS	Mean Square	F Value	Pr > F
YEAR	8	34.63606258	4.32950782	17.32	0.0001
MONTH	9	11.92598681	1.32510965	5.30	0.0001
VESSEL	26	12.83097854	0.49349917	1.97	0.0056

Parameter	Estimate	T for H0: Parameter=0	Pr > T	Std Error of Estimate	Retransformed Estimate
INTERCEPT	7.226367526 B	33.54	0.0001	0.21543547	1523.45
YEAR 88	0.019041494 B	0.07	0.9462	0.28178183	1531.11
89	-0.701001564 B	-3.67	0.0003	0.19101071	759.50
90	-0.492742873 B	-2.56	0.0114	0.19263525	936.54
91	0.529409980 B	2.15	0.0333	0.24665443	2587.95
92	0.069492940 B	0.34	0.7336	0.20385504	1644.25
93	0.719299092 B	4.08	0.0001	0.17637187	3140.25
94	0.945566555 B	5.58	0.0001	0.16954047	3945.06
95	0.379611385 B	2.37	0.0190	0.16021435	2235.64
96	0.000000000 B	.	.	.	1523.45

TABLE 2. NORTHERN SHRIMP FISHERY DATA FOR DIV. 0B (SFA 2), 1988 - 1996.

YEAR	TAC ^[1] (t)	CATCH ^[2] (t)	UNSTANDARDIZED			STANDARDIZED		
			CPUE (KG/HR)	INDEX	EFFORT ^[3] (HR)	CPUE (KG/HR)	INDEX	EFFORT ^[3] (HR)
1988	na	2826	585	1.00	4831	372	1.00	7597
1989	3500	3039	271	0.46	11214	201	0.54	15119
1990	3500	1609	497	0.85	3237	296	0.80	5436
1991	3485	1107	242	0.41	4574	255	0.69	4341
1992	3485	1291	315	0.54	4098	173	0.47	7462
1993	3485	106	193	0.33	549	85	0.23	1247
1994	3500	476	262	0.45	1817	169	0.45	2817
1995	3500	3564	560	0.96	6369	434	1.17	8212
1996	3500	3220	512	0.88	6289	427	1.15	7541

^[1] TAC'S FOR 1989 AND 1990 ARE FOR THE FISHING SEASON MAY 1 TO APRIL 30 AND FOR THE CALENDAR YEAR, THEREAFTER, MAKING 1991 AN 8 MONTH YEAR (MAY 1 - DEC. 31)

^[2] CATCH (TONS) FOR 1988 AND 1989 AS REPORTED IN ECONOMIC ASSESSMENT OF THE NORTHERN SHRIMP FISHERY AND FROM YEAR-END QUOTA REPORTS AND/OR LOGBOOK RECORDS, THEREAFTER.

^[3] EFFORT CALCULATED FROM CATCH/CPUE. CPUE CALCULATED FROM VESSEL LOG DATA.

TABLE 4. NORTHERN SHRIMP FISHERY DATA FOR DIV. 2G (SFA 4), 1979 - 1996.

YEAR	TAC ¹ (t)	CATCH ² (t)	UNSTANDARDIZED			STANDARDIZED		
			CPUE (KG/HR)	INDEX	EFFORT ³ (HR)	CPUE (KG/HR)	INDEX	EFFORT ³ (HR)
1979	500	3	823		4			
1980	500	<1	6		8			
1981	500	2	381		5			
1982	500	5	252		20			
1983	500	30	441		68			
1986	500	2	450		4			
1987	500	7	303		23			
1988	500	1083	1823	1.00	594	1531	1.00	707
1989	2580	3842	672	0.37	5716	760	0.50	5055
1990	2580	2945	703	0.39	4190	937	0.61	3143
1991	2635	2561	3071	1.68	834	2588	1.69	990
1992	2635	2706	1910	1.05	1417	1644	1.07	1646
1993	2735	2723	2174	1.19	1253	3140	2.05	867
1994	4000	3982	3169	1.74	1257	3945	2.58	1009
1995	5200	5104	1507	0.83	3387	2236	1.46	2283
1996	5200	5160	1226	0.67	4209	1523	0.99	3388

¹ TAC'S FROM 1987 TO 1990, INCLUSIVE ARE FOR THE FISHING SEASON MAY 1 TO APRIL 30, MAKING 1986 A 16 MONTH YEAR (JAN.1, 1986 - APRIL 30, 1987) AND 1991 AN 8 MONTH YEAR (MAY 1 - DEC. 31).

² CATCH (TONS) AS REPORTED IN: LOGBOOKS FOR 1979, ECONOMIC ASSESSMENT OF THE NORTHERN SHRIMP FISHERY FROM 1980 TO 1989 AND FROM YEAR-END QUOTA REPORTS AND/OR LOGBOOKS, THEREAFTER.

³ EFFORT CALCULATED FROM CATCH/CPUE. CPUE CALCULATED FROM VESSEL LOG DATA.

TABLE. 5 STANDARDIZATION OF CPUE - HOPEDALE + CARTWRIGHT - MULTIPLICATIVE, YEAR MONTH VESSEL AREA MODEL, 1977 - 1996

		General Linear Models Procedure	
		Class Level Information	
Class	Levels	Values	
YEAR	20	77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96	
MONTH	12	1 2 3 4 5 6 8 9 10 11 12 99	
VESSEL	49	1 2 4 5 6 7 10 13 15 21 22 26 29 30 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 56 57 58 59 64 65 66 67 68 69 70 99	
AREA	4	52 53 54 99	

Number of observations in data set = 1274

Dependent Variable: LNCPUE

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	81	408.00592006	5.03711012	19.10	0.0001
Error	1192	314.30117774	0.26367548		
Corrected Total	1273	722.30709780			

R-Square	C.V.	Root MSE	LNCPUE Mean
0.564865	8.227400	0.51349341	6.24125970

Source	DF	Type I SS	Mean Square	F Value	Pr > F
YEAR	19	286.12610094	15.05926847	57.11	0.0001
MONTH	11	77.90935497	7.08266863	26.86	0.0001
VESSEL	48	35.93054385	0.74855300	2.84	0.0001
AREA	3	8.03992030	2.67997343	10.16	0.0001

Source	DF	Type III SS	Mean Square	F Value	Pr > F
YEAR	19	42.64603781	2.24452831	8.51	0.0001
MONTH	11	69.67808645	6.33437150	24.02	0.0001
VESSEL	48	36.12583317	0.75262152	2.85	0.0001
AREA	3	8.03992030	2.67997343	10.16	0.0001

Parameter	Estimate	T for H0: Parameter=0	Pr > T	Std Error of Estimate	Retransformed Estimate
INTERCEPT	6.872311975 B	61.35	0.0001	0.11202056	1094.42
YEAR 77	-0.381935114 B	-2.13	0.0337	0.17960410	741.75
78	-0.370221782 B	-1.93	0.0535	0.19157611	748.96
79	-0.566077887 B	-3.55	0.0004	0.15946194	619.34
80	-0.936633218 B	-7.05	0.0001	0.13278894	429.21
81	-0.851499587 B	-6.19	0.0001	0.13756981	467.16
82	-1.019497772 B	-7.19	0.0001	0.14177634	394.77
83	-1.325973205 B	-9.09	0.0001	0.14594235	290.26
84	-1.177434017 B	-8.11	0.0001	0.14512346	336.78
85	-1.152990745 B	-8.68	0.0001	0.13277116	345.59
86	-0.604685025 B	-4.32	0.0001	0.13982327	597.46
87	-0.667068859 B	-5.73	0.0001	0.11649473	562.49
88	-0.523398489 B	-4.49	0.0001	0.11654089	649.01
89	-0.551092374 B	-5.31	0.0001	0.10378912	631.95
90	-0.598873770 B	-5.55	0.0001	0.10784008	602.21
91	-0.508297585 B	-4.83	0.0001	0.10520084	659.36
92	-0.516775403 B	-5.53	0.0001	0.09338766	653.99
93	-0.414755855 B	-4.20	0.0001	0.09873641	724.35
94	-0.348016351 B	-3.71	0.0002	0.09379416	774.44
95	-0.177472183 B	-2.00	0.0460	0.08885345	917.08
96	0.000000000 B	.	.	.	1094.42

TABLE 6. NORTHERN SHRIMP FISHERY DATA FOR HOPEDALE + CARTWRIGHT CHANNELS (SFA 5), 1977 - 1996.

YEAR	TAC ¹ (t)	CATCH ² (t)	UNSTANDARDIZED			STANDARDIZED		
			CPUE (KG/HR)	INDEX	EFFORT ³ (HR)	CPUE (KG/HR)	INDEX	EFFORT ³ (HR)
1977	.	2686	552	1.00	4865	742	1.00	3620
1978	5300	3630	453	0.82	8011	749	1.01	4846
1979	4000	3727	368	0.67	10136	619	0.83	6021
1980	4800	4108	388	0.70	10594	429	0.58	9576
1981	4800	3449	364	0.66	9485	467	0.63	7385
1982	4800	1983	372	0.67	5335	395	0.53	5020
1983	4800	1000	297	0.54	3368	290	0.39	3448
1984	4200	1002	297	0.54	3373	337	0.45	2973
1985	3570	1689	230	0.42	7350	346	0.47	4882
1986	4400	4826	538	0.97	8970	597	0.80	8084
1987	4800	5956	613	1.11	9714	562	0.76	10598
1988	4800	7838	625	1.13	12532	649	0.87	12077
1989	6000	5985	677	1.23	8847	632	0.85	9470
1990	6000	5360	626	1.13	8559	602	0.81	8904
1991	6375	6118	526	0.95	11634	659	0.89	9284
1992	6375	6315	695	1.26	9083	654	0.88	9656
1993	6375	5719	622	1.13	9201	724	0.98	7899
1994	7650	7499	757	1.37	9911	774	1.04	9689
1995	7650	7616	1387	2.51	5493	917	1.24	8305
1996	7650	7383	1887	3.42	3913	1094	1.47	6749

¹ TAC'S FROM 1987 TO 1990, INCLUSIVE ARE FOR THE FISHING SEASON MAY 1 TO APRIL 30, MAKING 1986 A 16 MONTH YEAR (JAN.1, 1986 - APRIL 30, 1987) AND 1991 AN 8 MONTH YEAR (MAY 1 - DEC. 31).

² CATCH (TONS) IN CALENDAR YEAR AS REPORTED IN : LOG BOOKS FOR 1977, ECONOMIC ASSESSMENT OF THE NORTHERN SHRIMP FISHERY FROM 1978 TO 1989 AND YEAR-END QUOTA REPORTS, THEREAFTER.

