4-2 Fish Landing Site Survey

4-2-1 Collection of Fisheries Statistics

21 sets of fisheries statistics from 1970-1990 published by the Prime Ministry State Institute of Statistics, Turkey were collected by the Turkish Ministry of Agriculture and Rural Affairs.

4-2-2 Fisheries Interview Survey and Length Composition Survey

A summary of surveys conducted by staff members of each of the regional offices of the Ministry of Agriculture and Rural Affairs are indicated in Table 4-8.

Table 4-8 Summary of Conditions for Carrying Out Landing Site Survey

Season / Item / Prefecture	Summer		Winter		Spring		Autumn	
	Inter-views	Size comp.	Inter-views	Size comp.	Inter-views	Size comp.	Inter-views	Size comp.
ISTANBUL	×	×	○	×	×	×	○	○
CANAKKALE	○	○	○	○	○	○	○	○
MUGLA	○	○	×	×	○	○	○	○
ANTALYA	○	○	○	○	○	○	○	○
MERSIN	○	○	×	○	×	○	×	○

O: Data was able to be recorded.
X: Data was unable to be recorded.

Chapter 5 Results

5-1 Sea-Borne Survey

5-1-1 Species Composition of Catches

Chapter 5 Results

5-1 Sea-Borne Survey

5-1-1 Species Composition of Catches

The following provides a description of the species composition of large demersal animals (including fishes and major invertebrates, shrimps, squids and octopuses species in particular) caught by trawling, concentrating primarily on fishes. Species composition is described in the form of summaries according to season, sub area and water depth zone.

(1) Species Composition of Catches in All Areas Surveyed

1) Fishes

Although there were roughly 60 families throughout all seasons, the number of species was highest in summer at 171 species, and somewhat less at a range of 130-150 species in other seasons. In addition, there were numerous families and species present at depths of 100 m or less, and this number decreased as depth increased. It should be noticed here that the number of species corresponds to a certain extent to the number of trawls. The number of species per haul was 15-19 species throughout all seasons, and there were no large differences in this number. In addition, the number of species of sea breams *Sparidae* was the highest throughout all seasons, while large numbers of rays *Rajidae* and cod fishes *Gadidae* were also observed. Other species also observed in large numbers depending on the season included sea basses *Serranidae*, horse mackerels *Carangidae*, wrasses *Labridae*, gurnards *Triglidae*, lefteye flounders *Bothidae* and soles *Soleidae*. The species that demonstrated the highest appearance frequency (No. caught / No. of trawls x 100%) throughout all seasons was hake *Merluccius merluccius* (appearance frequency: approx. 70-90%). The appearance frequencies of red mullet *Mullus barbatus* (appearance frequency: approx. 60-65%) and smallspotted catshark *Scyliorhinus canicula* (appearance frequency: approx. 50-60%) were also high throughout all seasons. The appearance frequencies of large-scaled gurnard *Lepidotrigla cavillone* and Atlantic horse-mackerel *Trachurus trachurus* were also high (Table 5-1-1-1).

Table 5-1-1-1 Number of Families and Species of Fishes by Season and Strata in All Areas Surveyed

Season	Spring			Summer			Autumn			Winter		
Stratum (m)	20~100m	101~200m	201~500m	20~100m	101~200m	201~500m	20~100m	101~200m	201~500m	20~100m	101~200m	201~500m
No. of families	49	38	34	56	38	32	48	38	37	48	40	32
	56			65			59			59		
No. of species	123	74	66	138	77	63	108	80	66	99	71	58
	148			171			143			134		
No. of species per haul	14	16	16	19	19	18	16	16	15	17	16	14
	15			19			16			16		
Families included many species (No. of species)	Sparidae (11) Labridae (8) Rajidae (7) Gadidae (7) Serranidae (7) Gobiidae (7)			Sparidae (13) Rajidae (10) Carangidae (8) Soleidae (8) Gadidae (7) Labridae (7) Callionymidae (7)			Sparidae (11) Rajidae (9) Gadidae (8) Serranidae (6) Triglidae (6) Bothidae (6)			Sparidae (13) Rajidae (8) Gadidae (6) Triglidae (6) Bothidae (5)		
High rank species of appearance frequency (%)	*Merluccius merluccius* (81) *Mullus barbatus* (63) *Lepidotrigla cavillone* (52) *Scyliorhinus canicula* (51)			*M. merluccius* (72) *Trachurus trachurus* (66) *M. barbatus* (61) *S. canicula* (59) *L. cavillone* (55)			*M. merluccius* (91) *T. trachurus* (70) *M. barbatus* (65) *L. cavillone* (63) *S. canicula* (56) *Serranus hepatus* (54)			*M. merluccius* (86) *T. trachurus* (75) *M. barbatus* (65) *S. canicula* (64) *Citharus linguatula* (57) *S. hepatus* (51)		

2) Major Invertebrates

The number of species in each season was roughly 30, and the number of species per haul was 5 or less. Those species that demonstrated a high appearance frequency throughout all seasons included deep-water pink shrimp *Parapenaeus longirostris* (appearance frequency: approx. 40-50%), elegant cuttlefish *Sepia elegans* (appearance frequency: approx. 20-50%), pink cuttlefish *Sepia orbignyana* (appearance frequency: approx. 30-40%) and broadtail squid *Illex coindetii* (appearance frequency:approx. 30-35%). The appearance frequencies of musky octopus *Eledone moschata* and horned octopus *Eledone cirrhosa* were also high depending on the season (Table 5-1-1-2).

Table 5-1-1-2 Number of Species of Major Invertebrates by Season and Strata in All Areas Surveyed

Season	Spring			Summer			Autumn			Winter		
Stratum (m)	20~100m	101~200m	201~500m	20~100m	101~200m	201~500m	20~100m	101~200m	201~500m	20~100m	101~200m	201~500m
No. of species	20	17	19	22	19	19	22	18	19	16	19	23
	29			32			30			30		
No. of species per haul	2	4	5	2	4	6	4	5	6	4	5	6
	3			3			5			4		
High rank species of appearance frequency (%)	*Parapenaeus longirostris* (46)			*E. cirrhosa* (57)			*S. elegans* (52)			*P. longirostris* (54)		
	Illex coindetii (30)			*P. longirostris* (40)			*P. longirostris* (51)			*S. elegans* (40)		
	Eledone moschata (29)			*I. coindetii* (31)			*S. orbignyana* (39)			*A. media* (38)		
	Sepia elegans (27)			*S. orbignyana* (28)			*E. moschata* (39)			*I. coindetii* (35)		
	S. orbignyana (26)			*S. elegans* (22)			*Alloteuthis media* (37)			*E. moschata* (34)		
	E. cirrhosa (25)			*S. officinalis* (22)			*I. coindetii* (34)			*E. cirrhosa* (33)		

(2) Species Composition of Catches in The Sea of Marmara

1) Fishes

The number of families of each season was 31-35, the number of species was 51-62, and the number of species per haul was in the range of 10-14 species. There were no large differences between seasons in each case. Species of rays *Rajidae*, cod fishes *Gadidae* and gurnards *Triglidae* were observed in large numbers throughout all seasons. In addition, the species demonstrating the highest appearance frequency throughout all seasons was hake *Merluccius merluccius* (appearance frequency: approx. 85-95%), followed by Atlantic horse-mackerel *Trachurus trachurus* (appearance frequency: approx. 60-90%). The appearance frequencies of smallspotted catshark *Scyliorhinus canicula* and whiting *Merlangius merlangus euxinus* were also high (Table 5-1-1-3).

Table 5-1-1-3 Number of Families and Species of Fishes by Season and Strata in The Sea of Marmara

Season	Spring			Summer			Autumn			Winter		
Stratum (m)	20~100m	101~200m	201~500m	20~100m	101~200m	201~500m	20~100m	101~200m	201~500m	20~100m	101~200m	201~500m
No. of families	27	10	9	28	14	7	30	14	9	31	16	9
	31			32			33			35		
No. of species	43	16	12	44	19	8	48	21	12	50	25	14
	52			51			57			62		
No. of species per haul	10	9	7	11	12	7	14	14	6	16	13	7
	10			11			13			14		
Families included many species (No. of species)	Triglidae (6) Gadidae (4) Scyliorhinidae (3) Rajidae (3)			Triglidae (4) Rajidae (3) Gadidae (3) Scorpaenidae (3) Soleidae (3)			Rajidae (5) Triglidae (5) Scyliorhinidae (3) Squalidae (3) Clupeidae (3) Gadidae (3) Bothidae (3) Soleidae (3)			Triglidae (5) Rajidae (4) Gadidae (4) Scyliorhinidae (3) Squalidae (3) Scorpaenidae (3) Bothidae (3)		
High rank species of appearance frequency (%)	*Merluccius merluccius* (85) *Trachurus trachurus* (59) *Scyliorhinus canicula* (52) *Raja clavata* (52)			*M. merluccius* (89) *T. trachurus* (68) *R. clavata* (54) *Lesueurigobius friesii* (54) *S. canicula* (50) *Merlangius merlangus euxinus* (50)			*M. merluccius* (85) *T. trachurus* (74) *M. m. euxinus* (63) *Trigla lucerna* (59) *Serranus hepatus and other 4 spp.* (56)			*M. merluccius* (95) *T. trachurus* (86) *Citharus linguatula* (62) *M. m. euxinus* (57) *L. friesii* (57)		

2) Major Invertebrates

There were 9-14 species observed in each season, and the number of species per haul was 2-4. The species demonstrating the highest appearance frequency throughout all seasons was deep-water pink shrimp *Parapenaeus longirostris* (appearance frequency: approx. 80-100%). Arrow shrimp *Plesionika heterocarpus*, pink cuttlefish *Sepia orbignyana*, midsize squid *Alloteuthis media* and musky octopus *Eledone moschata* also demonstrated high appearance frequencies (Table 5-1-1-4).

Table 5-1-1-4 Number of Species of Major Invertebrates by Season and Strata in The Sea of Marmara

Season	Spring			Summer			Autumn			Winter		
Stratum (m)	20~100m	101~200m	201~500m	20~100m	101~200m	201~500m	20~100m	101~200m	201~500m	20~100m	101~200m	201~500m
No. of species	8	5	1	11	4	1	9	8	3	8	9	4
	9			12			14			13		
No. of species per haul	2	3	1	2	3	1	4	6	3	4	6	2
	2			2			4			4		
High rank species of appearance frequency (%)	*Parapenaeus longirostris* (85) *Sepia orbignyana* (22) *Plesionika heterocarpus* (19) *Eledone moschata* (19) *Alloteuthis media* (15)			*P. longirostris* (86) *P. heterocarpus* (36) *A. media* (25) *Sepietta neglecta* (22) *Illex coindetii* (14)			*P. longirostris* (78) *S. orbignyana* (56) *S. elegans* (52) *Sepietta* sp. (41) *E. moschata* (37) *A. media* (33)			*P. longirostris* (100) *A. media* (72) *P. heterocarpus* (43) *S. orbignyana* (38) *E. moschata* (33) *S. elegans* (24)		

(3) Species Composition of Catches in the North Aegean Sea

1) Fishes

The number of families for each season was 43-48, the number of species was 97-107, and the number of species per haul was within the range of 17-19 species. There were no large differences observed between seasons. Species of rays *Rajidae*, cod fishes *Gadidae*, sea breams *Sparidae* and gurnards *Triglidae* were observed in large numbers throughout all seasons. In addition, the species demonstrating high appearance frequencies throughout all seasons were smallspotted catshark *Scyliorhinus canicula* (appearance frequency: approx. 80-90%), thornback ray *Raja clavata* (appearance frequency: approx. 60-70%), hake *Merluccius merluccius* (appearance frequency: approx. 90%), red mullet *Mullus barbatus* (appearance frequency: approx. 60-80%) and anglerfish *Lophius piscatorius* (appearance frequency: approx. 70-80%) (Table 5-1-1-5).

Table 5-1-1-5 Number of Families and Species of Fishes by Season and Strata in the North Aegean Sea

Season	Spring			Summer			Autumn			Winter		
Stratum (m)	20~100m	101~200m	201~500m	20~100m	101~200m	201~500m	20~100m	101~200m	201~500m	20~100m	101~200m	201~500m
No. of families	36	31	26	38	30	25	32	28	26	38	30	23
	43			48			44			48		
No. of species	80	53	44	78	51	41	68	49	41	74	48	38
	103			107			98			97		
No. of species per haul	17	19	17	20	19	18	17	17	16	19	19	14
	17			19			17			18		
Families included many species (No. of species)	Sparidae (10) Rajidae (7) Labridae (7) Triglidae (6) Gadidae (5) Soleidae (5)			Sparidae (7) Gadidae (6) Triglidae (6) Rajidae (5) Labridae (5) Soleidae (5)			Rajidae (8) Sparidae (8) Gadidae (7) Triglidae (6)			Sparidae (11) Rajidae (6) Triglidae (6) Gadidae (4) Scorpaenidae (4)		
High rank species of appearance frequency (%)	*Merluccius merluccius* (89) *Scyliorhinus canicula* (80) *Mullus barbatus* (69) *Lophius piscatorius* (69) *Raja clavata* (60) *Serranus hepatus* (58)			*M. merluccius* (90) *S. canicula* (87) *L. piscatorius* (83) *R. clavata* (72) *Trachurus trachurus* (71) *M. barbatus* (61)			*S. canicula* (89) *M. merluccius* (89) *L. piscatorius* (75) *T. trachurus* (68) *M. barbatus* (68) *R. clavata* (66)			*M. merluccius* (91) *S. canicula* (85) *M. barbatus* (79) *L. piscatorius* (70) *R. clavata* (67) *T. trachurus* (67)		

2) Major Invertebrates

The number of species for each season (seasonal range: 22-24) and the number of species per haul (seasonal range: 4-6) were generally uniform. In addition, the number of species tended to increase as water depth increased. Those species that demonstrated high appearance frequencies throughout all seasons included horned octopus *Eledone cirrhosa* (appearance frequency: approx. 50-90%) and broadtail squid *Illex coindetii* (appearance frequency: approx. 40-60%). In addition, elegant cuttlefish *Sepia elegans*, midsize squid *Alloteuthis media* and deep-water pink shrimp *Parapenaeus longirostris* also demonstrated high appearance frequencies (Table 5-1-1-6).