³ EFFORT CALCULATED FROM CATCH/CPUE. CPUE CALCULATED FROM VESSEL LOG DATA.

TABLE 7. ANALYSIS FOR SHRIMP IN HOPEDALE+CARTWRIGHT (SFA 5), 1996 (ALL DATA).

STRATUM	NO.SETS	TOTAL	AV./SET	UNITS	TOTAL WGT.	VARIANCE
201	2	16.50	8.250	98214.14	810266.65	7.07
202	2	86.93	43.465	96352.26	4187950.99	3304.03
203	2	224.38	112.190	75561.27	8477219.26	1785.63
204	2	175.65	87.826	44685.11	3924525.31	19.39
220	2	0.00	0.000	35375.71	0.00	0.00
221	2	0.00	0.000	38323.68	0.00	0.00
234	2	16.95	8.475	91232.09	773191.98	138.28
237	3	0.41	0.137	85180.98	11641.40	0.06
238	3	11.24	3.747	120711.85	452292.21	42.12
239	2	167.49	83.745	18618.79	1559230.93	9.46
930	4	10.79	2.698	159501.00	430253.96	2.44
931	2	9.66	4.830	42823.23	206849.57	15.01
932	2	0.40	0.198	8533.61	1690.72	0.00
933	2	0.13	0.065	7757.83	504.26	0.01
938	2	0.00	0.000	29634.91	0.00	0.00
939	2	0.00	0.000	20170.36	0.00	0.00
940	2	0.00	0.000	15050.19	0.00	0.00
941	2	0.00	0.000	13808.94	0.00	0.00
942	2	0.00	0.000	8533.61	0.00	0.00
943	2	5.48	2.742	54925.44	150615.86	7.94
944	3	21.98	7.325	133434.69	977472.89	90.25
945	2	3.54	1.772	71527.20	126737.26	1.36
946	3	36.03	12.011	111867.92	1343626.97	161.19
947	2	21.40	10.698	35220.55	376771.86	13.29
948	2	55.66	27.830	38168.53	1062239.26	149.57
949	2	389.48	194.742	31962.26	6224401.11	437.43
950	2	214.10	107.048	40495.88	4335020.41	22726.45
951	2	56.00	28.000	36306.65	1016586.17	816.89
952	2	60.22	30.108	27462.72	826833.89	484.69
953	2	981.54	490.769	45150.58	22158491.78	399763.29
954	4	12.63	3.157	150657.08	475670.64	6.64
955	2	634.15	317.074	60355.92	19137283.82	1085.20
956	3	0.23	0.078	163069.61	12739.81	0.02
957	5	5.40	1.081	212719.72	229878.07	1.77
958	2	111.78	55.890	45616.05	2549480.81	4215.46
959	2	27.08	13.538	27617.88	373877.03	0.03
960	2	0.80	0.401	16601.76	6661.46	0.05
961	2	0.00	0.000	32738.05	0.00	0.00
962	2	0.14	0.070	37547.90	2640.09	0.01
963	2	0.00	0.000	41116.50	0.00	0.00
964	2	0.00	0.000	53063.56	0.00	0.00
991	3	15.33	5.110	141502.84	723138.45	54.50
992	5	2739.85	547.970	271368.93	148702030.55	1204023.50
993	2	100.82	50.410	68113.76	3433635.71	279.91
994	3	0.51	0.170	53839.35	9152.69	0.09

95 % CONFIDENCE INTERVALS FOR TOTAL AND MEAN WEIGHT (KG)

TOTAL	UPPER	LOWER	MEAN	UPPER	LOWER	EFFECTIVE DF	STUDENTS T-VALUE
235,090,603.83	609,489,519.57	-139,308,311.91	78.0378	202.319	-46.2431	4	2.776

RESULTS WITH SETS 51 (938 KG) AND 83 (2508 KG) DELETED

TOTAL	UPPER	LOWER	MEAN	UPPER	LOWER	EFFECTIVE DF	STUDENTS T-VALUE
81,656,189.54	112,021,741.33	51,290,637.76	27.1056	37.1854	17.0258	5	2.571

**TABLE 8. STANDARDIZATION OF CPUE - HAWKE + DIV. 3K - MULTIPLICATIVE,
YEAR MONTH VESSEL AREA MODEL, 1988 - 1996**

General Linear Models Procedure
Class Level Information

Class	Levels	Values
YEAR	9	88 89 90 91 92 93 94 95 96
MONTH	5	2 3 4 5 99
VESSEL	27	5 12 13 21 30 32 33 34 36 37 38 39 40 41 42 43 44 46 47 48 57 58 66 67 69 70 99
AREA	7	67 68 69 90 91 92 99

Number of observations in data set = 801

Dependent Variable: LNCPUE

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	44	346.95872208	7.88542550	17.77	0.0001
Error	756	335.38631384	0.44363269		
Corrected Total	800	682.34503592			

R-Square	C.V.	Root MSE	LNCPUE Mean
0.508480	10.09982	0.66605757	6.59474490

Source	DF	Type I SS	Mean Square	F Value	Pr > F
YEAR	8	247.86278921	30.98284865	69.84	0.0001
MONTH	4	23.80834864	5.95208716	13.42	0.0001
VESSEL	26	28.08143809	1.08005531	2.43	0.0001
AREA	6	47.20614614	7.86769102	17.73	0.0001

Source	DF	Type III SS	Mean Square	F Value	Pr > F
YEAR	8	84.35882032	10.54485254	23.77	0.0001
MONTH	4	22.24875603	5.56218901	12.54	0.0001
VESSEL	26	28.21051304	1.08501973	2.45	0.0001
AREA	6	47.20614614	7.86769102	17.73	0.0001

Parameter	Estimate	T for H0: Parameter=0	Pr > T	Std Error of Estimate	Retransformed Estimate
INTERCEPT	7.715026534 B	59.51	0.0001	0.12964113	2775.83
YEAR 88	-1.340667453 B	-9.41	0.0001	0.14240106	723.81
89	-1.505280523 B	-11.88	0.0001	0.12667144	614.95
90	-1.305628789 B	-9.53	0.0001	0.13695433	750.03
91	-1.188488246 B	-9.47	0.0001	0.12554825	845.04
92	-0.667296462 B	-6.05	0.0001	0.11026814	1424.82
93	-0.625392424 B	-5.64	0.0001	0.11086045	1485.79
94	-0.614386713 B	-5.95	0.0001	0.10326761	1501.78
95	-0.139115960 B	-1.33	0.1832	0.10441773	2415.39
96	0.000000000 B	.	.	.	2775.83

TABLE 9. NORTHERN SHRIMP FISHERY DATA FOR HAWKE CHANNEL + DIVISION 3K (SFA 6), 1977 - 1996.

YEAR	TAC ¹ (t)	CATCH ² (t)	UNSTANDARDIZED			STANDARDIZED		
			CPUE (KG/HR)	INDEX	EFFORT ³ (HR)	CPUE (KG/HR)	INDEX	EFFORT ³ (HR)
1977		1	177		6			
1978	1300							
1979	2250	5	189		29			
1980	1350							
1981	1350	135	207		652			
1982	1350	1	151		3			
1983	1350							
1984	1350							
1985	1350							
1986	2050							
1987	3000	1845	333		5544			
1988	3000	7849	536	1.00	14640	724	1.00	10841
1989	5600	6662	432	0.81	15407	615	0.85	10833
1990	5600	5598	507	0.95	11048	750	1.04	7464
1991	4301	5500	603	1.12	9120	845	1.17	6509
1992	7565	6609	774	1.44	8538	1425	1.97	4638
1993	9180	8035	891	1.66	9021	1486	2.05	5407
1994	11050	10978	1287	2.40	8533	1502	2.07	7309
1995	11050	10914	1836	3.42	5944	2415	3.34	4519
1996	11050	10923	2020	3.77	5406	2776	3.83	3935

1 HISTORICAL TAC'S APPLIED AS FOLLOWS:

1978 TO 1985 - INCLUDES 500 TON EXPLORATORY TAC FOR DIVISION 3K;

1986 TO 1988 - HAWKE CHANNEL + ST. ANTHONY BASIN;

1989 TO 1991 - HAWKE CHANNEL, ST. ANTHONY BASIN, EAST ST. ANTHONY AND FUNK ISLAND DEEP;

1992 - INCLUDES 1700 TONS EXPLORATORY;

1993 - INCLUDES 3400 TONS EXPLORATORY;

1994 to 1996 - ALL AREAS COMBINED.

TAC'S FROM 1987 TO 1990, INCLUSIVE, ARE FOR THE FISHING SEASON MAY 1 TO APRIL 30, MAKING 1986 A 16 MONTH YEAR (JAN.1, 1986 - APRIL 30, 1987) AND 1991 AN 8 MONTH YEAR (MAY 1 - DEC. 31).

2 CATCH (TONS) IN CALENDAR YEAR AS REPORTED IN: LOG BOOKS FOR 1977, ECONOMIC ASSESSMENT OF THE NORTHERN SHRIMP FISHERY FROM 1978 TO 1989 AND YEAR-END QUOTA REPORTS, THEREAFTER.**3 EFFORT CALCULATED FROM CATCH/CPUE. CPUE CALCULATED FROM VESSEL LOG DATA.**

TABLE 10. ANALYSIS FOR SHRIMP IN HAWKE+3K (SFA 6), 1995 (ALL DATA).

STRATUM	NO.SETS	TOTAL	AV./SET	UNITS	TOTAL WGT.	VARIANCE
206	5	152.179	30.436	256939.36	7820174.27	4112.95
207	9	17.399	1.933	379823.40	734298.87	29.81
208	2	460.860	230.430	91232.09	21022610.93	98.56
209	2	117.100	58.550	96507.42	5650509.26	5694.58
210	3	332.193	110.731	160587.10	17781962.58	2618.58
211	2	383.620	191.810	38944.31	7469908.36	6732.64
212	2	76.746	38.373	86422.24	3316271.39	1259.31
213	8	980.569	122.571	384322.94	47106883.70	35195.27
222	2	182.980	91.490	86732.55	7935160.99	11464.01
223	2	12.962	6.481	32738.05	212173.23	25.08
224	4	10.444	2.611	49805.27	130038.46	26.24
227	2	145.803	72.902	92783.66	6764073.65	989.99
228	7	429.882	61.412	340723.93	20924434.86	1516.63
229	2	414.628	207.314	83163.95	17241029.86	52018.44
230	2	0.000	0.000	28703.97	0.00	0.00
231	2	0.110	0.055	28859.13	1587.25	0.01
235	2	185.908	92.954	64234.84	5970869.28	2246.68
236	4	0.000	0.000	39409.78	0.00	0.00
240	2	7.595	3.798	20635.83	78364.57	0.31
617	2	152.390	76.195	92007.87	7010540.03	449.10
618	5	13.809	2.762	208995.97	577187.14	23.90
619	4	0.067	0.017	271989.55	4533.16	0.00
620	3	46.254	15.418	394873.59	6088099.15	74.46
621	6	31.978	5.330	393632.34	2097958.83	28.25
622	3	301.668	100.556	107213.22	10780923.80	1411.74
623	2	44.360	22.180	76647.37	1700038.66	637.25
624	4	139.860	34.965	171448.06	5994681.55	237.95
625	3	210.405	70.135	137779.08	9663140.13	1255.13
626	4	19.306	4.827	172689.32	833489.43	31.77
627	5	184.352	36.870	194721.56	7179448.82	1535.64
628	5	107.109	21.422	168344.93	3606245.51	1509.46
629	2	26.233	13.116	76802.53	1007378.08	58.03
630	2	37.892	18.946	51512.00	975948.77	1.18
631	5	228.722	45.744	204961.89	9375852.21	237.63
633	8	687.334	85.917	320708.73	27554256.20	2839.07
634	7	193.271	27.610	241268.54	6661445.99	538.05
635	6	71.525	11.921	197669.53	2356385.55	6.79
636	7	188.768	26.967	225752.88	6087829.55	285.55
637	5	70.641	14.128	175637.29	2481425.62	271.60
638	9	422.133	46.904	319467.48	14984210.88	1744.71
639	7	318.208	45.458	226994.13	10318778.95	580.17
640	2	53.740	26.870	10705.81	287665.03	95.22
641	2	0.000	0.000	35686.02	0.00	0.00
642	2	0.000	0.000	64855.47	0.00	0.00
643	3	0.000	0.000	113729.80	0.00	0.00
644	2	0.000	0.000	73544.24	0.00	0.00
645	2	5.486	2.743	33513.83	91922.15	11.74
646	2	0.100	0.050	50425.90	2521.30	0.01
647	2	0.000	0.000	55856.38	0.00	0.00
650	2	7.530	3.765	20790.99	78278.07	28.35
651	2	0.16	0.08	55701.23	4456.10	0.01
652	2	0.00	0.00	80060.82	0.00	0.00
653	2	0.00	0.00	82388.16	0.00	0.00
654	2	0.00	0.00	74320.02	0.00	0.00

95 % CONFIDENCE INTERVALS FOR TOTAL AND MEAN WEIGHT (KG)

95 % CONFIDENCE INTERVALS FOR TOTAL AND MEAN WEIGHT (KG)						EFFECTIVE DF	STUDENTS T-VALUE
TOTAL	UPPER	LOWER	MEAN	UPPER	LOWER		
307,964,992.14	380,768,092.35	235,161,891.93	40.8157	50.4645	31.1668	13	2.16
143,198,827.06	MALES ONLY						
194,766,165.08	FEMALES AND TRANSITIONALS						
172,142,307.57	DEPTHS BETWEEN 300 AND 500 m.						

TABLE 11. ANALYSIS FOR SHRIMP IN HAWKE+3K (SFA 6), 1996 (ALL DATA).

STRATUM	NO. SETS	TOTAL	AV. /SET	UNITS	TOTAL WGT.	VARIANCE
205	4	36.74	9.185	139020.33	1276901.74	52.92
206	6	29.67	4.944	256939.36	1270351.02	62.75
207	9	14.74	1.638	379823.40	622066.33	3.03
208	2	292.54	146.270	91232.09	13344518.08	1583.72
209	3	477.32	159.105	96507.42	15354812.57	42327.47
210	4	881.93	220.483	160587.10	35406770.84	25280.69
211	2	591.71	295.853	38944.31	11521796.21	52490.03
212	2	15.20	7.600	86422.24	656809.00	20.22
213	10	994.32	99.432	384322.94	38213999.05	15505.60
222	3	215.77	71.923	86732.55	6238094.10	1750.22
223	3	67.18	22.393	32738.05	733093.53	591.44
224	3	0.00	0.000	49805.27	0.00	0.00
225	2	0.00	0.000	41892.29	0.00	0.00
226	2	0.00	0.000	44064.48	0.00	0.00
227	2	130.38	65.190	92783.66	6048566.67	147.58
228	8	3091.22	386.402	340723.93	131656420.55	143309.86
229	2	468.47	234.234	83163.95	19479855.31	88396.98
230	2	0.00	0.000	28703.97	0.00	0.00
231	2	0.11	0.055	28859.13	1587.25	0.01
232	2	0.01	0.005	35375.71	176.88	0.00
233	2	0.00	0.000	36772.12	0.00	0.00
235	2	71.65	35.825	64234.84	2301213.15	2154.96
236	4	0.10	0.025	39409.78	985.24	0.00
240	2	4.52	2.260	20635.83	46636.98	9.42
608	3	0.22	0.073	123814.98	9079.77	0.01
609	2	0.82	0.410	53063.56	21756.06	0.27
610	2	24.81	12.405	39720.09	492727.77	23.19
611	3	0.82	0.273	93093.97	25445.69	0.12
612	2	0.35	0.175	69044.70	12082.82	0.06
613	2	0.00	0.000	4654.70	0.00	0.00
614	2	0.04	0.020	40806.19	816.12	0.00
615	2	0.81	0.405	38944.31	15772.45	0.19
616	2	0.05	0.025	38789.15	969.73	0.00
617	3	383.61	127.871	92007.87	11765161.98	167.93
618	6	2.57	0.428	208995.97	89519.94	0.12
619	7	1.01	0.144	271989.55	39244.21	0.04
620	11	404.81	36.801	394873.59	14531639.96	1053.94
621	11	308.13	28.012	393632.34	11026357.59	576.69
622	3	253.08	84.360	107213.22	9044507.54	5271.48
623	2	100.78	50.390	76647.37	3862260.96	192.08
624	5	653.03	130.607	171448.06	22392251.33	8259.83
625	4	492.82	123.205	137779.08	16975071.24	1371.67
626	5	97.17	19.434	172689.32	3356044.18	415.39
627	5	239.23	47.845	194721.56	9316452.88	1594.07
628	5	87.72	17.544	168344.93	2953443.48	169.77
629	2	115.92	57.960	76802.53	4451474.43	1207.37
630	2	85.85	42.925	51512.00	2211152.49	1316.36
631	6	383.22	63.870	204961.89	13090916.14	857.23
633	9	1461.22	162.358	320708.73	52069556.90	8497.02
634	7	695.12	99.303	241268.54	23958655.59	3029.56
635	5	129.66	25.932	197669.53	5125966.31	35.31
636	6	354.37	59.062	225752.88	13333341.37	2619.20
637	5	129.32	25.864	175637.29	4542682.93	104.19
638	9	827.95	91.994	319467.48	29389177.12	1231.24
639	6	1055.30	175.883	226994.13	39924374.47	3291.29
640	2	52.90	26.450	10705.81	283168.59	1245.01
641	2	2.61	1.305	35686.02	46570.26	0.02
642	2	1.75	0.875	64855.47	56748.53	1.53
643	3	0.00	0.000	113729.80	0.00	0.00
644	2	0.00	0.000	73544.24	0.00	0.00
645	2	1.84	0.920	33513.83	30832.72	1.69
646	2	0.02	0.010	50425.90	504.26	0.00
647	2	0.02	0.010	55856.38	558.56	0.00
648	2	0.00	0.000	35375.71	0.00	0.00
649	2	0.00	0.000	32893.20	0.00	0.00
650	2	118.44	59.220	20790.99	1231242.25	34.44
652	2	0.00	0.000	80060.82	0.00	0.00
653	2	0.00	0.000	82388.16	0.00	0.00
654	2	0.00	0.000	74320.02	0.00	0.00

95 % CONFIDENCE INTERVALS FOR TOTAL AND MEAN WEIGHT (KG)

95 % CONFIDENCE INTERVALS FOR TOTAL AND MEAN WEIGHT (KG)						EFFECTIVE	STUDENTS
TOTAL	UPPER	LOWER	MEAN	UPPER	LOWER	DF	T-VALUE
579,852,183.09	702,695,882.79	457,008,483.40	69.3861	84.0858	54.6864	14	2.145
343,961,062.12	MALES ONLY						
235,891,120.97	FEMALES AND TRANSITIONALS						
253,142,194.08	DEPTHS BETWEEN 300 AND 500 m.						