Table 5-1-1-6 Number of Species of Major Invertebrates by Season and Strata in the North Aegean Sea

Season	Spring			Summer			Autumn			Winter		
Stratum (m)	20~100m	101~200m	201~500m	20~100m	101~200m	201~500m	20~100m	101~200m	201~500m	20~100m	101~200m	201~500m
No. of species	13	13	14	13	13	15	14	14	15	13	15	17
	23			23			22			24		
No. of species per haul	3	5	6	3	4	6	5	6	7	5	6	8
	4			4			5			6		
High rank species of appearance frequency (%)	*Eledone cirrhosa* (56)			*E. cirrhosa* (89)			*S. elegans* (66)			*E. cirrhosa* (64)		
	Illex coindetii (45)			*S. orbignyana* (40)			*A. media* (57)			*S. elegans* (61)		
	E. moschata (42)			*I. coindetii* (38)			*I. coindetii* (55)			*A. media* (52)		
	Sepia elegans (40)			*Parapenaeus longirostris* (30)			*P. longirostris* (47)			*E. moschata* (52)		
	S. orbignyana (40)			*Nephrops norvegicus* (28)			*Sepietta* sp. (47)			*I. coindetii* (49)		
	Alloteuthis media (38)						*E. cirrhosa* (45)			*P. longirostris* (43)		

(4) Species Composition of Catches in the South Aegean Sea

1) Fishes

The number of families for each season was 38-42, and there were no large differences between seasons. The number of species tended to gradually decrease from spring to winter, with 87 species observed in spring and 67 in winter. The number of species per haul was 15-20. Large numbers of rays *Rajidae*, cod fishes *Gadidae*, sea breams *Sparidae* and gurnards *Triglidae* were observed in the same manner as in the North Aegean Sea. In addition, those species demonstrating high appearance frequencies throughout all seasons consisted of hake *Merluccius merluccius* (appearance frequency: approx. 70-80%) and red mullet *Mullus barbatus* (appearance frequency: approx. 60-70%). Atlantic horse-mackerel *Trachurus trachurus*, large-scaled gurnard *Lepidotrigla cavillone*, smallspotted catshark *Scyliorhinus canicula* and spotted flounder *Citharus linguatula* also demonstrated high appearance frequencies (Table 5-1-1-7).

Table 5-1-1-7 Number of Families and Species of Fishes by Season and Strata in the South Aegean Sea

Season	Spring			Summer			Autumn			Winter		
Stratum (m)	20~100m	101~200m	201~500m	20~100m	101~200m	201~500m	20~100m	101~200m	201~500m	20~100m	101~200m	201~500m
No. of families	33	27	26	30	18	23	27	19	27	19	22	19
	42			40			40			38		
No. of species	57	44	46	49	30	39	43	30	43	34	32	28
	87			75			73			67		
No. of species per haul	17	22	21	20	20	19	15	13	15	14	15	17
	19			20			15			15		
Families included many species (No. of species)	Sparidae (9) Gadidae (6) Rajidae (5) Triglidae (5)			Sparidae (7) Rajidae (6) Gadidae (5) Triglidae (4)			Sparidae (7) Gadidae (5) Scorpaenidae (5) Rajidae (4) Triglidae (4)			Sparidae (6) Triglidae (5) Rajidae (4) Gadidae (4) Scorpaenidae (4)		
High rank species of appearance frequency (%)	*Merluccius merluccius* (83) *Mullus barbatus* (74) *Trigloporus lastoviza* (70) *Lepidotrigla cavillone* (65) *Macroramphosus scolopax* (57) *and other 2 spp.*			*L. cavillone* (72) *M. merluccius* (68) *Trachurus trachurus* (68) *M. barbatus* (64) *Citharus linguatula* (64) *Scyliorhinus canicula* (57)			*M. merluccius* (79) *T. trachurus* (79) *L. cavillone* (72) *Zeus faber* (64) *M. barbatus* (57) *S. canicula* (54) *Boops boops* (54)			*M. merluccius* (77) *Serranus hepatus* (69) *M. barbatus* (69) *Aspitrigla cuculus* (69) *T. trachurus* (62) *S. canicula and other 3 spp.* (54)		

2) Major Invertebrates

There were 14-20 species observed in each season, and the number of species per haul was within a range of 3-5 species. Those species demonstrating high appearance frequencies throughout all seasons consisted of deep-water pink shrimp *Parapenaeus longirostris* (appearance frequency: approx. 20-40%), European squid *Loligo vulgaris* (appearance frequency: approx. 20-50%) and broadtail squid *Illex coindetii* (appearance frequency: approx. 30-50%) (Table 5-1-1-8).

Table 5-1-1-8 Number of Species of Major Invertebrates by Season and Strata in the South Aegean Sea

Season	Spring			Summer			Autumn			Winter		
Stratum (m)	20~100m	101~200m	201~500m	20~100m	101~200m	201~500m	20~100m	101~200m	201~500m	20~100m	101~200m	201~500m
No. of species	6	13	14	4	11	14	7	12	16	4	10	10
	19			17			20			14		
No. of species per haul	3	5	8	2	5	6	3	4	7	2	3	5
	5			4			4			3		
High rank species of appearance frequency (%)	*Illex coindetii* (52)			*E. cirrhosa* (82)			*E. moschata* (57)			*I. coindetii* (46)		
	Eledone moschata (48)			*L. vulgaris* (50)			*L. vulgaris* (47)			*E. cirrhosa* (39)		
	Loligo vulgaris (39)			*P. longirostris* (36)			*L. forbesi* (43)			*S. officinalis* (31)		
	Parapenaeus longirostris (35)			*S. orbignyana* (36)			*P. longirostris* (39)			*L. forbesi* (31)		
	Sepia elegans (35)			*I. coindetii* (32)			*S. orbignyana* (39)			*P. longirostris* and other 5 spp. (23)		
	S. orbignyana (35)						*I. coindetii* (36)					

(5) Species Composition of Catches in the West Mediterranean Sea

1) Fishes

There were 37-42 families and 64-66 species observed in each season. There were no large differences between seasons. The number of species per haul in each season was 16-20. Species of sea breams *Sparidae* were observed in the largest number throughout all seasons, while large numbers of rays *Rajidae*, goatfishes *Mullidae* and gurnards *Triglidae* were also observed. Those species having high appearance frequencies throughout all seasons consisted of hake *Merluccius merluccius* and red mullet *Mullus barbatus*. In addition, other species having high appearance frequencies varied according to the season (Table 5-1-1-9).

Table 5-1-1-9 Number of Families and Species of Fishes by Season and Strata in the West Mediterranean Sea

Season	Spring			Summer			Autumn			Winter		
Stratum (m)	20~100m	101~200m	201~500m	20~100m	101~200m	201~500m	20~100m	101~200m	201~500m	20~100m	101~200m	201~500m
No. of families	24	21	23	26	21	19	25	17	19	20	19	18
	37			42			37			40		
No. of species	41	26	28	44	31	22	42	27	30	35	32	24
	64			66			66			64		
No. of species per haul	19	13	17	20	20	20	18	14	14	20	17	14
	16			20			16			17		
Families included many species (No. of species)	Sparidae (7) Serranidae (5) Triglidae (4) Rajidae (3) Mullidae (3) Bothidae (3)			Sparidae (8) Rajidae (4) Triglidae (4) Serranidae (3) Mullidae (3)			Sparidae (8) Rajidae (5) Triglidae (4) Gadidae (3) Carangidae (3) Mullidae (3) Centracanthidae (3)			Sparidae (6) Rajidae (5) Triglidae (4) Macrouridae (3) Mullidae (3) Centracanthidae (3) Bothidae (3)		
High rank species of appearance frequency (%)	*Merluccius merluccius* (90) *Mullus barbatus* (80) *Raja alba* (70) *Macroramphosus scolopax* (60) *Capros aper* (60) *Spicara maena* (60)			*M. merluccius* (60) *M. barbatus* (60) *Lepidotrigla cavillone* (60) *Raja alba* (50) *Trachurus trachurus* (50) *Boops boops and other 4 spp.* (50)			*M. barbatus* (60) *Pagellus erythrinus* (60) *S. smaris* (60) *M. scolopax* (50) *M. merluccius* (50) *B. boops , Scomber japonicus* (50)			*T. trachurus* (89) *Scyliorhinus canicula* (67) *M. merluccius* (67) *M. barbatus* (67) *B. boops* (67) *Dentex macrophthalmus* (67)		

2) Major Invertebrates

There were 13-17 species observed in each season, and the number of species per haul was 3-4 species. Both the number of species and number of species per haul tended to be larger in deep strata. The high appearance frequency throughout all seasons was observed for pink cuttlefish *Sepia orbignyana* (appearance frequency: approx. 20-50%). Deep-water pink shrimp *Parapenaeus longirostris*, elegant cuttlefish *Sepia elegans*, common cuttlefish *Sepia officinalis* and veined squid *Loligo forbesi* also demonstrated high values for appearance frequency depending on the season (Table 5-1-1-10).

Table 5-1-1-10 Number of Species of Major Invertebrates by Season and Strata in the West Mediterranean Sea

Season	Spring			Summer			Autumn			Winter		
Stratum (m)	20~100m	101~200m	201~500m	20~100m	101~200m	201~500m	20~100m	101~200m	201~500m	20~100m	101~200m	201~500m
No. of species	2	5	10	3	6	9	7	6	8	1	9	11
	13			14			14			17		
No. of species per haul	1	3	6	2	3	5	4	3	6	1	4	5
	3			3			4			3		
High rank species of appearance frequency (%)	*Parapenaeus longirostris* (50) *Illex coindetii* (50) *Sepia orbignyana*, *Sepietta* sp., *Eledone cirrhosa* (30)			*P. longirostris* (40) *Sepia officinalis* (40) *S. orbignyana* (40) *S. elegans*, *Loligo forbesi*, *L. coindetii* (30)			*S. elegans* (60) *S. orbignyana* (50) *L. forbesi* (50) *Sepietta* sp. (40) *Octopus vulgaris* (40)			*S. officinalis* (45) *L. coindetii* (45) *P. longirostris* (33) *L. forbesi* (33) *S. elegans*, *S. orbignyana*, *Abralia veranyi* (22)		

(6) Species Composition of Catches in the East Mediterranean Sea

1) Fishes

The number of families observed in each season was 37-51 and the number of species observed was 58-105. Both the numbers of families and species were highest in summer. The number of species of sea breams *Sparidae* was the highest throughout all seasons, while that of rays *Rajidae* was also high. The number of species of gurnards *Triglidae*, lefteye flounders *Bothidae*, sea basses *Serranidae*, horse mackerels *Carangidae* and goatfishes *Mullidae* were also high depending on the season. Those species demonstrating an appearance frequency of 50% or higher throughout all seasons consisted of the four species of brushtooth lizardfish *Saurida undosquamis* (appearance frequency: 50-70%), red mullet *Mullus barbatus* (appearance frequency: approx. 60-90%), common pandora *Pagellus erythrinus* (appearance frequency: approx. 50-70%) and spotted flounder *Citharus linguatula* (appearance frequency: approx. 50-70%). Hake *Merluccius merluccius*, Atlantic horse-mackerel *Trachurus trachurus*, golden-banded goatfish *Upeneus moluccensis* and bogue *Boops boops* also demonstrated appearance frequencies of 50% or higher depending on the season (Table 5-1-1-11).

Table 5-1-1-11 Number of Families and Species of Fishes by Season and Strata in the East Mediterranean Sea

Season	Spring			Summer			Autumn			Winter		
Stratum (m)	20~100m	101~200m	201~500m	20~100m	101~200m	201~500m	20~100m	101~200m	201~500m	20~100m	101~200m	201~500m
No. of families	32	19	25	44	24	21	34	23	19	20	15	26
	43			51			46			37		
No. of species	64	31	31	84	41	34	64	39	26	30	21	34
	82			105			89			58		
No. of species per haul	13	12	16	22	22	20	16	17	18	17	14	19
	13			22			16			17		
Families included many species (No. of species)	Sparidae (8) Triglidae (5) Bothidae (5) Rajidae (4) Serranidae (4) Mullidae (4)			Sparidae (12) Rajidae (7) Carangidae (7) Mullidae (4) Callionymidae (4) Scorpaenidae (4) Bothidae, Soleidae (4)			Sparidae (10) Rajidae (5) Serranidae (5) Carangidae (5) Triglidae (5) Bothidae (5)			Sparidae (7) Rajidae (3) Centracanthidae (3) Triglidae (3)		
High rank species of appearance frequency (%)	*Pagellus erythrinus* (69) Saurida undosquamis (66) *Merluccius merluccius* (63) *Mullus barbatus* (63) *Spicara maena* (54) *Citharus linguatula* (52)			*M. barbatus* (80) *Upeneus moluccensis* (74) *Boops boops* (72) *Arnoglossus laterna* (69) *S. undosquamis and other 2 spp.* (66)			*M. barbatus* (85) *M. merluccius* (74) *Trachurus trachurus* (74) *P. erythrinus* (71) *Lepidotrigla cavillone* (71) *Spicara flexuosa* (71)			*M. merluccius* (80) *T. trachurus* (80) *M. barbatus* (80) *Aspitrigla cuculus* (80) *S. undosquamis* (70) *U. moluccensis and other 2 spp.* (70)		

2) Major Invertebrates

There were 16-20 species observed in each season, and the number of species per haul was 2-4. Those species demonstrating a high appearance frequency throughout all seasons consisted of deep-water pink shrimp *Parapenaeus longirostris* and elegant cuttlefish *Sepia elegans*. Common cuttlefish *Sepia officinalis*, midsize squid *Alloteuthis media*, broadtail squid *Illex coindetii* and Red-sea mantis shrimp *Oratosquilla massavensis* also demonstrated high appearance frequencies depending on the season (Table 5-1-1-12).

Table 5-1-1-12 Number of Species of Major Invertebrates by Season and Strata in the East Mediterranean Sea

Season	Spring			Summer			Autumn			Winter		
Stratum (m)	20~100m	101~200m	201~500m	20~100m	101~200m	201~500m	20~100m	101~200m	201~500m	20~100m	101~200m	201~500m
No. of species	12	7	5	11	11	9	14	11	10	6	6	9
	17			20			20			16		
No. of species per haul	2	2	3	2	5	5	4	5	7	2	4	4
	2			3			4			3		
High rank species of appearance frequency (%)	*Parapenaeus longirostris* (40) *Sepia elegans* (23) *Alloteuthis media* (20) *Eledone moschata* (17) *Oratosquilla massavensis*, *Illex coindetii* (14)			*Sepia officinalis* (54) *O. massavensis* (34) *P. longirostris* (29) *I. coindetii* (29) *E. cirrhosa* (29) *S. elegans* (20)			*P. longirostris* (53) *Loligo forbesi* (50) *S. elegans* (44) *E. cirrhosa* (44) *S. officinalis* (38) *A. media* (32)			*P. longirostris* (50) *S. officinalis* (50) *L. vulgaris* (50) *S. elegans* (40) *Penaeus kerathurus*, *I. coindetii*, *Aristaeomorpha foliacea* (20)		

Finally, a comparison was made of the number of species of fishes and major invertebrates between sub areas. Both the number of species of fishes and major invertebrates were highest throughout all seasons in the North Aegean Sea, the sub area having the largest area, and as a result, the largest number of survey stations. On the other hand, The Sea of Marmara demonstrated the lowest numbers of species of fishes and major invertebrates throughout all seasons (Table 5-1-1-13). The following lists some of the representative species observed in each sub area (primarily those species demonstrating high appearance frequencies throughout all seasons).

The Sea of Marmara:
Merluccius merluccius, Trachurus trachurus, Parapenaeus longirostris (Merlangius merlangus euxinus)

North Aegean Sea:
Scyliorhinus canicula, Raja clavata, M. merluccius, Mullus barbatus, Lophius piscatorius, Eledone cirrhosa, Illex coindetii (T. trachurus, P. longirostris)

South Aegean Sea:
M. merluccius, M. barbatus, Loligo vulgaris, I. coindetii, P. longirostris (T. trachurus, Lepidotrigla cavillone, E. cirrhosa)

West Mediterranean Sea:
M. merluccius, M. barbatus, Sepia orbignyana (T. trachurus, Boops boops, Spicara smaris, Sepia officinalis, Loligo forbesi)

East Mediterranean Sea:
Saurida undosquamis, M. barbatus, Pagellus erythrinus, Citharus linguatula, P. longirostris, Sepia elegans, (M. merluccius, Upeneus moluccensis, T. trachurus, B. boops, Oratosquilla massavensis, S. officinalis)

Table 5-1-1-13 Comparison of Number of Species of Fishes and Major Invertebrates Between Sub Areas

Classification	Sub area	Spring	Summer	Autumn	Winter
Fishes	The Sea of Marmara	52	51	57	62
	North Aegean Sea	103	107	98	97
	South Aegean Sea	87	75	73	67
	West Mediterranean Sea	64	66	66	64
	East Mediterranean Sea	82	105	89	58
	ALL area	148	171	143	134
Invertebrates	The Sea of Marmara	9	9	14	13
	North Aegean Sea	23	23	22	24
	South Aegean Sea	19	17	20	14
	West Mediterranean Sea	13	14	14	17
	East Mediterranean Sea	17	20	20	16
	ALL area	29	32	30	30

5-1-2 Top Ranking Species for Catch Per Unit Area and Estimated Stock Size

5-1-2 Top Ranking Species for Catch Per Unit Area (kg/km^2) and Estimated Stock Size

The top ranking species for catch per unit area (kg/km^2) (to be referred to as CPUA) and estimated stock size (to be referred to as stock size) for each sub area were grouped by season and water depth zones to examine the actual status of fish and major invertebrate resources.

(1) Top Ranking Species for CPUA

1) Top Ranking Species for CPUA in All Areas Surveyed

Those species of fishes that demonstrated high CPUA values at all depths and in each season consisted of smallspotted catshark *Scyliorhinus canicula*, longnose spurdog *Squalus blainvillei*, thornback ray *Raja clavata*, hake *Merluccius merluccius*, Atlantic horse-mackerel *Trachurus trachurus*, red mullet *Mullus barbatus* and anglerfish *Lophius piscatorius*. At depths of 201 m or more, boarfish *Capros aper* demonstrated high CPUA values in all seasons except winter (Table 5-1-2-1).

Table 5-1-2-1 Top 10 Ranked Species of Fishes in Terms of Catch Per Unit Area (kg/km^2) by Season and Strata in All Areas Surveyed

Scientific name \ Season / Stratum	Spring			Summer			Autumn			Winter		
	20~100m	101~200m	201~500m	20~100m	101~200m	201~500m	20~100m	101~200m	201~500m	20~100m	101~200m	201~500m
Scyliorhinus canicula	29.2	16.0	27.7	130.0	57.4	54.3	47.3	24.7	16.9	38.2		14.0
Galeus melastomus			32.0									13.7
Mustelus mustelus	48.2	38.4			32.4							
Squalus blainvillei	50.7	57.2	25.6			30.8	27.5	36.3	23.0	16.8		43.0
Squatina squatina					33.4							
Raja clavata	41.2	29.3	24.8	49.6	91.3	45.9	50.3	36.3	33.8	52.3	26.3	21.6
R. oxyrinchus			30.9						15.9			28.8
R. alba											27.4	
Dasyatis pastinaca		83.4					44.2			90.2	278.9	
D. violacea				34.6								
Myliobatis aquila		12.1								56.0	84.2	
Argentina sphyraena			18.4			40.0						50.9
Chlorophthalmus agassizii					143.1			19.4				
Macroramphosus scolopax												
* *Merluccius merluccius*	86.2	80.0	25.9	146.1	257.6	82.3	47.7	63.7	29.5	66.9	44.7	50.7
Micromesistius poutassou									11.2			11.2
Zeus faber								12.0				
Capros aper			38.2			75.9			35.3			
Serranus hepatus										21.4		
Trachurus trachurus	22.6				54.6	43.0	20.9	29.3		21.4	23.2	18.7
* *Mullus barbatus*	51.4	50.7		76.1	79.2		31.4	40.6		50.1	36.7	
* *Upeneus moluccensis*				32.6							50.7	
Boops boops							18.2			17.4		
* *Dentex macrophthalmus*				31.0				13.7			36.3	
* *Diplodus annularis*	16.6			31.0								
* *Pagellus erythrinus*	31.2			47.9								
* *P. acarne*							18.3					
Spicara smaris					38.9							10.4
Lepidopus caudatus									11.6			
Scorpaena scrofa												
Trigla lyra						34.1					26.4	
Aspitrigla cuculus			15.5									
Lepidotrigla cavillone		15.0				36.4						
Lepidorhombus boscii			22.6						10.7			
Lophius piscatorius	23.7	33.4		29.0	80.2	33.4	21.7	17.8	16.0			

Note: Those species of the 35 species shown that are indicated with an asterisk (*) indicate important species to the fisheries (target species of measurements).

With respect to major invertebrates, the CPUA of deep-water pink shrimp *Parapenaeus longirostris* was high in all seasons and water depth zones. In addition, horned octopus *Eledone cirrhosa* demonstrated a high CPUA in summer. At depths of 201 m or more, Norway lobster *Nephrops norvegicus* demonstrated high CPUA values throughout all seasons (Table 5-1-2-2).

Table 5-1-2-2 Catch Per Unit Area (kg/km^2) of Major Invertebrates by Season and Strata in All Areas Surveyed

Season / Stratum / Scientific name	Spring			Summer			Autumn			Winter		
	20~100m	101~200m	201~500m	20~100m	101~200m	201~500m	20~100m	101~200m	201~500m	20~100m	101~200m	201~500m
〈Shrimps & lobster〉												
Aristaeomorpha foliacea												9.4
Parapenaeus longirostris	26.3	34.4	13.2	29.1	31.0	19.5	16.2	27.0	10.3	24.2	53.0	16.1
Plesionika heterocarpus	0.3	7.3	1.4	0.5	2.4	0.8		8.8	1.2	1.7	7.9	0.5
Nephrops norvegicus		1.3	34.0	0.1	0.4	56.6	0.3	0.1	24.5		1.7	38.1
〈Cuttlefish & squids〉												
Sepia orbignyana	0.9	6.6	1.9	0.9	10.6	8.9	1.4	1.0	2.1	0.5	2.8	0.9
Loligo forbesi		0.9	2.5		0.1	8.3	1.5	1.9	15.0		2.8	6.0
L. vulgaris	1.2	1.2		5.7	12.0	6.6	5.5	0.2		3.1	5.0	0.2
Illex coindetii	1.4	2.6	9.8	0.5	7.1	10.8	0.7	2.2	9.9	0.2	3.3	8.9
〈Octopuses〉												
Octopus vulgaris	10.0		0.2	16.5	6.0		4.8	1.1		9.2	0.4	
O. salutii		0.4	2.8	0.2		8.9		0.1	0.4		0.2	3.5
Eledone moschata	15.3	7.6					11.9	5.8		24.4	1.5	
E. cirrhosa	6.2	4.6	11.1	53.2	82.4	37.4	1.4	2.0	0.2	8.2	4.2	1.7

2) Top Ranking Species for CPUA in The Sea of Marmara

Those species of fishes that demonstrated high values of CPUA at all depths and in all seasons consisted of longnose spurdog *Squalus blainvillei* (CPUA range: 9.2-345.3), thornback ray *Raja clavata* (CPUA range: 9.2-152.6) and hake *Merluccius merluccius* (CPUA range: 47.7-1,421.0). Other species that demonstrated high CPUA values included smallspotted catshark *Scyliorhinus canicula*, Atlantic horse-mackerel *Trachurus trachurus* and piper gurnard *Trigla lyra*. In addition, at depths of 200 m or less in winter, the CPUA values of both common stingray *Dasyatis pastinaca* and common eagle ray *Myliobatis aquila* were high (CPUA ranges of both species: 145.5-520.5). At depths of 201 m or more, the CPUA of blackmouth catshark *Galeus melastomus* (range: 25.1-251.5) was also high (Table 5-1-2-3).

Table 5-1-2-3 Top 10 Ranked Species of Fishes in Terms of Catch Per Unit Area (kg/km^2) by Season and Strata in The Sea of Marmara

Scientific name \ Season	Spring			Summer			Autumn			Winter		
Stratum	20~100m	101~200m	201~500m	20~100m	101~200m	201~500m	20~100m	101~200m	201~500m	20~100m	101~200m	201~500m
Scyliorhinus canicula	25.4	18.9					19.0	62.6	0.8	27.5	23.0	23.1
Galeus melastomus			251.5			163.3			25.1			138.9
Mustelus mustelus	102.5						24.2			18.4	30.6	
M. asterias					31.2							59.5
Oxynotus centrina			8.1				16.1		0.8			
Squalus acanthias				31.8				28.4				
S. blainvillei	145.4	322.3		74.2	87.6	9.2	112.7	345.3		24.0		89.3
Centrophorus granulosus									45.3			21.2
Squatina squatina				29.4								
Torpedo marmorata											20.1	
Raja clavata	64.0	47.1	51.3	45.5	152.6	9.2	144.9	148.8	32.3	101.2	23.3	
R. oxyrinchus		7.2	9.1		16.8			47.9			67.4	37.6
Dasyatis pastinaca	40.6	162.0								231.1	306.2	
Myliobatis aquila	30.1			40.6						145.5	520.5	
Sprattus sprattus sprattus	51.9			24.3	20.6		18.6					
Conger conger			8.1									
Nezumia sclerorhynchus			32.6			3.1			13.7			7.8
* *Merluccius merluccius*	198.0	341.9	47.7	432.6	1,421.0	331.1	92.5	237.6	117.0	128.3	76.6	189.1
Gadiculus argenteus		0.9			29.4							
Merlangius merlangus euxinus				40.8	54.3			80.0				
Micromesistius poutassou			25.2						15.1			
Serranus hepatus							42.5			41.3		
Trachurus trachurus	68.2	19.2		29.6	14.3	8.4		36.7	0.4	55.5	15.8	
* *Mullus barbatus*										23.4		
Helicolenus dactylopterus d.			3.3			3.1						15.8
Trigla lyra	53.1	18.4		24.3	45.1		17.3	49.6	2.7		125.3	
T. lucerna							17.5					
Lepidotrigla cavillone		9.2										
Lophius piscatorius			21.9					18.9				
L. budegassa												40.7

Note: Those species of the 30 species shown that are indicated with an asterisk (*) indicate important species to the fisheries (target species of measurements).

With respect to major invertebrates, the CPUA of deep-water pink shrimp *Parapenaeus longirostris* was overwhelmingly high throughout all seasons and depth zones (range: 7.0-313.8). In addition, the CPUA of arrow shrimp *Plesionika heterocarpus* demonstrated a relatively high value at depths of 200 m or less throughout all seasons (Table 5-1-2-4).

Table 5-1-2-4 Catch Per Unit Area (kg/km^2) of Major Invertebrates in The Sea of Marmara

Scientific name \ Season	Spring			Summer			Autumn			Winter		
Stratum	20~100m	101~200m	201~500m	20~100m	101~200m	201~500m	20~100m	101~200m	201~500m	20~100m	101~200m	201~500m
〈Shrimps〉												
Parapenaeus longirostris	96.2	236.9	7.0	122.1	218.9	51.9	68.0	245.6	10.5	69.1	313.8	82.9
Plesionika heterocarpus	1.0	55.7		2.1	21.2		0.2	83.7		5.0	51.4	
〈Cuttlefishes & squids〉												
Sepia orbignyana	0.2						1.3	0.7		0.4	0.6	
Sepietta sp.							0.2	2.5			2.3	
Alloteuthis media				1.0						0.4	6.9	
Illex coindetii				0.5								12.5
〈Octopus〉												
Eledone moschata	2.2	6.0					2.5			10.6		

3) Top Ranking Species for CPUA in the North Aegean Sea

Those species of fishes that demonstrated high CPUA values at all depths and in all seasons consisted of smallspotted catshark *Scyliorhinus canicula* (CPUA range: 6.5-339.8), thornback ray *Raja clavata* (CPUA range: 21.0-112.4), hake *Merluccius merluccius* (CPUA range: 18.2-157.5) and anglerfish *Lophius piscatorius* (CPUA range: 9.7-160.7).

The CPUA of Atlantic horse-mackerel *Trachurus trachurus* in all seasons except spring (range: 17.5-101.2) as well as the CPUA of red mullet *Mullus barbatus* at depths of 200 m or less in all seasons (range: 16.9-76.3) were also high. At depths of 201 m or more, the CPUA values of argentine *Argentina sphyraena*, blue whiting *Micromesistius poutassou* and four-spotted megrim *Lepidorhombus boscii* were high in comparison with other species of fishes at similar depths (CPUA range for the above three species in all seasons: 6.4-60.9) (Table 5-1-2-5).