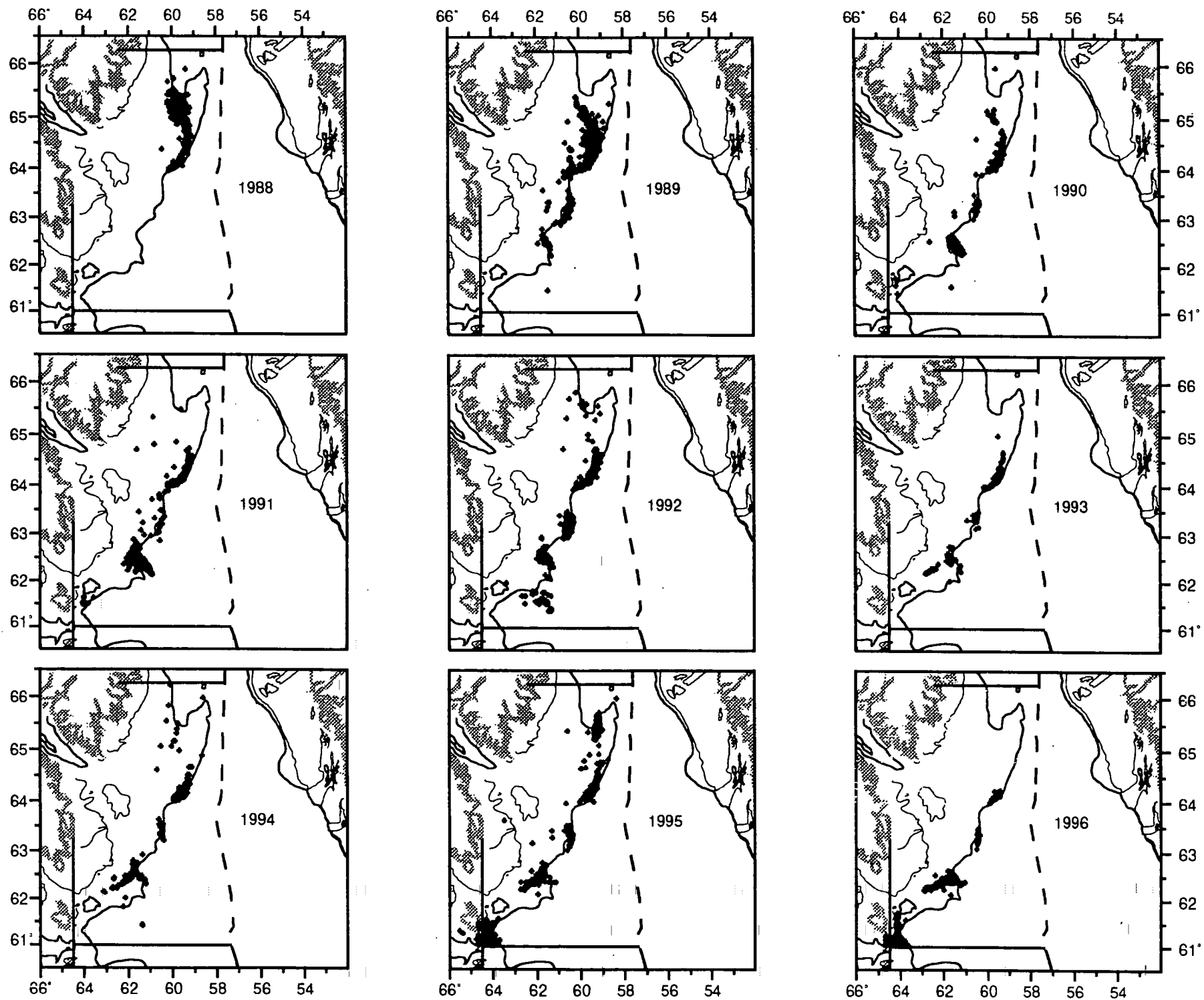
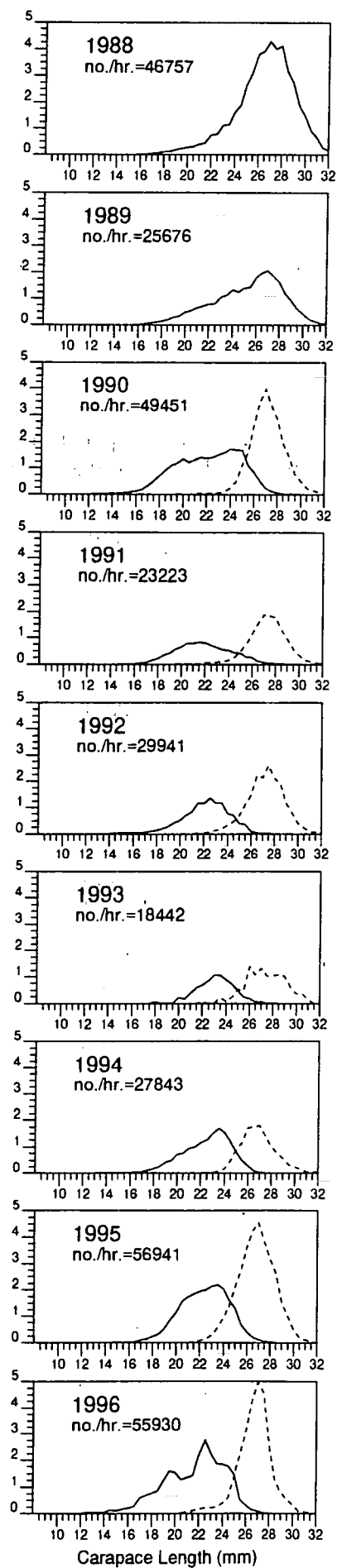


Figure 1. Distribution of fishing effort in Division 0B (SFA 2), 1988 - 1996.

Figure 2. Catch ...numbers-per-hour..000s in NAFO Division 0B (SFA 2), 1988-96.
Single-line graphs represent unsexed samples, broken line=females.



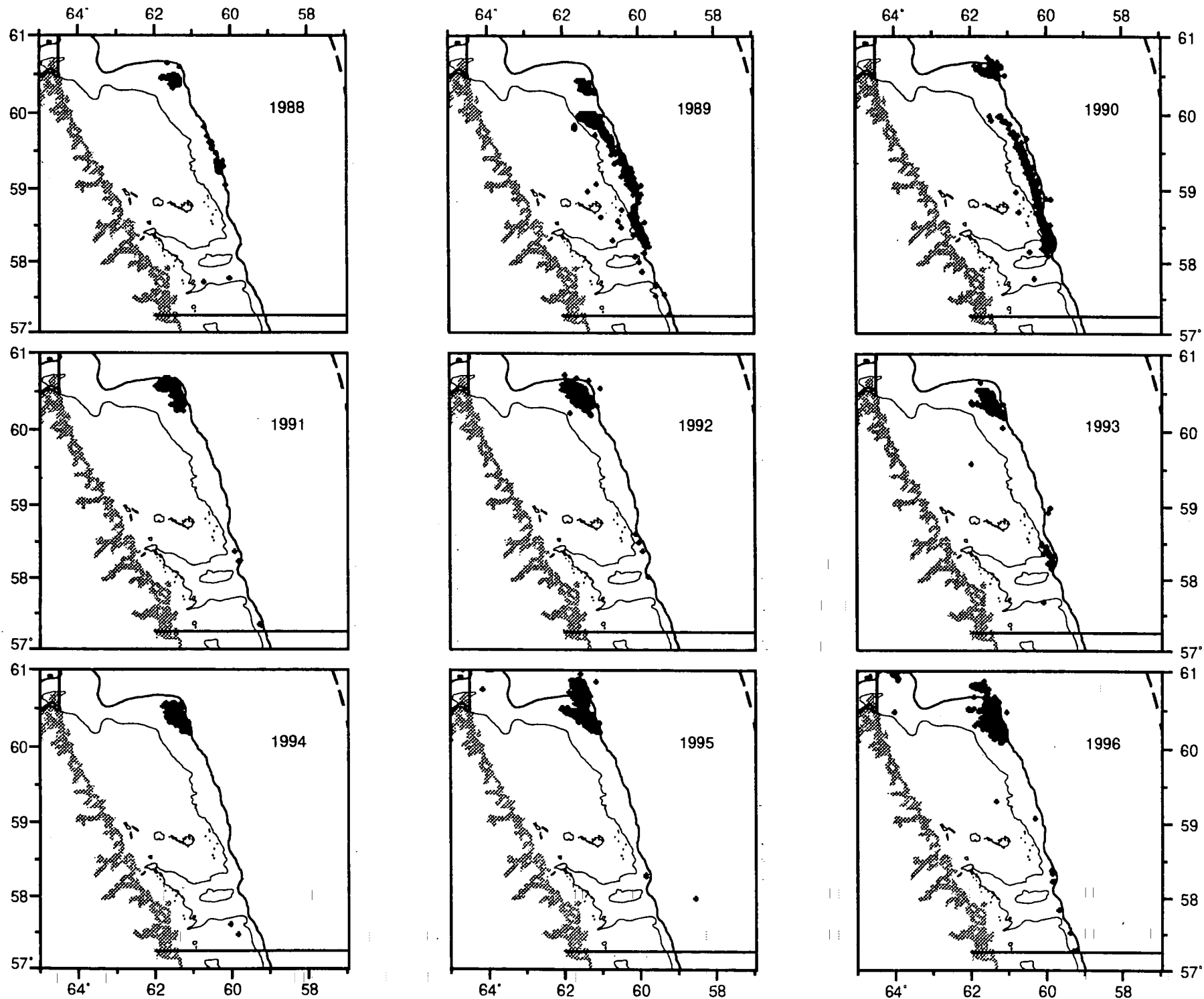


Figure 3. Distribution of fishing effort in Division 2G (SFA 4), 1988 - 1996.

Figure 4. Catch ...numbers-per-hour...000s in NAFO Division 2G (SFA 4), 1988-96.
Single-line graphs represent unsexed samples, broken line=females.