Table 5-1-2-5 Top 10 Ranked Species of Fishes in Terms of Catch Per Unit Area (kg/km^2) by Season and Strata in the North Aegean Sea

Scientific name \ Season / Stratum	Spring			Summer			Autumn			Winter		
	20~100m	101~200m	201~500m	20~100m	101~200m	201~500m	20~100m	101~200m	201~500m	20~100m	101~200m	201~500m
Scyliorhinus canicula	47.1		15.2	339.8	94.5	54.6	125.3	17.3	12.9	62.6	43.9	6.5
S. stellaris	39.8	30.6										
Squalus acanthias										31.5		
S. blainvillei	33.5	18.9				44.9				21.6	23.9	
Raja clavata	64.8		29.4	110.3	112.4	67.9	51.2	40.8	53.8	44.5	46.2	21.0
R. oxyrinchus									27.6			10.9
Dasyatis pastinaca				38.6						27.4	85.3	
Myliobatis aquila		34.9										
Argentina sphyraena		18.4	15.6			60.9					34.7	6.4
Coelorhynchus coelorhynchus			20.1						14.1			
* *Merluccius merluccius*	59.1	32.3	26.6	131.9	157.5	86.1	47.3	24.6	30.8	50.2	61.5	18.2
Gadiculus argenteus			12.7									
Micromesistius poutassou			17.6			49.9			22.9			29.9
Trisopterus minutus capelanus	25.9			35.6			20.7	10.6				
Phycis blennoides												12.7
Zeus faber		22.1						28.2			28.6	5.2
Capros aper		27.8	12.2						9.5			
* *Serranus cabrilla*								15.4				
S. hepatus							15.1					
Trachurus trachurus					101.2	36.7	17.5	40.6			36.6	
* *Mullus barbatus*	57.6	39.7		76.3	65.0		30.1	16.9		35.1	40.0	
* *M. surmuletus*					43.3							
* *Dentex macrophthalmus*								10.5				
* *Diplodus annularis*	31.7			39.5								
* *D. vulgaris*										17.0		
* *Pagellus erythrinus*	30.4			39.5								
Scorpaena scrofa									30.2			
Helicolenus dactylopterus d.						38.7						
Trigla lyra		18.9	13.9		50.0							
Aspitrigla cuculus					45.0							
Lepidotrigla cavillone				31.4	28.4		11.5			19.4		
Citharus linguatula							14.7					
Lepidorhombus boscii			40.8			41.1			27.7			14.5
Lophius piscatorius	37.4	31.3		71.3	160.7	50.2	57.1	31.2	25.5	28.5	45.2	9.7

Note: Those species of the 34 species shown that are indicated with an asterisk (*) indicate important species to the fisheries (target species of measurements).

With respect to major invertebrates, the CPUA values of common octopus *Octopus vulgaris*, musky octopus *Eledone moschata* and horned octopus *Eledone cirrhosa* were high at depths of 100 m or less (range of these three species throughout all seasons: 0.2-127.6). The CPUA values of pink cuttlefish *Sepia orbignyana*, broadtail squid *Illex coindetii* and the two species of *Eledone* described above were high in strata of 101-200 m (range of these four species throughout all seasons: 1.8-152.5). At depths of 201 m or more, the CPUA of Norway lobster *Nephrops norvegicus* (range: 59.1-102.0) was the highest throughout all seasons. At this depth zone, the CPUA of deep-water pink shrimp *Parapenaeus longirostris* (range: 16.1-23.3) was also relatively high (Table 5-1-2-6).

Table 5-1-2-6 Catch Per Unit Area (kg/km^2) of Major Invertebrates in the North Aegean Sea

Scientific name \ Season / Stratum	Spring			Summer			Autumn			Winter		
	20~100m	101~200m	201~500m	20~100m	101~200m	201~500m	20~100m	101~200m	201~500m	20~100m	101~200m	201~500m
(Shrimps & lobsters)												
Parapenaeus longirostris	0.3	2.8	16.1	3.4	1.4	23.3	1.4	0.2	21.9	0.5	4.3	18.4
Plesionika heterocarpus			2.4			1.4			2.9			0.9
Nephrops norvegicus		3.7	63.6	0.2	0.8	99.2	0.5	0.2	59.1		4.7	102.0
Palinurus elephas	0.8				8.9					0.3		
(Cuttlefishes & squids)												
Sepia elegans		0.3		4.2			3.3	0.8	0.5	1.3		0.6
S. officinalis	1.4			6.5			1.2			3.4		
S. orbignyana	2.4	5.1	0.9	2.5	19.1	10.1	3.0	1.8		0.8	7.4	
Sepietta sp.			1.2			0.6		0.2	1.2			0.3
Rossia macrosoma		0.3	1.8		0.6	7.3		0.3	0.8		0.2	0.6
Loligo forbesi		2.7				3.4		1.2	7.7		5.6	0.5
L. vulgaris	0.3	3.0		9.4			1.8			3.3		
Illex coindetii	4.0	5.2	4.9	0.9	9.2	7.4	1.9	4.8	13.8	0.5	7.1	6.5
Todarodes sagittatus						7.6			0.6			0.5
(Octopuses)												
Octopus vulgaris	23.7		0.5	40.5	6.2		10.2	0.4		22.9	1.2	
O. salutii			2.3	0.7		17.1			0.8		0.6	6.1
Eledone moschata	29.2	13.1					23.7	3.6		50.6	2.1	
E. cirrhosa	18.1	7.9	18.2	127.6	152.5	69.0	0.2	2.5	0.4	5.0	10.0	4.8

4) Top Ranking Species for CPUA in the South Aegean Sea

Those species of fishes that demonstrated relatively high CPUA values at all depths included smallspotted catshark *Scyliorhinus canicula* (CPUA range: 31.7-83.2), thornback ray *Raja clavata* (CPUA range at depths of 201 m or more throughout all seasons: 17.9-175.8), hake *Merluccius merluccius* (CPUA range: 30.8-87.5), red mullet *Mullus barbatus* (CPUA range at depths of 200 m or less throughout all seasons: 21.6-123.4), red gurnard *Aspitrigla cuculus* (CPUA range in all seasons except autumn: 10.6-23.4), large-scaled gurnard *Lepidotrigla cavillone* (CPUA range in all seasons except winter: 6.8-79.7) and anglerfish *Lophius piscatorius* (CPUA range at depths of 101 m or more in all seasons except winter: 16.5-53.9). At depths of 100 m or less, the CPUA values of comber *Serranus cabrilla*, brown comber *Serranus hepatus*, large-eye dentex *Dentex macrophthalmus*, annular sea bream *Diplodus annularis*, common pandora *Pagellus erythrinus* and axillary sea bream *Pagellus acarne* were also relatively high. In addition, the CPUA values of longnose spurdog *Squalus blainvillei*, longnosed skate *Raja oxyrinchus*, argentine *Argentina sphyraena*, boarfish *Capros aper* and piper gurnard *Trigla lyra* were relatively high at depths of 201 m or more. In particular, the CPUA of snipe fish *Macroramphosus scolopax* at strata of 101-200 m was extremely high in summer at 974.5 (Table 5-1-2-7).

Table 5-1-2-7 Top 10 Ranked Species of Fishes in Terms of Catch Per Unit Area (kg/km^2) by Season and Strata in the South Aegean Sea

Scientific name \ Season / Stratum	Spring 20~100m	Spring 101~200m	Spring 201~500m	Summer 20~100m	Summer 101~200m	Summer 201~500m	Autumn 20~100m	Autumn 101~200m	Autumn 201~500m	Winter 20~100m	Winter 101~200m	Winter 201~500m
Scyliorhinus canicula	38.1	36.6	63.3		72.6	83.2		65.5	32.1	37.8		31.7
Squalus acanthias						28.5						
S. blainvillei			14.2		46.8				63.6			74.0
Raja asterias		17.8										
R. clavata		51.6			175.8	41.3		28.5	31.2			17.9
R. oxyrinchus			41.2			38.5						48.4
R. alba											152.4	
Dasyatis pastinaca	24.4	20.5										
D. violacea				233.2								
Myliobatis aquila									16.6		22.9	
Argentina sphyraena			15.9			30.2						17.0
Chlorophthalmus agassizii												43.4
Conger conger		16.1										
Macroramphosus scolopax					974.5			33.0			94.6	
* *Merluccius merluccius*	41.8	47.2			87.5		39.8	58.2			30.8	45.7
Gadiculus argenteus												22.6
Zeus faber					71.4							
Capros aper			51.3			230.8			18.9			
* *Serranus cabrilla*	57.9			44.3						43.0		
S. hepatus				42.1						46.3		
Epinephelus aeneus				77.0								
Trachurus trachurus						58.3	82.1	34.3			23.1	
* *Mullus barbatus*	60.7	35.2		123.4	21.6		63.6	83.3		111.0	67.4	
* *M. surmuletus*										37.1		
Boops boops							71.7				36.5	
* *Dentex macrophthalmus*				195.9			15.6	29.6			120.9	
* *Diplodus annularis*	34.9			71.2			27.3					
* *Pagellus erythrinus*	45.2			136.6			25.8				20.6	
* *P. acarne*	33.5			34.2			119.7					
Spicara smaris					38.8					50.1		
Lepidopus caudatus									11.2			
Scomber scombrus							12.1					
S. japonicus							19.5					
Scorpaena elongata									16.6			
S. scrofa										12.4		
Helicolenus dactylopterus d.			15.3			32.5						
Trigla lyra			20.5			75.3		9.9	15.0			
Aspitrigla cuculus			21.3		16.6					10.6	23.4	22.9
Lepidotrigla cavillone	26.4	19.9		48.3		79.7		6.8	17.3			
Trigloporus lastoviza		14.5								27.1		
Peristedion cataphractum												10.4
Citharus linguatula	21.5									23.3		
Lepidorhombus boscii			22.0									
Lophius piscatorius		44.5	18.7		53.9			10.2	16.5			

Note: Those species of the 44 species shown that are indicated with an asterisk (*) indicate important species to the fisheries (target species of measurements).

With respect to major invertebrates, the CPUA of common cuttlefish *Sepia officinalis*, pink cuttlefish *Sepia orbignyana*, European squid *Loligo vulgaris*, musky octopus *Eledone moschata* and horned octopus *Eledone cirrhosa* were relatively high at depths of 200 m or less (CPUA range of these five species: 0.6-65.3). At depths of 201 m or more, the CPUA of deep-water pink shrimp *Parapenaeus longirostris*, Norway lobster *Nephrops norvegicus*, pink cuttlefish *Sepia orbignyana*, veined squid *Loligo forbesi*, broadtail squid *Illex coindetii* and spider octopus *Octopus salutii* were relatively high throughout all seasons (CPUA range of these six species: 0.1-29.8) (Table 5-1-2-8).

Table 5-1-2-8 Catch Per Unit Area (kg/km^2) of Major Invertebrates in the South Aegean Sea

Scientific name \ Season	Spring			Summer			Autumn			Winter		
Stratum	20~100m	101~200m	201~500m	20~100m	101~200m	201~500m	20~100m	101~200m	201~500m	20~100m	101~200m	201~500m
〈Shrimp & lobster〉												
Parapenaeus longirostris		2.9	15.0	0.5	10.8	3.5		1.2	2.5		2.5	0.5
Nephrops norvegicus			29.8			22.1			5.9			5.8
〈Cuttlefishes & squids〉												
Sepia elegans	1.1	1.5	0.3	1.0	4.4	1.2					1.7	0.5
S. officinalis	6.3	1.2		19.7	14.4		4.9			22.4	3.4	
S. orbignyana		11.5	2.6		14.0	11.7		1.4	4.2			1.6
Sepietta sp.			4.1								0.8	1.6
Loligo forbesi			8.0		1.0	14.2	4.1	1.2	20.2		2.4	11.1
L. vulgaris	6.1	0.8		14.9	4.4	25.7	35.4	1.0		14.6	1.7	
Illex coindetii	0.5	0.7	15.1		11.9	5.0		1.1	11.3		0.8	20.6
Todarodes sagittatus						6.3			5.0			
〈Octopuses〉												
Octopus vulgaris	11.1						0.4	3.0				
O. salutii		1.8	7.1			0.4		0.3	0.1			5.8
Pteroctopus tetracirrhus			4.2			1.7						
Eledone moschata	25.6	9.3					17.1	9.2		6.1	1.6	
E. cirrhosa		3.2	14.0	31.3	59.0	7.7	0.6			65.3	1.7	

5) Top Ranking Species for CPUA in the West Mediterranean Sea

Those species of fishes that demonstrated relatively high CPUA at all depths and in all seasons consisted of hake *Merluccius merluccius* (CPUA range: 11.1-153.3), red mullet *Mullus barbatus* (CPUA range: 10.6-210.1), large-eye dentex *Dentex macrophthalmus* (CPUA range at depths of 200 m or less: 7.9-147.6) and common pandora *Pagellus erythrinus* (CPUA range at depths of 200 m or less: 20.0-130.3). Other species demonstrating relatively high CPUA values included smallspotted catshark *Scyliorhinus canicula* (CPUA range at depths of 201 m or more throughout all seasons: 8.2-45.1), longnose spurdog *Squalus blainvillei* (CPUA range at depths of 101 m or more in all seasons except summer: 19.0-175.0), white skate *Raja alba* (CPUA range in spring and summer: 28.5-130.2), golden-banded goatfish *Upeneus moluccensis* (CPUA range at depths of 200 m or less in all seasons except spring: 19.0-223.4), bogue *Boops boops* (CPUA range at depths of 200 m or less in all seasons except spring: 8.8-212.3) and picarel *Spicara smaris* (CPUA range at depths of 200 m or less in all seasons except summer: 12.5-127.3). In addition, those species that demonstrated high CPUA depending on the season included angelshark *Squatina squatina* (CPUA at strata of 101-200 m in summer: 371.6), common stingray *Dasyatis pastinaca* (CPUA at depths of 101- 200 m in spring and winter: 440.2 and 1,307.8, respectively), shortnose greeneye *Chlorophthalmus augustus* (CPUA at depths of 201 m or more in winter: 201.4), boarfish *Capros aper* (CPUA at depths of 201 m or more in autumn: 237.4), large-eyed hairtail *Trichiurus lepturus* (CPUA at depths of 100 m or less in summer: 185.7) and chub mackerel *Scomber japonicus* (CPUA at depths of 100 m or less in autumn: 240.5) (Table 5-1-2-9).

Table 5-1-2-9 Top 10 Ranked Species of Fishes with Respect to Catch Per Unit Area (kg/km^2) by Season and Strata in the West Mediterranean Sea

Scientific name \ Season / Stratum	Spring 20~100m	Spring 101~200m	Spring 201~500m	Summer 20~100m	Summer 101~200m	Summer 201~500m	Autumn 20~100m	Autumn 101~200m	Autumn 201~500m	Winter 20~100m	Winter 101~200m	Winter 201~500m
Scyliorhinus canicula			15.2		43.0	45.1			8.2			12.1
Mustelus mustelus	177.3		45.9						15.1			
M. asterias		14.1	14.2						7.3			
Oxynotus centrina						99.4						
Squalus acanthias									19.0		37.7	73.5
S. blainvillei		66.0	175.0		371.6	39.4						
Squatina squatina							11.2		8.6			
S. oculata								11.6				
Raja asterias								5.7			25.9	17.4
R. clavata												
R. oxyrinchus						148.5			12.4			16.6
R. alba	59.2	51.3	28.5		130.2	66.6					1,307.8	
Dasyatis pastinaca		440.2		80.5				37.6				
D. violacea			57.5									
Argentina sphyraena	26.9			25.7								
Synodus saurus				27.0			7.6					201.4
* *Saurida undosquamis*					32.2							
Chlorophthalmus agassizii								45.2			25.9	
Conger conger												
Macroramphosus scolopax												
Nezumia sclerorhynchus						33.4						14.2
Coelorhynchus coelorhynchus												10.6
* *Merluccius merluccius*	27.1	23.0	26.4		33.0	153.3		28.8	11.1			38.0
Zeus faber	23.1	7.9									28.8	
Capros aper			64.8						237.4			
Epinephelus caninus						126.7						
* *Mullus barbatus*	156.7	23.1	26.7	153.4	45.9		93.7	10.6		210.1	47.1	
* *Upeneus moluccensis*				59.7			19.0			21.6	223.4	
Pagrus pagrus				25.7			13.7					
Boops boops				67.4			44.3	8.8		212.3	29.7	
* *Dentex macrophthalmus*		7.9			147.6			39.3		12.2	90.5	
* *Diplodus annularis*				116.0			45.6			68.9		
* *Pagellus erythrinus*	126.6			130.3	29.9		63.5	20.0		39.3	60.1	
* *P. acarne*										87.7		
* *P. bogaraveo*		19.4									76.8	
Centracanthus cirrus					39.2					55.5		
Spicara maena	190.5									127.3		
S. smaris	83.7						78.7	12.5				
Trichiurus lepturus				185.7								46.2
Lepidopus caudatus												
Scomber japonicus							240.5					
Scorpaena porcus						69.8						
Aspitrigla cuculus		18.5	43.8						8.8			
Lepidotrigla cavillone		20.3			29.9	119.8				13.0		
Lophius piscatorius	91.8	7.9							12.2			13.0

Note: Those species of the 45 species shown that are indicated with an asterisk (*) indicate important species to the fisheries (target species of measurements).

With respect to major invertebrates, those species that demonstrated relatively high CPUA values throughout all seasons included deep-water pink shrimp *Parapenaeus longirostris* (CPUA range at depths of 101 m or more: 0.4-17.7), common cuttlefish *Sepia officinalis* (CPUA range at depths of 100 m or less: 7.4-42.8), veined squid *Loligo forbesi* (CPUA range at depths of 201 m or more: 4.3-49.6) and broadtail squid *Illex coindetii* (CPUA range at depths of 101 m or more: 1.8-38.0). In addition, the CPUA of horned octopus *Eledone cirrhosa* (CPUA range: 15.1-16.1) was relatively high at depths of 200 m or less in summer, while that of common octopus *Octopus vulgaris* (CPUA: 18.2) was relatively high at depths of 100 m or less in autumn (Table 5-1-2-10).

Table 5-1-2-10 Catch Per Unit Area (kg/km^2) of Major Invertebrates in the West Mediterranean Sea

Scientific name \ Season	Spring			Summer			Autumn			Winter		
Stratum	20~100m	101~200m	201~500m	20~100m	101~200m	201~500m	20~100m	101~200m	201~500m	20~100m	101~200m	201~500m
〈Shrimps〉												
Aristaeomorpha foliacea												1.6
Parapenaeus longirostris			1.5			12.9		1.8	0.4		17.7	0.8
Plesionika heterocarpus						1.2			0.4			
〈Cuttlefishes & squids〉												
Sepia elegans						1.4			0.8		3.3	
S. officinalis	18.0			42.8			7.4			13.0	5.5	
S. orbignyana		15.0	7.3		1.7	4.2			0.8			2.3
Sepietta sp.			0.6			1.4			3.7			
Rossia macrosoma			0.7			7.0			2.2			0.7
Loligo forbesi			4.3			38.3	3.3		49.6		2.0	20.3
L. vulgaris											3.8	
Illex coindetii		1.8	26.8			38.0			6.3		7.4	3.0
Todarodes sagittatus						9.9						
〈Octopuses〉												
Octopus vulgaris				8.1			18.2	1.9				
Pteroctopus tetracirrhus			3.7									
Eledone moschata							5.2	0.6			2.0	
E. cirrhosa	1.4	1.8		16.1	15.1		2.2				2.2	
Scaeurgus unicirrhus			1.3									

6) Top Ranking Species for CPUA in the East Mediterranean Sea

Those species of fishes that demonstrated relatively high CPUA values throughout all seasons consisted of longnosed skate *Raja oxyrinchus* (CPUA range at depths of 201 m or more: 10.9-221.3), brushtooth lizardfish *Saurida undosquamis* (CPUA range at depths of 200 m or less: 20.8-112.2), hake *Merluccius merluccius* (CPUA range: 21.2-71.5), red mullet *Mullus barbatus* (CPUA range: 11.5-192.1), golden-banded goatfish *Upeneus moluccensis* (CPUA range at depths of 200 m or less: 6.7-121.0), common pandora *Pagellus erythrinus* (CPUA range at depths of 200 m or less: 11.0-88.3) and anglerfish *Lophius piscatorius* (CPUA range: 10.2-71.3). In addition, those species that demonstrated high CPUA values depending on the season included smoothhound *Mustelus mustelus* (CPUA at strata of 101-200 m in spring and summer: 252.4 and 145.8, respectively), common stingray *Dasyatis pastinaca* (CPUA at strata of 101-200 m in summer and at depths of 100 m or less in autumn: 145.5 and 174.0, respectively), boarfish *Capros aper* (CPUA at depths of 201 m or more in spring: 145.9) and picarel *Spicara smaris* (CPUA at strata of 101-200 m in summer: 141.3) (Table 5-1-2-11).

Table 5-1-2-11 Top 10 Ranked Species of Fishes in Terms of Catch Per Unit Area (kg/km^2) by Season and Strata in the East Mediterranean Sea

Season	Spring			Summer			Autumn			Winter		
Stratum / Scientific name	20~100m	101~200m	201~500m	20~100m	101~200m	201~500m	20~100m	101~200m	201~500m	20~100m	101~200m	201~500m
Scyliorhinus canicula			40.7						10.0			
Mustelus mustelus	24.2	252.4		40.1	145.8							
M. asterias			25.3			79.5						33.4
Squalus blainvillei												13.9
Squatina squatina	28.4					17.1						
S. oculata							16.7	5.2				
Raja asterias						20.8		7.5	13.5			
R. clavata		43.0	40.6								12.2	43.0
R. oxyrinchus			221.3			28.9			10.9			49.3
Dasyatis pastinaca					145.5		174.0					
Gymnura altavela				26.3								
Argentina sphyraena									19.1			
* *Saurida undosquamis*	29.9			112.2			20.8			73.6	33.8	
Chlorophthalmus agassizii			38.0									46.4
Macroramphosus scolopax		17.4					13.1	35.7				
Coelorhynchus coelorhynchus			28.7									
* *Merluccius merluccius*	24.6	64.9	26.3		66.6	21.9	21.8	66.7	21.8	26.5	21.2	71.5
Zeus faber									6.8	8.2		
Capros aper			145.9			15.9			32.1			
Trachurus trachurus						73.9		16.5			15.2	82.9
T. picturatus						21.9			8.7			
Leiognathus klunzingeri				38.9								
* *Mullus barbatus*	54.0	167.5	35.6	93.9	192.1		28.2	75.7	11.5	29.6	19.3	12.1
* *Upeneus moluccensis*	20.0			121.0	36.5		15.6			6.7	101.7	
* *Sparus aurata*										12.9		
Pagrus pagrus	16.7											
Boops boops					83.0		24.2			24.2	23.6	
* *Dentex macrophthalmus*		17.0										
D. maroccanus					79.9							
* *Pagellus erythrinus*	34.7	88.3		41.2			24.8	11.0			16.2	
* *P. acarne*						42.0						
* *P. coeruleostictus*										81.8		
Spicara maena	30.8											
S. flexuosa							13.9	9.6				
S. smaris				43.3	141.3							
Gobius niger				26.6								
* *Sphyraena chrysotaenia*										12.3		
Helicolenus dactylopterus d.			29.1								5.1	
Trigla lucerna										9.1		21.4
Aspitrigla cuculus												
Lepidotrigla cavillone		16.9			26.6			4.5	21.3			
Citharus linguatula		16.1			34.5						13.1	
Arnoglossus laterna				61.7								
Lophius piscatorius	23.5	71.3				21.5		10.2				16.0

Note: Those species of the 44 species shown that are indicated with an asterisk (*) indicate important species to the fisheries (target species of measurements).

With respect to major invertebrates, those species that demonstrated relatively high CPUA values throughout all seasons consisted of deep-water pink shrimp *Parapenaeus longirostris* (CPUA range: 0.4-29.7), elegant cuttlefish *Sepia elegans*, common cuttlefish *Sepia officinalis*, pink cuttlefish *Sepia orbignyana* (CPUA range for the above three species: 0.3-15.0), broadtail squid *Illex coindetii* (CPUA range at depths of 101 m or more: 1.2-27.4) and horned octopus *Eledone cirrhosa* (CPUA range at depths of 200 m or less: 0.6-23.4). In addition, Red-sea mantis shrimp *Oratosquilla massavensis* (CPUA range: 1.3-34.2) demonstrated a relatively high CPUA at depths of 100 m or less in all seasons except winter, while giant red shrimp *Aristaeomorpha foliacea* demonstrated a relatively high CPUA (54.8) at depths of 201 m or more in winter (Table 5-1-2-12).

Table 5-1-2-12 Catch Per Unit Area of Major Invertebrates in the East Mediterranean Sea

Scientific name \ Season	Spring			Summer			Autumn			Winter		
Stratum	20~100m	101~200m	201~500m	20~100m	101~200m	201~500m	20~100m	101~200m	201~500m	20~100m	101~200m	201~500m
〈Shrimps〉												
Aristaeomorpha foliacea												54.8
Parapenaeus longirostris	0.8	11.7	20.3	1.8	20.7	29.7	2.6	2.7	0.4	4.1		13.9
Penaeus kerathurus										1.8		
〈Sea mantis shrimp〉												
Oratosquilla massavensis	2.4			34.2			1.3					
〈Cuttlefishes & squids〉												
Sepia elegans		4.2	1.8		7.7		0.6	1.9	1.8	1.9	4.9	
S. officinalis	0.8			13.2	15.0		4.3	4.1		2.4	4.9	
S. orbignyana		0.8				3.4	0.3		5.5			0.9
Sepietta sp.									2.7			
Rossia macrosoma			1.8					0.9	0.8			
Alloteuthis media	1.0	0.8		0.3	0.7		0.2					
Loligo forbesi							3.2	5.0	9.7			
L. vulgaris	0.8			1.0	51.1					4.4	26.6	0.9
Illex coindetii		2.3	7.4		6.2	27.4		1.2	4.0			2.6
〈Octopuses〉												
Octopus vulgaris	1.1			6.9	14.6		1.8	1.1				
O. salutii									0.4			
Eledone moschata	3.7						2.6	11.4			1.1	
E. cirrhosa		5.7		11.6	23.4		4.6	4.4		0.6		
E. sp.					19.6							
Scaeurgus unicirrhus	4.3					2.2						

(2) Top Ranking Species for Stock Size

1) Top Ranking Species for Stock Size in All Area Surveyed

There were 15 species of fishes (of which three are commercially important species) and 3 species of invertebrates (consisting of 2 species of shrimps and 1 species of octopus) having stock sizes of 1,000 tons or more. The majority of these appeared in the summer and demonstrated maximum stock size in the summer as well. There were 5 species that demonstrated stock sizes of 1,000 tons or more throughout all seasons, namely smallspotted catshark *Scyliorhinus canicula* (stock size range: 1,290-4,633 tons), longnose spurdog *Squalus blainvillei* (stock size range: 1,207-1,597 tons), thornback ray *Raja clavata* (stock size range: 1,706-2,825 tons), hake *Merluccius merluccius* (stock size range: 2,174-6,963 tons) and red mullet *Mullus barbatus* (stock size range: 1,126-2,585 tons). Those species that demonstrated maximum stock size for each season consisted of hake *Merluccius merluccius* in spring and summer (stock size in spring: 2,818 tons, stock size in summer: 6,963 tons), thornback ray *Raja clavata* in autumn (stock size: 2,248 tons) and common stingray *Dasyatis pastinaca* in winter (stock size: 3,124 tons) (Table 5-1-2-13).

Table 5-1-2-13 Species Having Stock Sizes of 1,000 Tons or More in All Areas Surveyed by Season

Scientific name \ Season	Spring	Summer	Autumn	Winter
〈Fishes〉				
Scyliorhinus canicula	1,321	4,633	1,699	1,290
Mustelus mustelus	1,492			
Squalus blainvillei	1,597	1,257	1,207	1,227
Raja clavata	1,751	2,825	2,248	1,706
Dasyatis pastinaca			1,032	3,124
Myliobatis aquila				1,024
Macroramphosus scolopax		1,289		
* *Merluccius merluccius*	2,818	6,963	2,174	2,608
Capros aper		1,374		
Trachurus trachurus		1,741		
* *Mullus barbatus*	1,866	2,585	1,126	1,631
* *Pagellus erythrinus*		1,241		
Trigla lyra		1,082		
Lepidotrigla cavillone		1,398		
Lophius piscatorius	1,322	2,067	1,117	
〈Shrimp & lobster〉				
Parapenaeus longirostris	1,050	1,291		1,099
Nephrops norvegicus		1,094		1,221
〈Octopus〉				
Eledone cirrhosa		2,734		

Note: Those species of the 15 fishes species shown that are indicated with an asterisk (*) indicate important species to the fisheries.