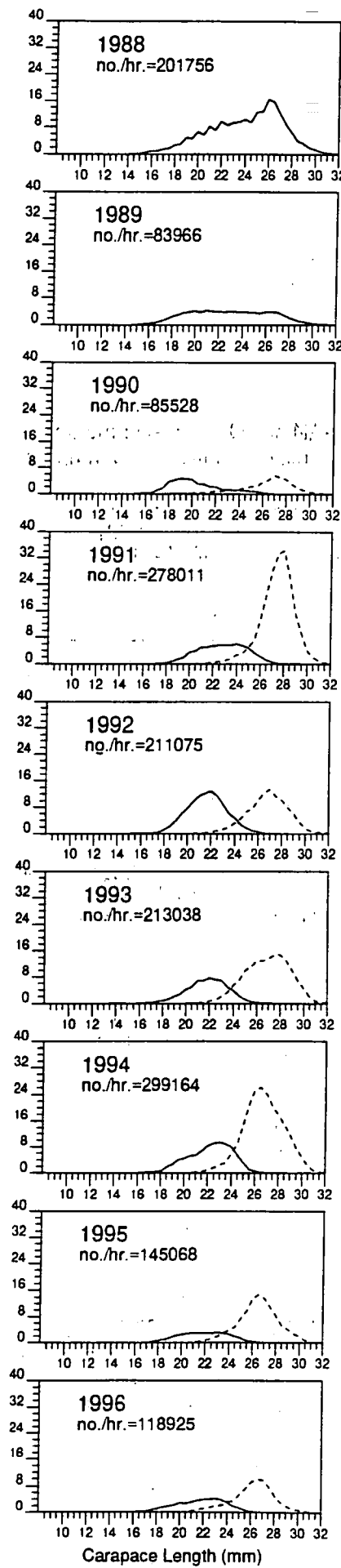
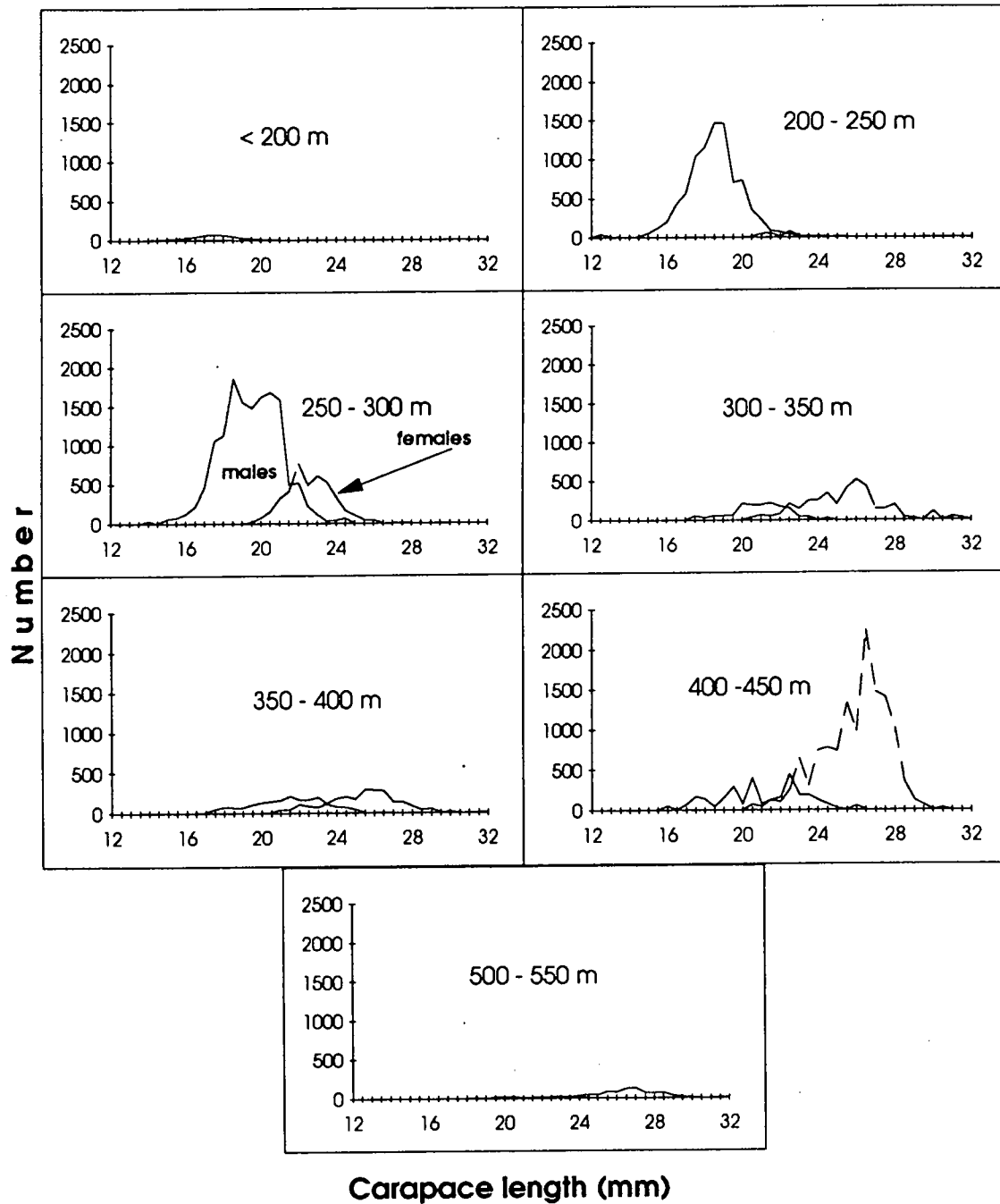


Figure 5. Length distributions for male and female shrimp by depth interval (number per standard tow) - 1996 research survey - Division 2G (SFA 4).



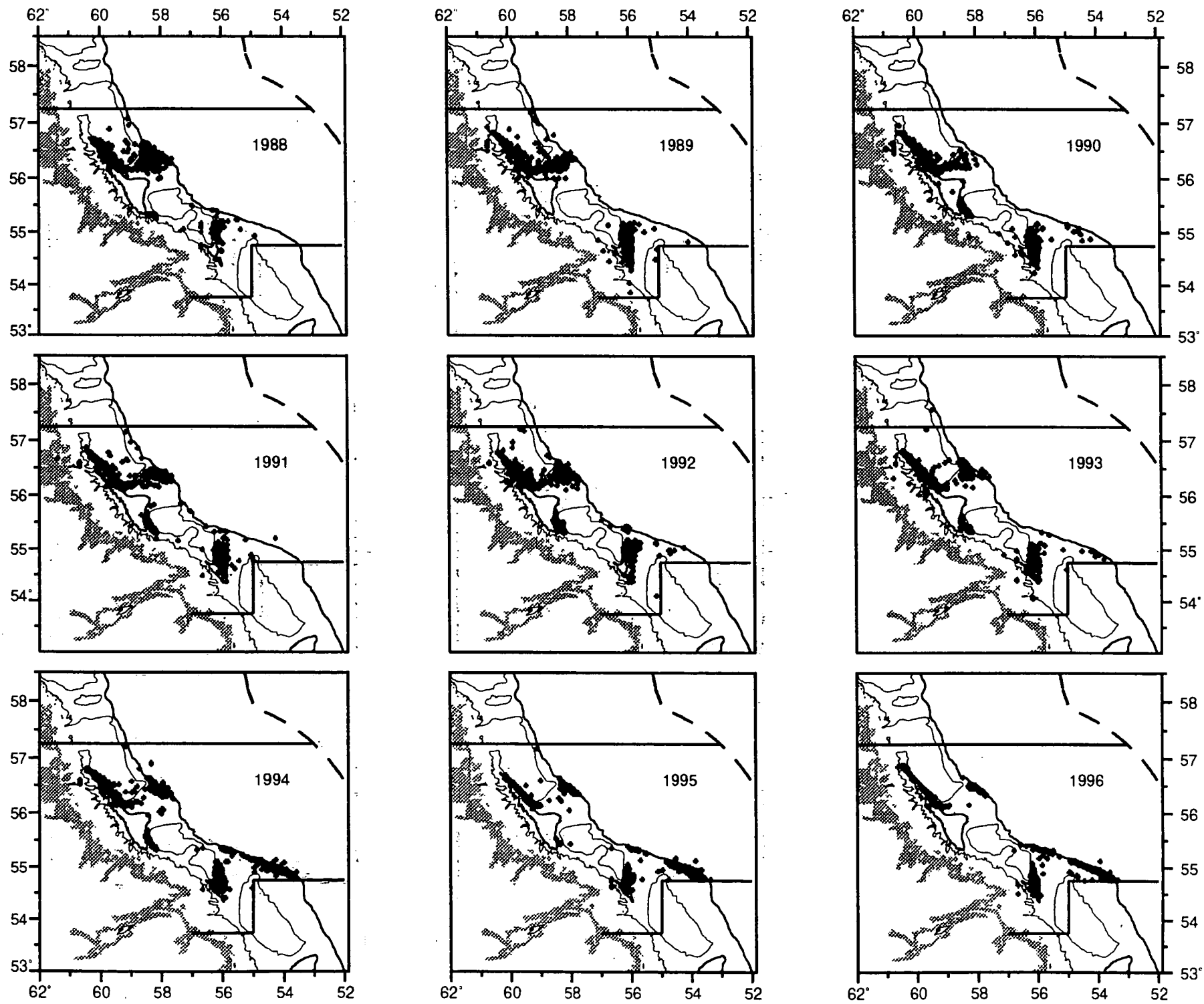


Figure 6. Distribution of fishing effort in Hopedale + Cartwright (SFA 5), 1988 - 1996.

Figure 7. Catch ...numbers-per-hour..000s in NAFO Divisions 2H-2J (SFA 5), 1988-96.
Single-line graphs represent unsexed samples, broken line=females.

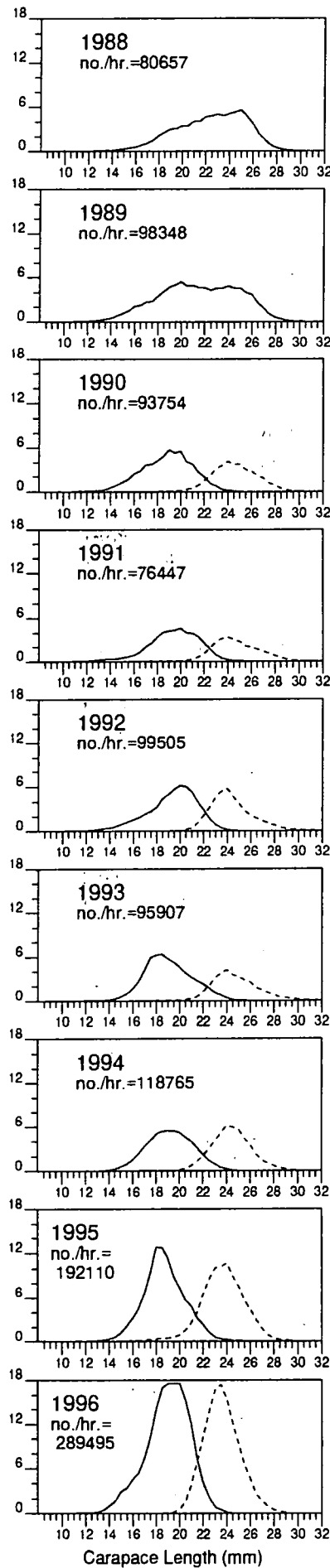


Figure 8. Length distributions for male and female shrimp by depth interval (numbers per standard tow) - 1996 research survey - Hopedale + Cartwright (SFA 5).