2) Top Ranking Species for Stock Size in The Sea of Marmara

There were four species having large stock sizes at all depths throughout all seasons, namely longnose spurdog *Squalus blainvillei* (stock size range: 12-720 tons), thornback ray *Raja clavata* (stock size range: 12-749 tons), hake *Merluccius merluccius* (stock size range: 46-2,349 tons) and deep-water pink shrimp *Parapenaeus longirostris* (stock size range: 9-663 tons). Other species having large stock sizes at depths of 200 m or less, and particularly at depths of 100 m or less, consisted of sprat *Sprattus sprattus sprattus* (stock size range at depths of 100 m or less in all seasons except winter: 96-255 tons), Atlantic horse-mackerel *Trachurus trachurus* (stock size range at depths of 100 m or less in all seasons except autumn: 161-485 tons) and piper gurnard *Trigla lyra* (stock size range at depths of 200 m or less throughout all seasons: 11-261 tons). At 201 m or more, blackmouth catshark *Galeus melastomus* (stock size range: 34-336 tons) demonstrated large stock size. In addition, those species that demonstrated large stock sizes depending on the season included smoothhound *Mustelus mustelus* (stock size at depths of 100 m or less: 513 tons) in spring, and common stingray *Dasyatis pastinaca* (stock size at depths of 100 m or less: 1,317 tons), common eagle ray *Myliobatis aquila* (stock size range at depths of 200 m or less: 313-558 tons) and brown comber *Serranus hepatus* (stock size at depths of 100 m or less: 425 tons) in winter (Table 5-1-2-14).

Table 5-1-2-14 Top 10 Ranked Species in Terms of Stock Size (tons) by Season and Strata in The Sea of Marmara

Scientific name \ Season / Stratum	Spring 20~100m	Spring 101~200m	Spring 201~500m	Summer 20~100m	Summer 101~200m	Summer 201~500m	Autumn 20~100m	Autumn 101~200m	Autumn 201~500m	Winter 20~100m	Winter 101~200m	Winter 201~500m
⟨Fishes⟩												
Scyliorhinus canicula		11					98	38	1	139	14	31
Galeus melastomus			336			218			34			185
Mustelus mustelus	513						125				18	
M. asterias					19							
Oxynotus centrina			11						1			
Squalus acanthias	148			173								
S. blainvillei	720	194		403	53	12	583	208		181		119
Centrophorus granulosus									60			28
Squatina squatina				160								
Raja asterias												79
R. clavata	315	28	68	247	92	12	749	89	43	496	14	
R. oxyrinchus			12					29			41	50
Dasyatis pastinaca	200	97								1,317	184	
Myliobatis aquila				220						558	313	
Sprattus sprattus sprattus	255			132	12		96					
Conger conger			11									
Nezumia sclerorhynchus			44			4			18			
* *Merluccius merluccius*	975	206	64	2,349	854	442	478	143	156	775	46	252
Gadiculus argenteus					18							
Merlangius merlangus euxinus				222	33			48				
Micromesistius poutassou			34						20			
Serranus hepatus							220			425		
Trachurus trachurus	485	12		161		11		22		290		
* *Mullus barbatus*										111		
Helicolenus dactylopterus d.						4						21
Trigla lyra	261	11			27		90	30	4		75	
T. lucerna							91					
Lepidotrigla cavillone		6										
Lophius piscatorius			29									
L. budegassa												54
⟨Shrimps⟩												
Parapenaeus longirostris	582	142	9	663	132	69	352	148	14	430	189	111
Plesionika heterocarpus		34			13			50			31	

Note: Those species of the 30 fishes species shown that are indicated with an asterisk (*) indicate important species to the fisheries.

3) Top Ranking Species for Stock Size in the North Aegean Sea

There were eight species that demonstrated large stock sizes throughout all seasons, namely smallspotted catshark *Scyliorhinus canicula* (stock size range: 71-2,902 tons), thornback ray *Raja clavata* (stock size range: 161-942 tons), hake *Merluccius merluccius* (stock size range: 111-1,127 tons), blue whiting *Micromesistius poutassou* (stock size range at depths of 201 m or more: 176-498 tons), red mullet *Mullus barbatus* (stock size range at depths of 200 m or less: 67-651 tons), four-spotted megrim *Lepidorhombus boscii* (stock size range at depths of 201 m or more: 191-410 tons), anglerfish *Lophius piscatorius* (stock size range: 110-651 tons) and Norway lobster *Nephrops norvegicus* (stock size range at depths of 201 m or more: 636-1,178 tons, demonstrating the largest stock size in this water depth zone throughout all seasons). The stock sizes of longnose spurdog *Squalus blainvillei*, common stingray *Dasyatis pastinaca*, argentine *Argentina* sphyraena, Atlantic horse-mackerel *Trachurus trachurus*, common octopus *Octopus vulgaris*, musky octopus *Eledone moschata* and horned octopus *Eledone cirrhosa* also demonstrated high values of 400-1,000 tons depending on the season (Table 5-1-2-15).

Table 5-1-2-15 Top 10 Ranked Species in Terms of Stock Size (tons) by Season and Strata in the North Aegean Sea

Scientific name \ Season / Stratum	Spring			Summer			Autumn			Winter		
	20~100m	101~200m	201~500m	20~100m	101~200m	201~500m	20~100m	101~200m	201~500m	20~100m	101~200m	201~500m
⟨Fishes⟩												
Scyliorhinus canicula	411		152	2.902	383	545	1.103	71		505	219	
S. stellaris	403	124										
Squalus acanthias										254		
S. blainvillei	249	77				448				174	147	
Raja clavata	644		294	942	455	678	469	161	533	389	247	322
R. oxyrinchus									287			177
Dasyatis pastinaca				329						221	605	
Myliobatis aquila		141										
Argentina sphyraena		75	156			608					228	116
Coelorhynchus coelorhynchus			201									
* *Merluccius merluccius*	543	131	266	1.127	638	860	409	111	311	417	242	208
Micromesistius poutassou			176			498			222			277
Trisopterus minutus capelanus							172	74				
Phycis blennoides												118
Zeus faber		89						109			116	
Capros aper		113										
* *Serranus cabrilla*								60				
S. hepatus							131					
Trachurus trachurus					410		146	157			214	
* *Mullus barbatus*	460	161		651	264		273	67		300	157	
* *M. surmuletus*					175							
* *Dentex macrophthalmus*								41				
* *Diplodus annularis*	314			338								
* *Pagellus erythrinus*				337								
Scorpaena scrofa									290			
Trigla lyra		77			203							
Aspitrigla cuculus					182							
Citharus linguatula							125					
Lepidorhombus boscii			408			410			288			191
Lophius piscatorius	447	127		609	651	502	513	172	249	230	229	110
⟨Shrimp & lobster⟩												
Parapenaeus longirostris			161						221			273
Nephrops norvegicus			636			991			684			1.178
⟨Squid⟩												
Illex coindetii									138			
⟨Octopuses⟩												
Octopus vulgaris	287			346						219		
Eledone moschata	373						203			424		
E. cirrhosa			182	1.090	618	689						

Note: Those species of the 30 fishes species shown that are indicated with an asterisk (*) indicate important species to the fisheries.

4) Top Ranking Species for Stock Size in the South Aegean Sea

There were five species that had large stock sizes throughout all seasons, namely smallspotted catshark *Scyliorhinus canicula* (stock size range: 45-370 tons), thornback ray *Raja clavata* (stock size range at depths of 101 m or more: 35-215 tons), hake *Merluccius merluccius* (stock size range: 35-203 tons), red mullet *Mullus barbatus* stock size range at depths of 200 m or less: 26-476 tons) and common pandora *Pagellus erythrinus* (stock size range at depths of 200 m or less: 22-439 tons). At depths of 100 m or less, violet stingray *Dasyatis violacea*, comber *Serranus cabrilla*, white grouper *Epinephelus aeneus*, Atlantic horse-mackerel *Trachurus trachurus*, bogue *Boops boops*, large-eye dentex *Dentex macrophthalmus*, annular sea bream *Diplodus annularis*, axillary sea bream *Pagellus acarne*, picarel *Spicara smaris* and horned octopus *Eledone cirrhosa*, at strata of 101-200 m, snipe fish *Macroramphosus scolopax*, and at depths of 201 m or more, longnose spurdog *Squalus blainvillei*, longnosed skate *Raja oxyrinchus*, boarfish *Capros aper*, piper gurnard *Trigla lyra*, and

large-scaled gurnard *Lepidotrigla cavillone* each demonstrated stock sizes from 100 tons to 1,200 tons depending on the season (Table 5-1-2-16).

Table 5-1-2-16 Top 10 Ranked Species in Terms of Stock Size (tons) by Season and Strata in the South Aegean Sea

Scientific name \ Season / Stratum	Spring			Summer			Autumn			Winter		
	20~100m	101~200m	201~500m	20~100m	101~200m	201~500m	20~100m	101~200m	201~500m	20~100m	101~200m	201~500m
⟨Fishes⟩												
Scyliorhinus canicula	125	45	282		89	370		80	143	109		141
Squalus acanthias						127						
S. blainvillei					57				283			330
Raja asterias		24										
R. clavata		66			215	184		35	139			80
R. oxyrinchus			183			171						215
R. alba											163	
Dasyatis pastinaca		27										
D. violacea				749								
Myliobatis aquila									74		24	
Argentina sphyraena			71			135						76
Chlorophthalmus agassizii												193
Macroramphosus scolopax					1,189			40			155	
* *Merluccius merluccius*	121	55			107		123	71			35	203
Gadiculus argenteus												101
Zeus faber					87							
Capros aper			228			1,027			84			
* *Serranus cabrilla*	251			142						211		
S. hepatus				135						166		
Epinephelus aeneus				247								
Trachurus trachurus						259	260	42			31	
* *Mullus barbatus*	159	43		396	26		200	102		476	89	
* *M. surmuletus*										190		
Boops boops							223				47	
* *Dentex macrophthalmus*				629				36			134	
* *Diplodus annularis*	102			229			84					
* *Pagellus erythrinus*	143			439			80				22	
* *P. acarne*	81			110			375					
* *Spicara smaris*					47					257		
Scomber japonicus							60					
Scorpaena elongata									74			
Helicolenus dactylopterus d.			68			145						
Trigla lyra			91			335		12	67			
Aspitrigla cuculus			95								34	102
Lepidotrigla cavillone	70	26		155		355			77			
Trigloporus lastoviza	63	17								126		
Citharus linguatula		15								90		
Lepidorhombus boscii			98									
Lophius piscatorius		60	84		66			13	73			
⟨Lobster⟩												
Nephrops norvegicus			133									
⟨Squids⟩												
Loligo forbesi									90			
L. vulgaris							119			70		
Illex coindetii												92
⟨Octopuses⟩												
Eledone moschata	82						56	11				
E. cirrhosa					72					315		

Note: Those species of the 39 fishes species shown that are indicated with an asterisk (*) indicate important species to the fisheries.

5) Top Ranking Species for Stock Size in the West Mediterranean Sea

There were four species that had large stock sizes throughout all seasons, namely smallspotted catshark *Scyliorhinus canicula* (stock size range at depths of 201 m or more: 12-65 tons), hake *Merluccius merluccius* (stock size range: 14-221 tons), red mullet *Mullus barbatus* (stock size range: 6-235 tons) and common pandora *Pagellus erythrinus* (stock size range at depths of 200 m or less: 12-145 tons). Other top ranked species in terms of stock size included smoothhound *Mustelus mustelus*, bogue *Boops boops*,

annular sea bream *Diplodus annularis*, blotched picarel *Spicara maena*, picarel *Spicara smaris*, large-eyed hairtail *Trichiurus lepturus*, chub mackerel *Scomber japonicus* and anglerfish *Lophius piscatorius* at depths of 100 m or less, angelshark *Squatina squatina*, common stingray *Dasyatis pastinaca*, golden-banded goatfish *Upeneus moluccensis* and large-eye dentex *Dentex macrophthalmus* at strata of 101-200 m, and spurdog *Squalus acanthias*, longnose spurdog *Squalus blainvillei*, longnosed skate *Raja oxyrinchus*, shortnose greeneye *Chlorophthalmus augustus*, boarfish *Capros aper* and large-scaled gurnard *Lepidotrigla cavillone* at depths of 201 m or more. The stock sizes of these species were 100-300 tons depending on the season (however, the stock size of common stingray *Dasyatis pastinaca* in winter was 776 tons) (Table 5-1-2-17).

Table 5-1-2-17 Top 10 Ranked Species in Terms of Stock Size (tons) by Season and Strata in the West Mediterranean Sea

Scientific name \ Season / Stratum	Spring 20~100m	Spring 101~200m	Spring 201~500m	Summer 20~100m	Summer 101~200m	Summer 201~500m	Autumn 20~100m	Autumn 101~200m	Autumn 201~500m	Winter 20~100m	Winter 101~200m	Winter 201~500m
‹Fishes›												
Scyliorhinus canicula			22		26	65			12			17
Mustelus mustelus	198		66									
M. asterias		8							22			
Squalus acanthias						143						
S. blainvillei		39	252						27		22	106
Squatina squatina					220	57						
S. oculata							13		12			
Raja asterias								7				
R. clavata								3				25
R. oxyrinchus						214			18			24
R. alba	66	30	41		77	96						
Dasyatis pastinaca		261									776	
D. violacea				90				22				
Argentina sphyraena			83									
Synodus saurus	30			29								
* *Saurida undosquamis*				30								
Chlorophthalmus agassizii												290
Conger conger					19							
Macroramphosus scolopax								27			15	
Nezumia sclerorhynchus												21
* *Merluccius merluccius*	30	14	38		20	221		17	16			55
Zeus faber	26										17	
Capros aper			93						342			
Epinephelus caninus						182						
* *Mullus barbatus*	175	14	38	171	27		105	6		235	28	
* *Upeneus moluccensis*				67			21			24	133	
Pagrus pagrus							15					
Boops boops				75			50	5		237	18	
* *Dentex macrophthalmus*					88			23			54	
* *Diplodus annularis*				129			51			77		
* *Pagellus erythrinus*	141			145			71	12		44	36	
* *P. acarne*										98		
* *P. bogaraveo*		12										
Centracanthus cirrus					23						46	
Spicara maena	112									62		
S. smaris	93						88	7		142		
Trichiurus lepturus				207								
Lepidopus caudatus												67
Scomber japonicus							269					
Scorpaena porcus						101						
Aspitrigla cuculus		11	63						13			
Lepidotrigla cavillone		12			18	173				15		
Lophius piscatorius	103								18			19
‹Shrimp›												
Parapenaeus longirostris					18							
‹Cuttlefishes & squids›												
Sepia officinalis				48						15		
S. orbignyana		9										
Loligo forbesi						55			72			29
Illex coindetii			39									
‹Octopuses›												
Octopus vulgaris							20					

Note: Those species of the 43 fishes species shown that are

indicated with an asterisk (*) indicate important species to the fisheries.

6) Top Ranking Species for Stock Size in the East Mediterranean Sea

There were seven species that demonstrated large stock sizes throughout all seasons, namely longnosed skate *Raja oxyrinchus* (stock size range at depths of 201 m or more: 24-482 tons), brushtooth lizardfish *Saurida undosquamis* (stock size range at depths of 100 m or less: 123-665 tons), hake *Merluccius merluccius* (stock size range: 37-156 tons), red mullet *Mullus barbatus* (stock size range: 25-556 tons), golden-banded goatfish *Upeneus moluccensis* (stock size range at depths of 200 m or less: 40-717 tons), common pandora *Pagellus erythrinus* (stock size range at depths of 200 m or less: 19-244 tons) and anglerfish *Lophius piscatorius* (stock size range: 18-139 tons). Other species that demonstrated large stock sizes included smoothhound *Mustelus mustelus* (stock size range in spring and summer: 144-445 tons), common stingray *Dasyatis pastinaca* (stock size range in summer and autumn: 293-1,032 tons), pony fish *Leiognathus klunzingeri* (stock size at depths of 100 m or less in summer: 230 tons), bogue *Boops boops* (stock size range in all seasons except spring: 143-167 tons), Morocco dentex *Dentex maroccanus* (stock size at 101-200 m strata in summer: 161 tons), blue-spotted sea bream *Pagrus coeruleostictus* (stock size at depths of 100 m or less in winter: 485 tons), blotched picarel *Spicara maena* (stock size at depths of 100 m or less in spring: 183 tons), picarel *Spicara smaris* (stock size range in summer: 256-276 tons), scaldfish *Arnoglossus laterna* (stock size at depths of 100 m or less in summer: 365 tons) and Red-sea mantis shrimp *Oratosquilla massavensis* (stock size at depths of 100 m or less in summer: 203 tons) at depths of 200 m or less, and starry smoothhound *Mustelus asterias* (stock size in summer: 173 tons), shortnose greeneye *Chlorophthalmus augustus* (stock size range in spring and winter: 83-101 tons), boarfish *Capros aper* (stock size in spring: 318 tons), Atlantic horse-mackerel *Trachurus trachurus* (stock size range in summer and winter: 161-181 tons) and giant red shrimp *Aristaeomorpha foliacea* (stock size in winter: 119 tons) at depths of 201 m or more (Table 5-1-2-18).

Table 5-1-2-18 Top 10 Ranked Species in Terms of Stock Size (Tons) by Season and Strata in the East Mediterranean Sea

Scientific name \ Season / Stratum	Spring			Summer			Autumn			Winter		
	20~100m	101~200m	201~500m	20~100m	101~200m	201~500m	20~100m	101~200m	201~500m	20~100m	101~200m	201~500m
⟨Fishes⟩												
Scyliorhinus canicula			89						22			
Mustelus mustelus	144	445		238	294							
M. asterias			55			173						
Squalus blainvillei												73
Squatina squatina	169											30
S. oculata							99	9				
Raja asterias						45		13	29			
R. clavata		76	89								21	94
R. oxyrinchus			482			63			24			107
Dasyatis pastinaca					293		1.032					
Argentina sphyraena									42			
* *Saurida undosquamis*	177			665			123			436	60	
Chlorophthalmus agassizii			83									101
Macroramphosus scolopax		31					78	63				
Coelorhynchus coelorhynchus			63									
* *Merluccius merluccius*	146	114	57		131	48	129	118	48	157	37	156
Zeus faber										49		
Capros aper			318						76			
Trachurus trachurus						161		29			27	181
T. picturatus						48			19			
Leiognathus klunzingeri				230								
* *Mullus barbatus*	320	295	78	556	387		167	133	25	175	34	
* *Upeneus moluccensis*	118			717	72		92			40	179	
* *Sparus aurata*										77		
Pagrus pagrus	99											
Boops boops					167		144			143	42	
* *Dentex macrophthalmus*		30										
D. maroccanus					161							
* *Pagellus erythrinus*	206	156		244			147	19			29	
* *P. acarne*						92						
* *P. coeruleostictus*										485		
Spicara maena	183											
S. flexuosa							82	17				
S. smaris				256	276							
Gobius niger				158								
* *Sphyraena chrysotaenia*										73		
Helicolenus dactylopterus d.			63									
Aspitrigla cuculus										54		47
Lepidotrigla cavillone		30							46			
Citharus linguatula		28			61						23	
Arnoglossus laterna				365								
Lophius piscatorius	139	126				47		18				35
⟨Shrimps & Sea mantis shrimp⟩												
Aristaeomorpha foliacea												119
Parapenaeus longirostris						65						
Oratosquilla massavensis				203								
⟨Squids⟩												
Loligo forbesi									21			
L. vulgaris					102						47	
Illex coindetii						60						
⟨Octopus⟩												
Eledone moschata								20				

Note: Those species of the 42 fishes species shown that are indicated with an asterisk (*) indicate important species to the fisheries.

A comparison was made between the CPUA and estimated stock sizes for all fishes species and major invertebrates between each sub area as indicated below.

With the exception of summer, the CPUA of fishes tended to be high in The Sea of Marmara and the West Mediterranean Sea. The CPUA of fishes in summer were high in all sub areas, reaching values of roughly 900-1,200. The CPUA of invertebrates tended to be high in The Sea of Marmara and the North Aegean Sea throughout all seasons (Table 5-1-2-19).

The stock sizes in all areas for both fishes and invertebrates were large in summer, totalling roughly 50,000 tons

for fishes and roughly 8,000 tons for invertebrates. The stock sizes were roughly 20,000-30,000 tons for fishes and roughly 3,000-5,000 tons for invertebrates in the other three seasons. The sub area demonstrating the largest stock sizes for both fishes and invertebrates throughout all seasons was the North Aegean Sea. Stock sizes in that sub area accounted for roughly 35-45% of the total stock sizes of fishes, and roughly 55-65% of the total stock sizes of invertebrates (Table 5-1-2-19).

Thus, despite CPUA values for both fishes and invertebrates in the North Aegean Sea being equal or somewhat lower than other sub areas, particularly in the case of fishes, the stock sizes in that sub area are the largest. The reason for this is that the surveyed area of the North Aegean Sea is extremely wide, accounting for 44% of the total area surveyed (three times larger than the surveyed area of The Sea of Marmara, and 7 times larger than the surveyed area of the West Mediterranean Sea).

Table 5-1-2-19 Comparison of CPUA and Estimated Stock Sizes of Fishes and Invertebrates Between Sub Areas

Classification		Sub srea	Spring	Summer	Autumn	Winter
CPUA (Catch in kg／km²)	Fishes	The Sea of Marmara	846	997	634	949
		North Aegean Sea	507	1,035	407	428
		South Aegean Sea	481	1,188	436	510
		West Mediterranean Sea	792	1,023	462	1,152
		East Mediterranean Sea	571	893	356	355
		All area	609	1,023	443	636
	Invertebrates	The Sea of Marmara	112	138	96	132
		North Aegean Sea	82	211	56	91
		South Aegean Sea	61	89	50	60
		West Mediterranean Sea	28	67	35	29
		East Mediterranean Sea	21	91	25	39
		All area	70	146	53	83
	Fishes & Invertebrates	The Sea of Marmara	959	1,134	730	1,081
		North Aegean Sea	589	1,246	463	518
		South Aegean Sea	541	1,277	486	569
		West Mediterranean Sea	820	1,089	497	1,181
		East Mediterranean Sea	592	984	381	394
		All area	679	1,169	496	719
Stock size in tons	Fishes	The Sea of Marmara	5,824	6,597	4,215	6,624
		North Aegean Sea	10,279	21,577	8,625	9,130
		South Aegean Sea	3,999	9,865	3,617	4,555
		West Mediterranean Sea	2,358	3,219	1,458	2,933
		East Mediterranean Sea	5,945	8,411	3,315	3,431
		All area	28,406	49,669	21,229	26,674
	Invertebrates	The Sea of Marmara	787	902	593	877
		North Aegean Sea	2,196	4,947	1,687	2,752
		South Aegean Sea	690	809	454	718
		West Mediterranean Sea	101	251	136	82
		East Mediterranean Sea	217	869	244	316
		All area	3,991	7,777	3,114	4,745
	Fishes & Invertebrates	The Sea of Marmara	6,611	7,499	4,807	7,501
		North Aegean Sea	12,475	26,524	10,312	11,882
		South Aegean Sea	4,689	10,675	4,071	5,274
		West Mediterranean Sea	2,459	3,469	1,594	3,015
		East Mediterranean Sea	6,162	9,280	3,559	3,747
		All area	32,397	57,446	24,344	31,419

5-1-3 Distribution and Stock Size of Important Species

5-1-3 Distribution and Stock Size of Important Species

The important species being dealt with here consist of the 17 commercially important species indicated in Table 2-1 of Chapter 2, as well as 4 of the 18 species having a stock size of 1,000 tons or more indicated in Table 5-1-2 of Chapter 5 that are considered to be economically important, namely Atlantic horse-mackerel *Trachurus trachurus*, deep-water pink shrimp *Parapenaeus longirosiris*, Norway lobster *Nephrops norvegicus* and horned octopus *Eledone cirrhosa*.

The stock size was calculated using the method described in Section 3-1-1 of Chapter 3. The catches of important species during each season and at each trawling station were revised into values per square kilometer of unit area, and distribution charts were then prepared based on those values.

(1) Brushtooth Lizardfish *Saurida undosquamis*

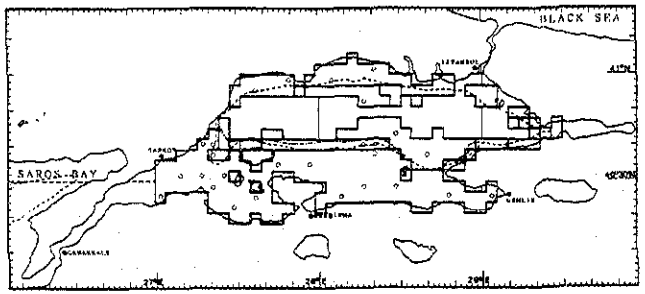
1) Distribution

The distribution of this species is limited to depths of 200 m or less at points in the Aegean Sea and Mediterranean Sea south of 37° north latitude. This species was primarily distributed in the East Mediterranean Sea (Figs. 5-1-3-1-1 to 5-1-3-1-4). In addition, its appearance frequency in the East Mediterranean Sea was high at depths of 100 m or less, and within a range of 75-100% throughout all seasons (Table 5-1-3-1).

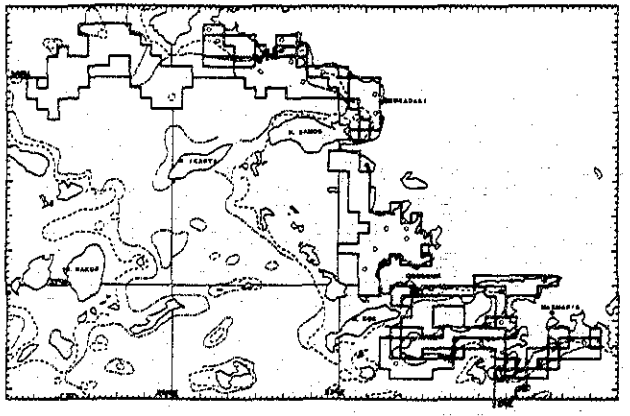
Table 5-1-3-1 Appearance Frequency of Brushtooth Lizardfish*

Sub area	Stratum (m)	Appearance Frequency (%)			
		Spring	Summer	Autumn	Winter
The Sea of Marmara	20~500	0	0	0	0
North Aegean Sea	20~500	0	0	0	0
South Aegean Sea	20~100	8	0	0	0
	101~500	0	0	0	0
	Sub total	4	0	0	0
West Mediterranean Sea	20~100	25	25	50	33
	101~500	0	0	0	0
	Sub total	10	10	20	11
East Mediterranean Sea	20~100	79	92	74	100
	101~200	57	14	0	100
	201~500	0	0	0	0
	Sub total	66	66	50	70
All area	20~100	24	24	21	11
	101~200	15	3	0	14
	201~500	0	0	0	0
	Total	18	14	12	9

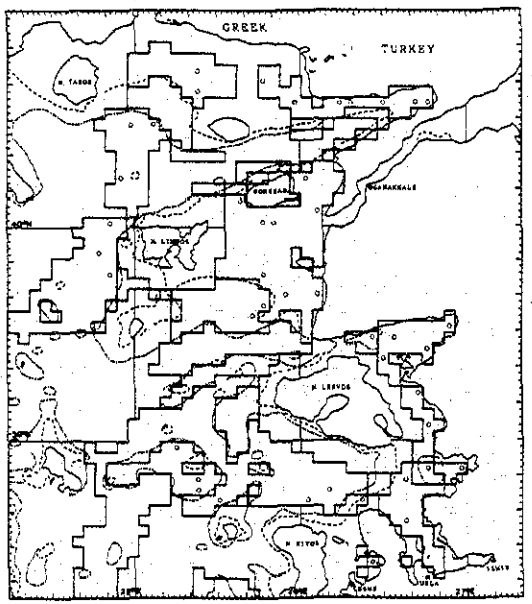
* Appearance frequency: No. caught / No. of trawls x 100%