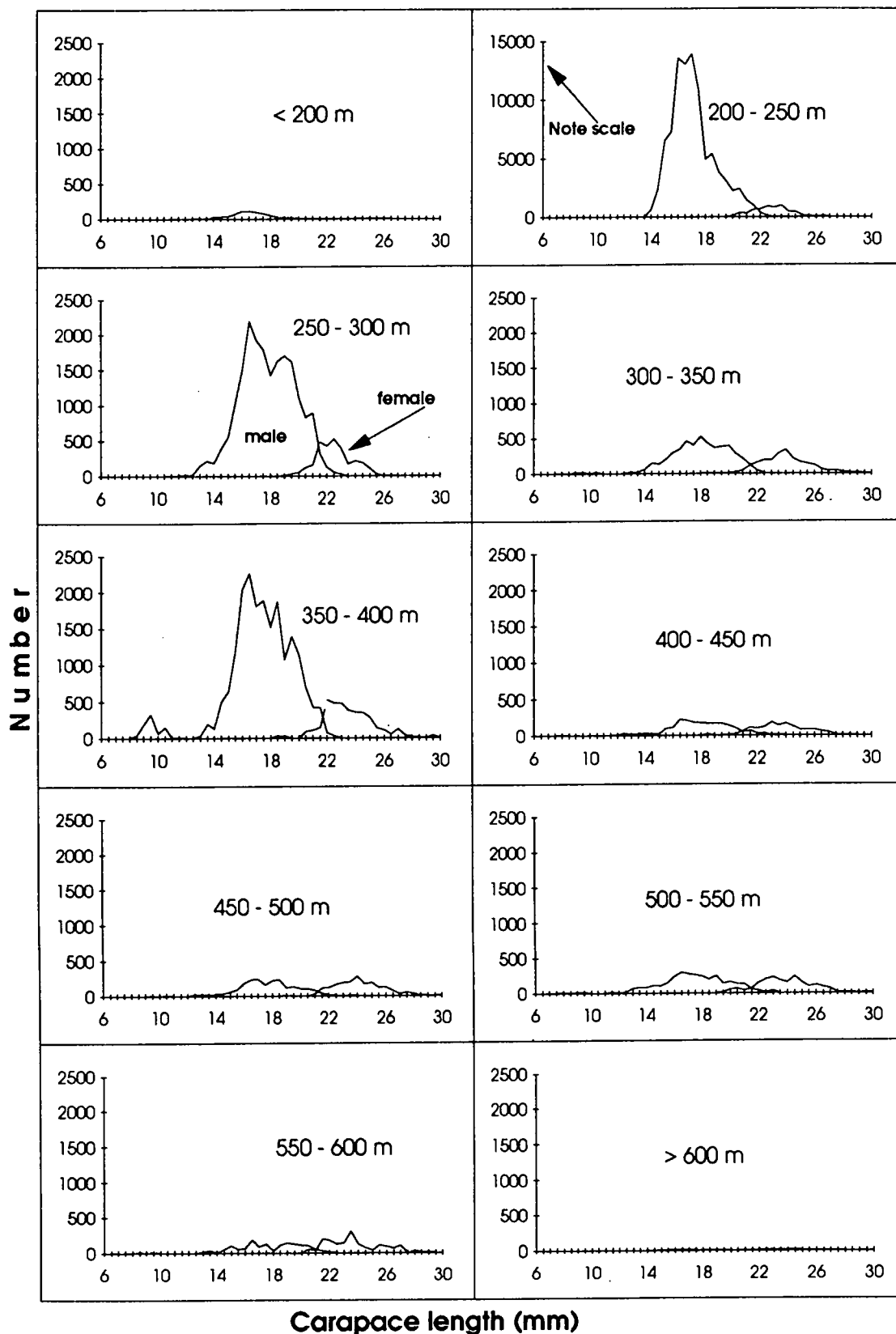
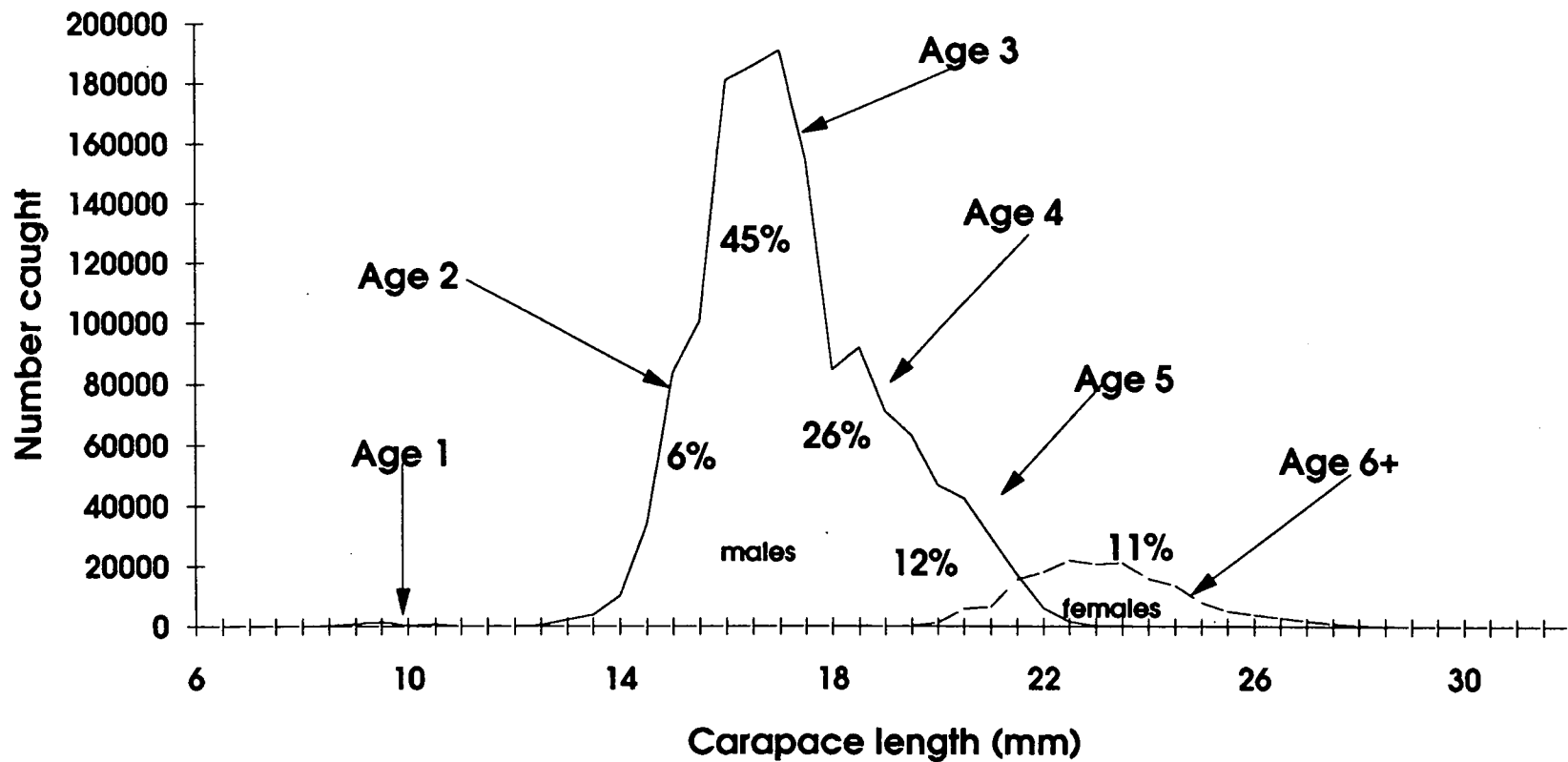


Figure 9. Estimation of age composition of shrimp caught during the 1996 research trawl survey in Hopedale + Cartwright (SFA 5).



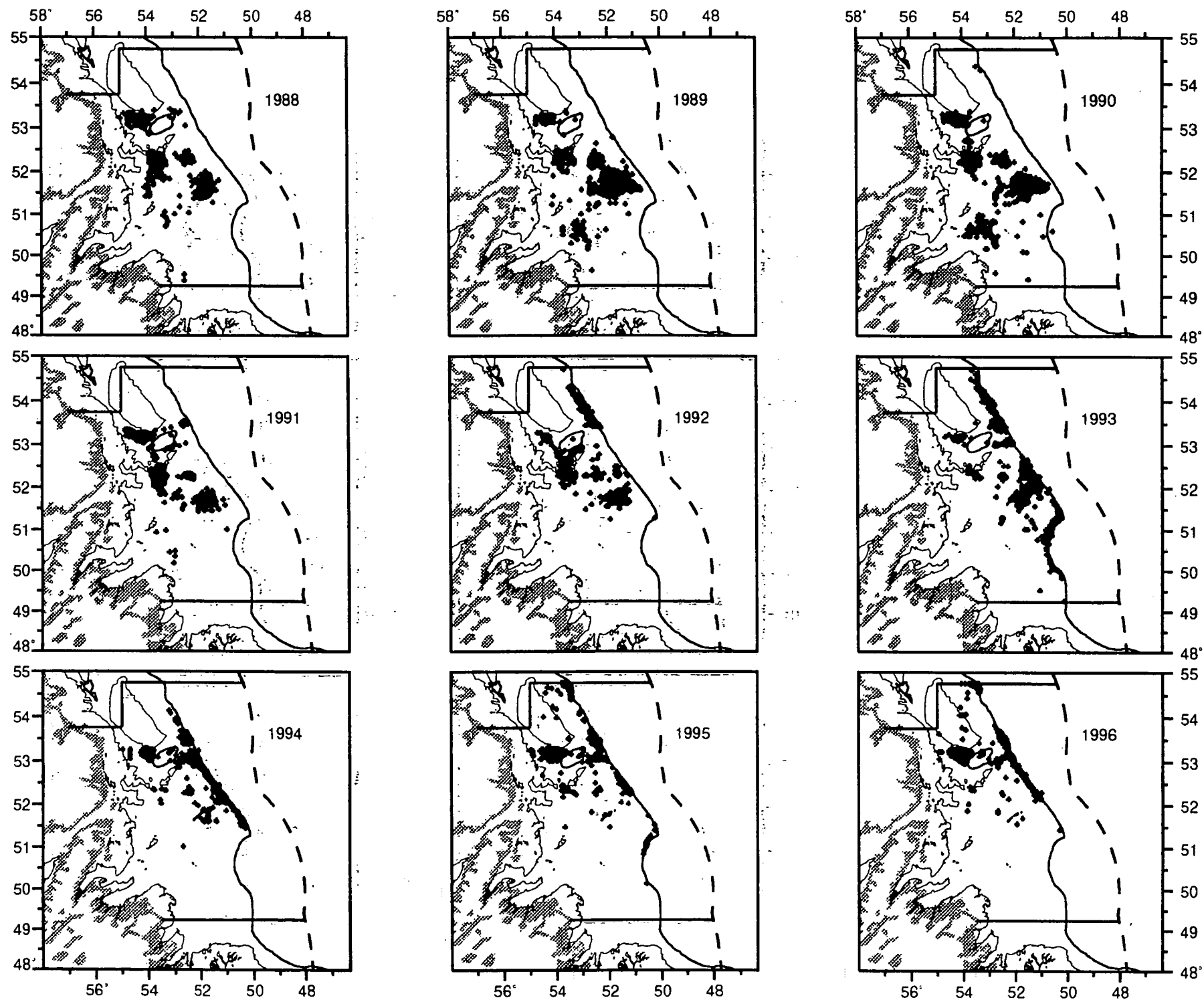
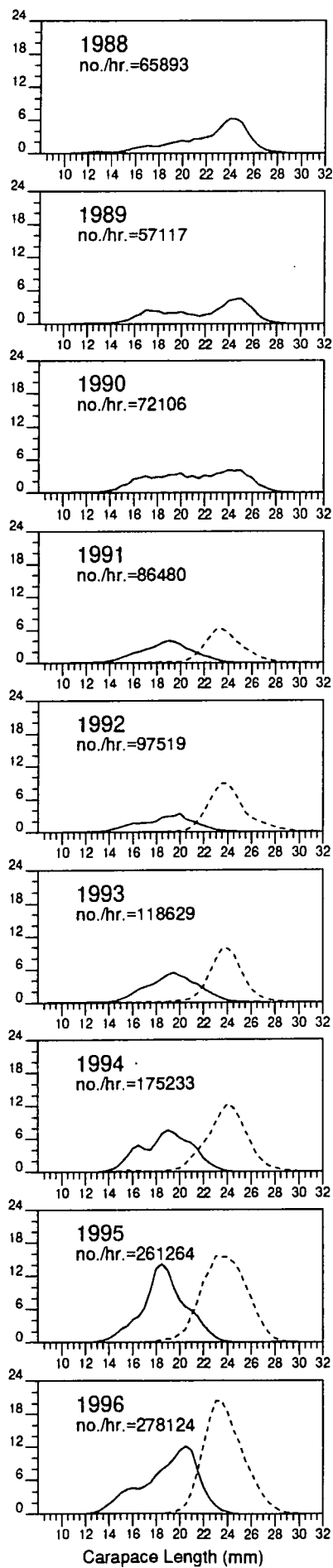


Figure 10. Distribution of fishing effort in Hawke + Division 3K (SFA 6), 1988 - 1996.

Figure 11. Catch ...numbers-per-hour...000s in NAFO Divisions 2J-3K (SFA 6), 1988-96.
Single-line graphs represent unsexed samples, broken line=females.



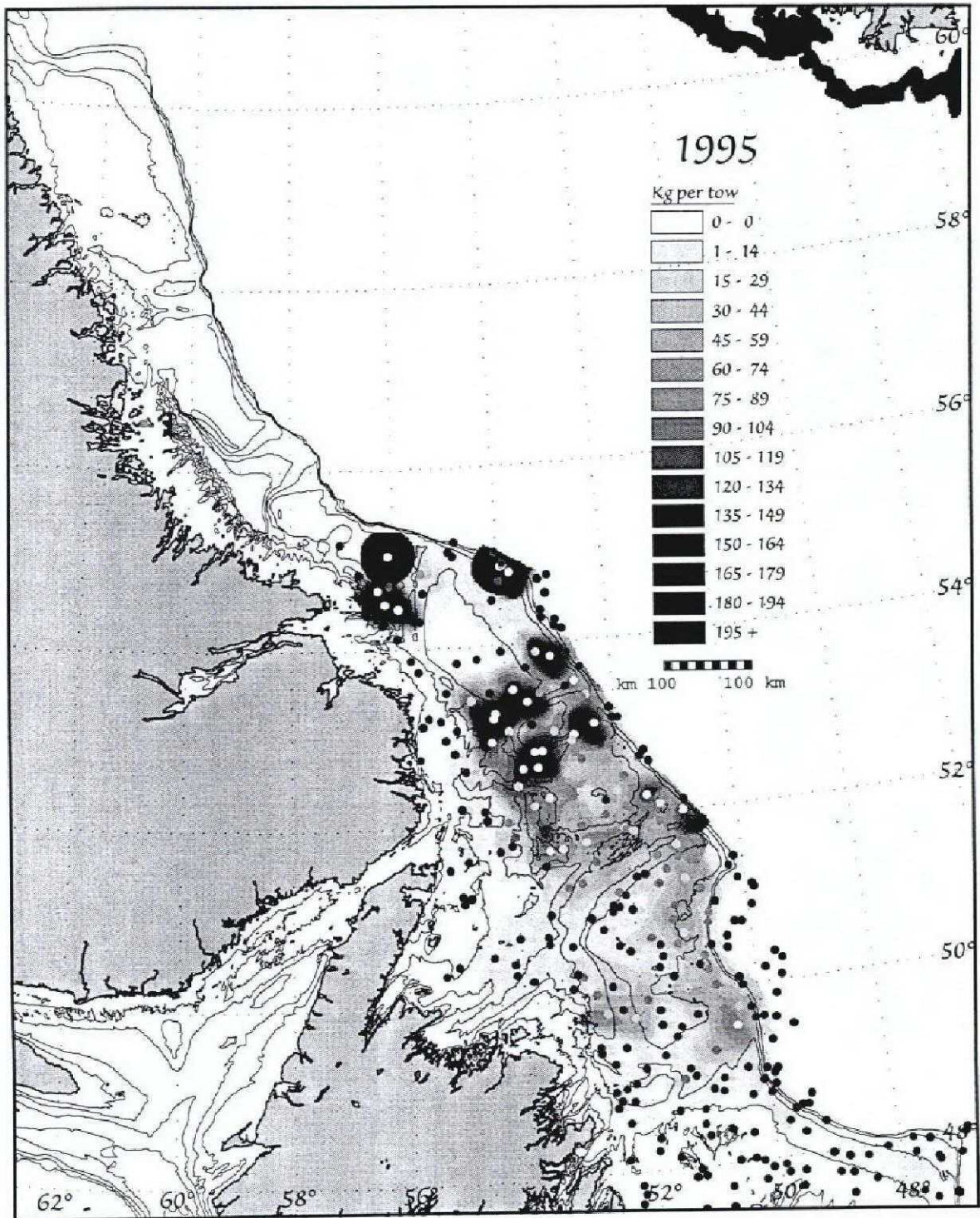


Figure 12. Research trawl survey stations and estimates of shrimp density (SPANS) - fall 1995.

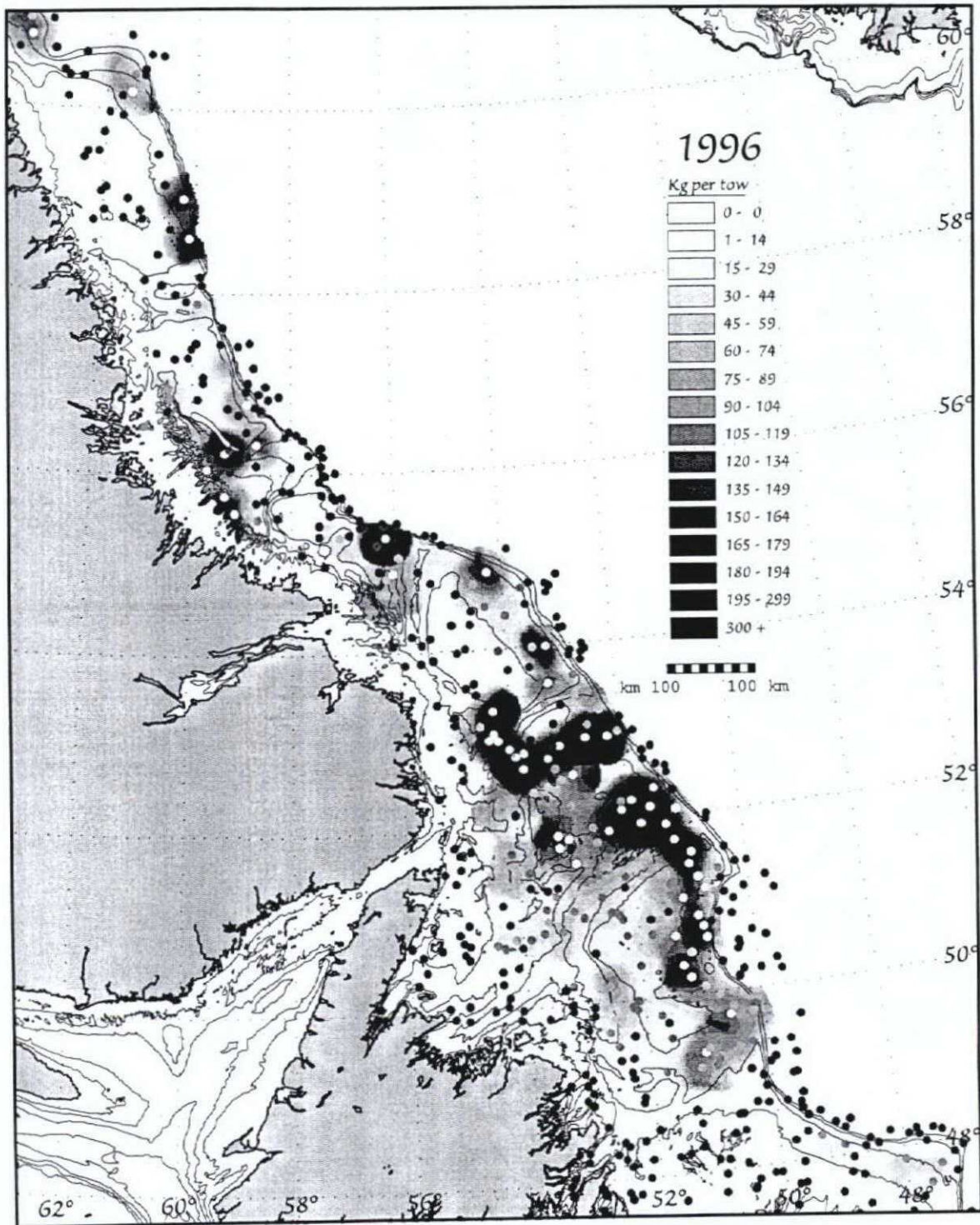


Figure 13. Research trawl survey stations and estimates of shrimp density (SPANS) - fall 1996.

Figure 14. Length distributions for male and female shrimp by depth interval (numbers per standard tow) - 1995 research survey - Hawke + 3K (SFA 6).

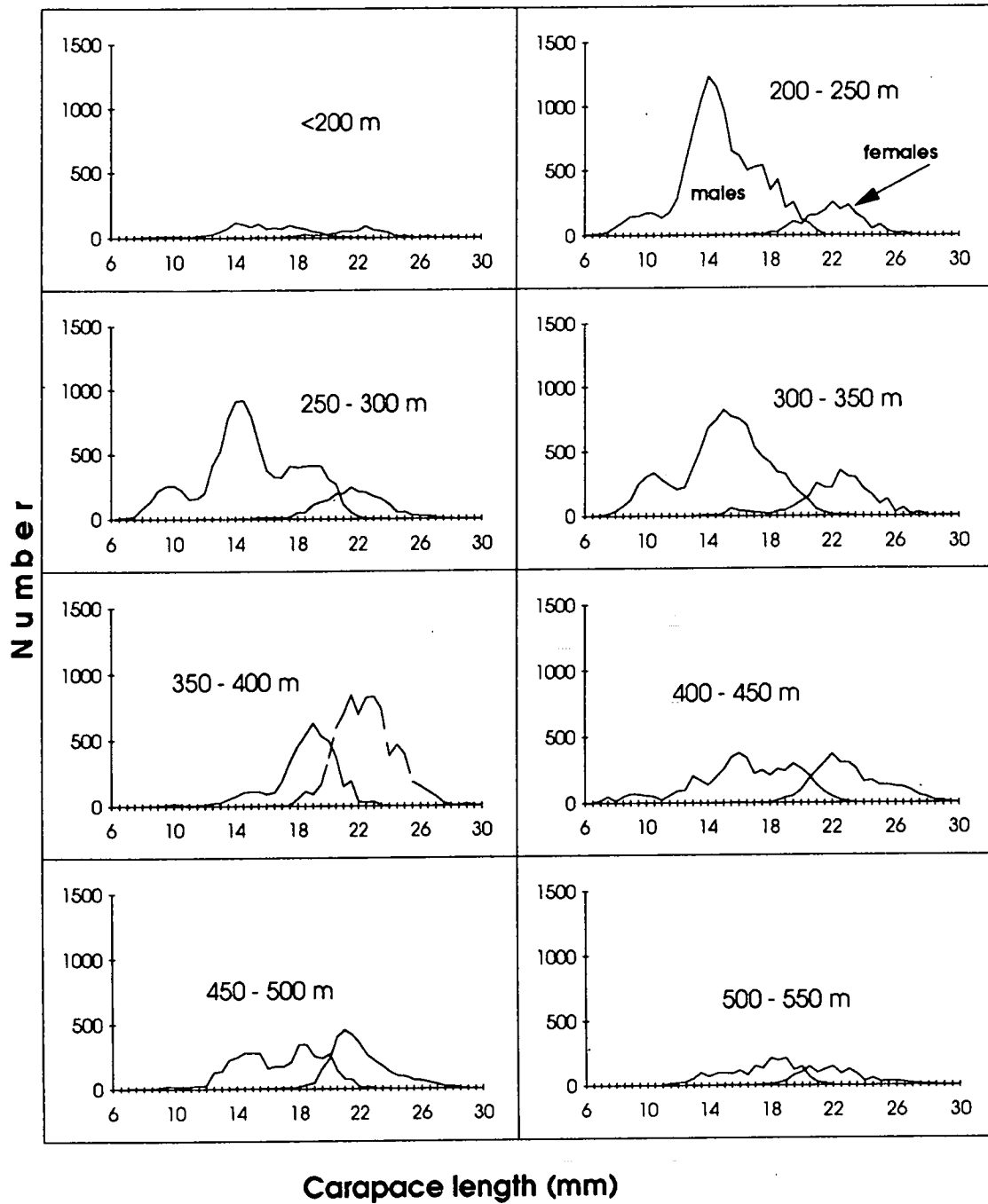


Figure 15. Estimation of age composition of shrimp caught during the 1995 research trawl survey in Hawke + 3K (SFA 6).

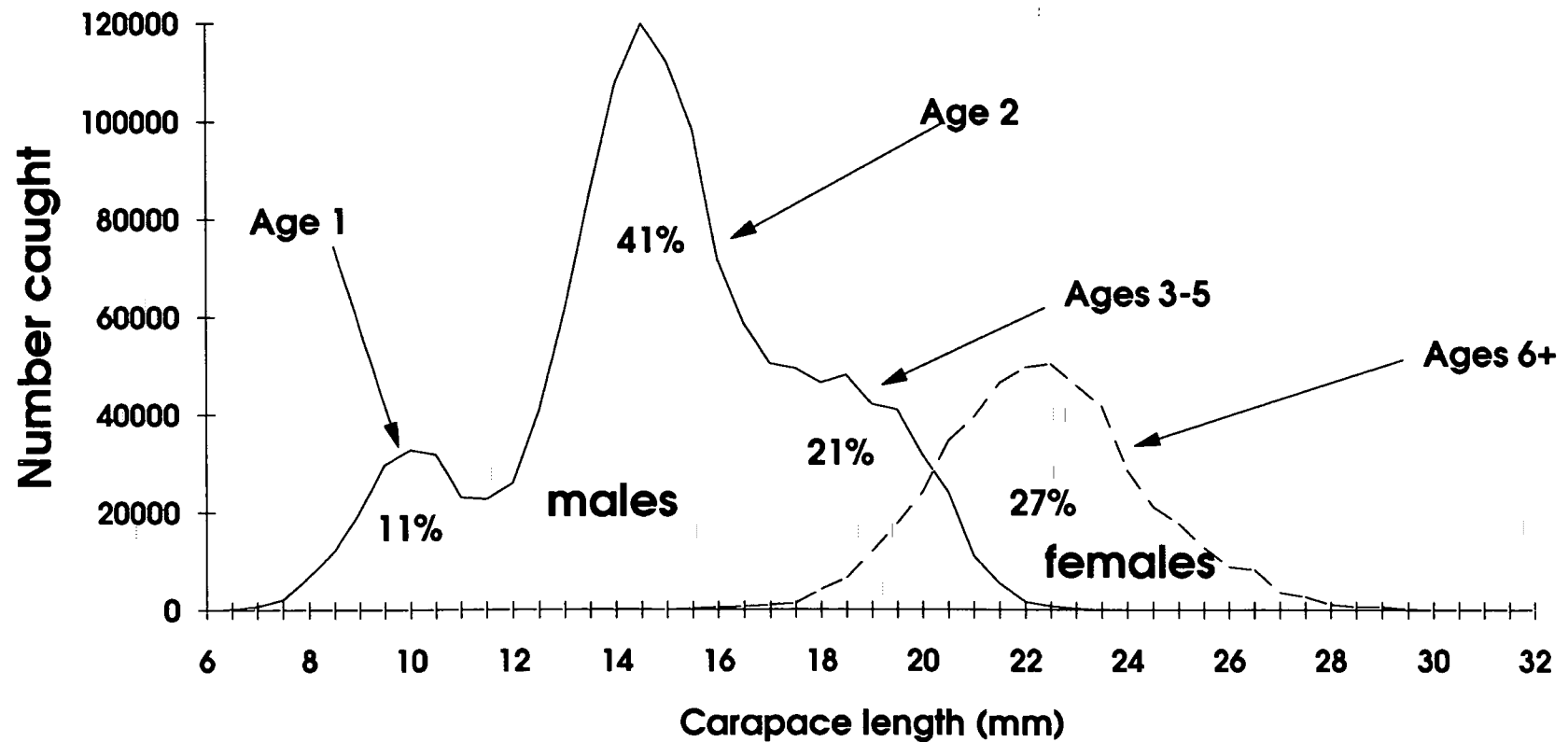


Figure 16. Length distributions for male and female shrimp by depth interval (numbers per standard tow) - 1996 research survey - Hawke + 3K (SFA 6).

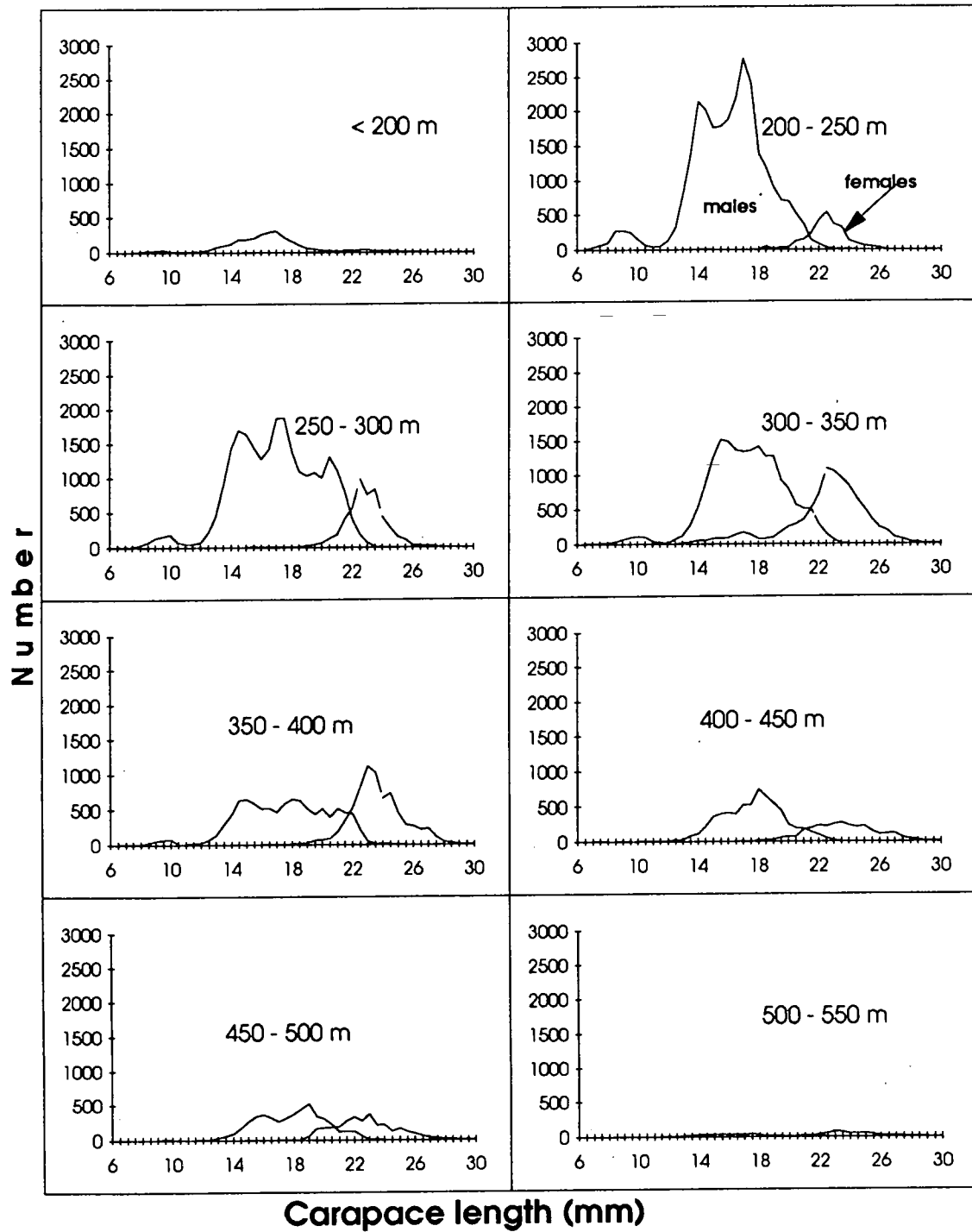


Figure 17. Estimation of age composition of shrimp caught during the 1996 research trawl survey in Hawke + 3K (SFA 6).