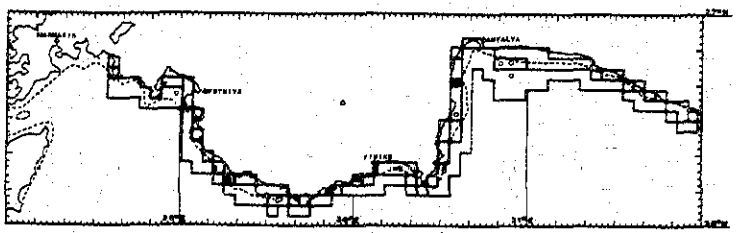
The Sea of Marmara



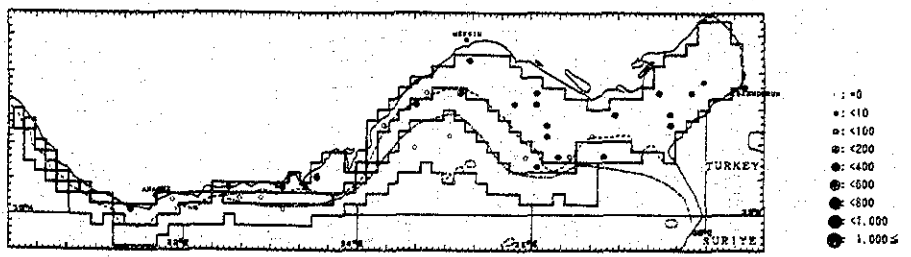
South Aegean Sea



North Aegean Sea

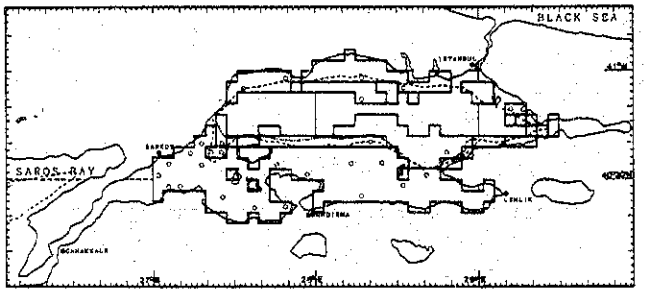


West Mediterranean Sea

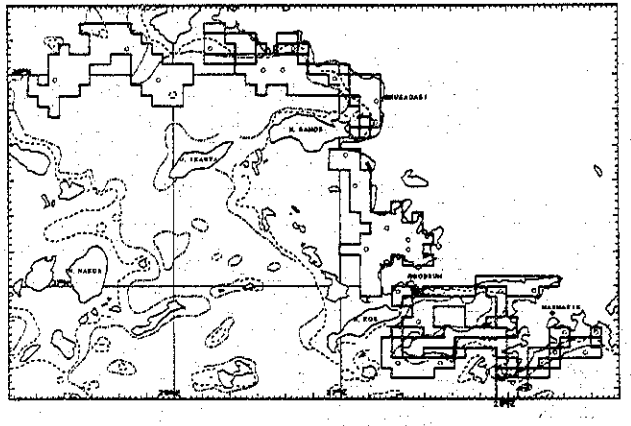


East Mediterranean Sea

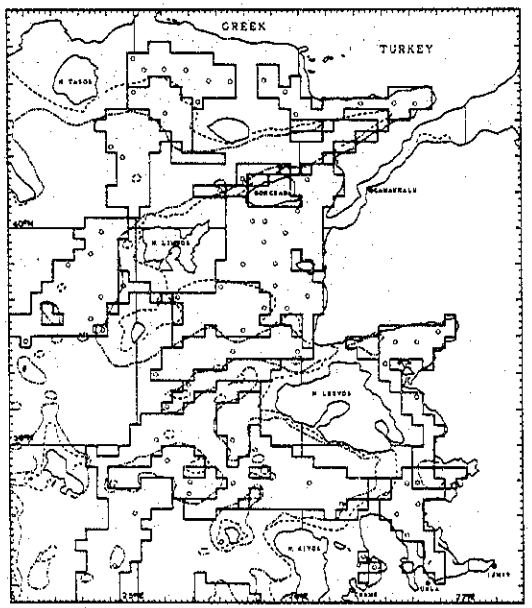
Fig.5-1-3-1-1 The catch in kg of brushtooth lizardfish *Saurida undosquamis* at each stations in the spring season survey



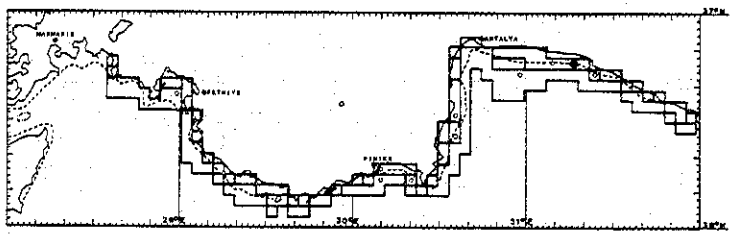
The Sea of Marmara



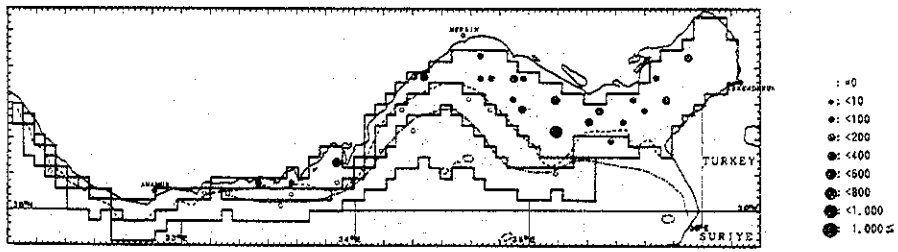
South Aegean Sea



North Aegean Sea

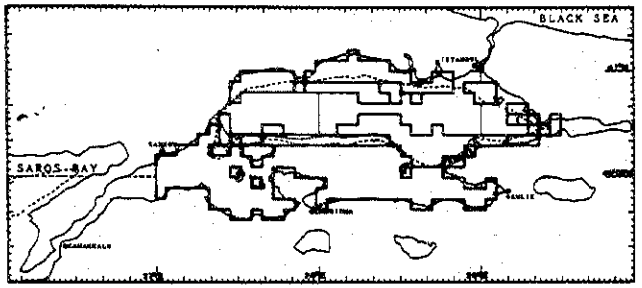


West Mediterranean Sea

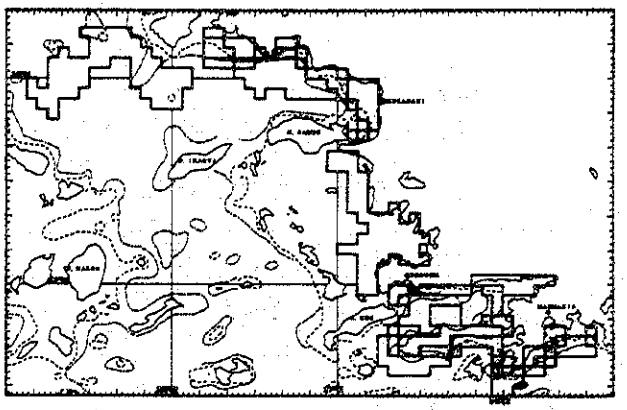


East Mediterranean Sea

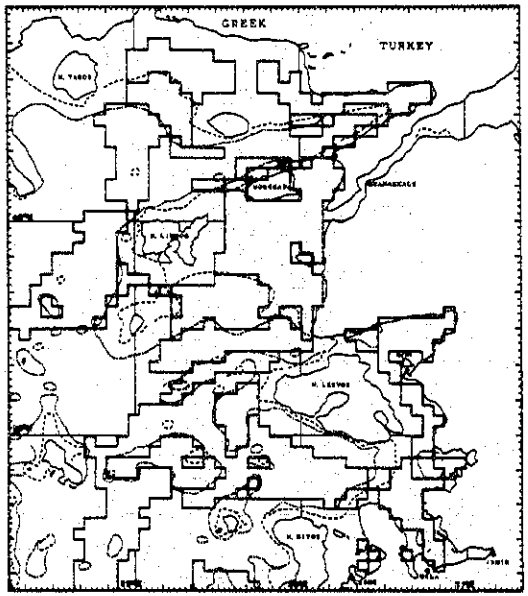
Fig.5-1-3-1-2 The catch in kg of brushtooth lizardfish *Saurida undosquamis* at each stations in the summer season survey



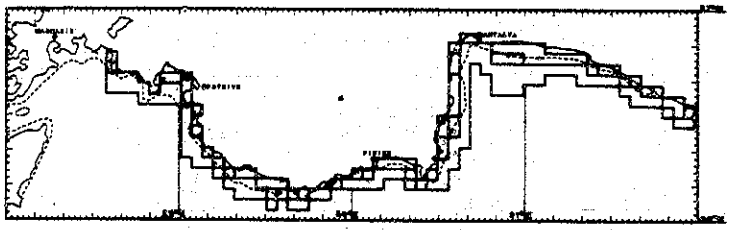
The Sea of Marmara



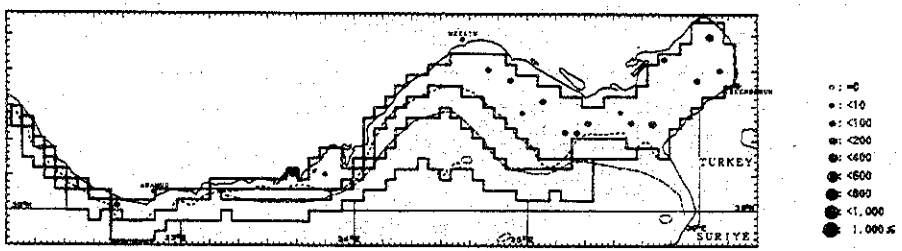
South Aegean Sea



North Aegean Sea

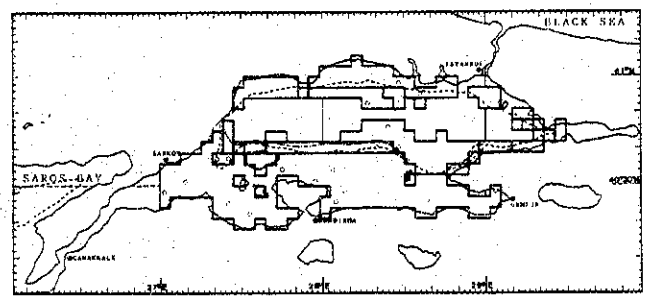


West Mediterranean Sea

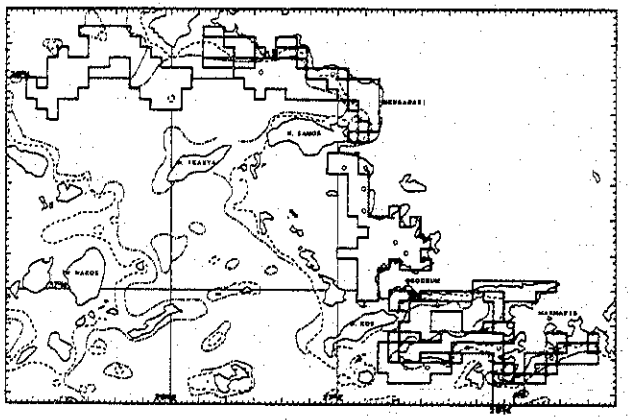


East Mediterranean Sea

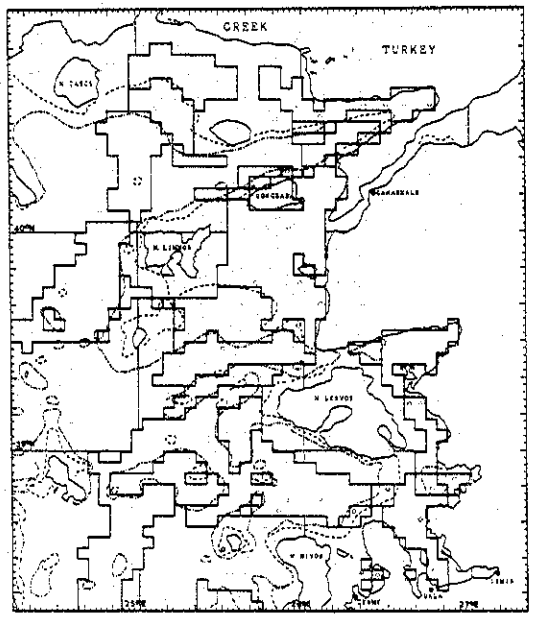
Fig.5-1-3-1-3 The catch in kg of brushtooth lizardfish *Saurida undosquamis* at each stations in the autumn season survey



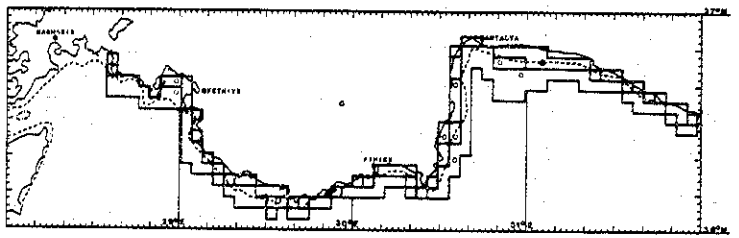
The Sea of Marmara



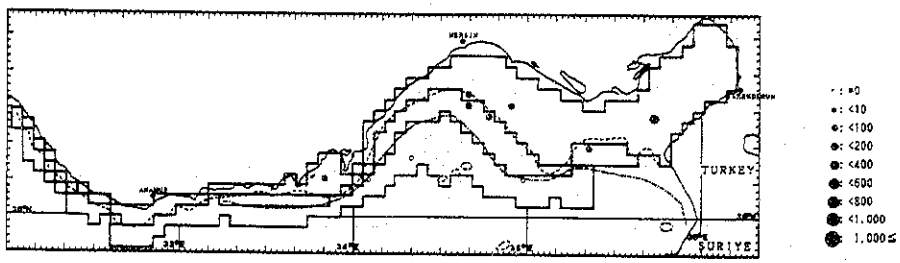
South Aegean Sea



North Aegean Sea



West Mediterranean Sea



East Mediterranean Sea

Fig.5-1-3-1-4 The catch in kg of brushtooth lizardfish *Saurida undosquamis* at each stations in the winter season survey

The catch per unit area (CPUA) of this species was high in the summer and low in the other three seasons. Comparison of CPUA between strata revealed CPUA to be high at strata of 20-100 m throughout all seasons. In addition, the CPUA of 101-200 m strata in the East Mediterranean Sea demonstrated a maximum in winter, and then decreased from spring to autumn (Table 5-1-3-2).

Table 5-1-3-2 Catch Per Unit Area of Brushtooth Lizardfish

Sub area	Stratum (m)	Mean catch in kg/km²			
		Spring	Summer	Autumn	Winter
The Sea of Marmara	20~500	0	0	0	0
North Aegean Sea	20~500	0	0	0	0
South Aegean Sea	20~100	0.2	0	0	0
	101~500	0	0	0	0
	Sub total	0.1	0	0	0
West Mediterranean Sea	20~100	2.8	27.0	7.6	10.9
	101~500	0	0	0	0
	Sub total	1.1	10.8	3.0	3.6
East Mediterranean Sea	20~100	29.9	112.2	20.8	73.6
	101~200	11.5	3.7	0	33.8
	201~500	0	0	0	0
	Sub total	22.8	75.6	14.1	39.6
All area	20~100	5.3	28.6	5.6	7.7
	101~200	1.8	0.8	0	5.2
	201~500	0	0	0	0
	Total	3.5	16.4	3.4	5.4

2) Stock Size

The estimations of the stock size of brushtooth lizardfish are indicated in Table 5-1-3-3. The total stock size was 210 tons in the spring (95% confidence interval: ±70 tons, coefficient of variation CV: 17%), 699 tons in the summer (95% confidence interval: ±368 tons, CV: 26%), 132 tons in autumn (95% confidence interval: ±96 tons, CV: 35%) and 508 tons in winter (95% confidence interval: ±1,025 tons, CV: 63%). The stock size at strata of 20-100 m in the East Mediterranean Sea was overwhelmingly large, accounting for 85-95% of the total stock size throughout all seasons.

The difference in the estimations of stock size between seasons was a minimum of 100 tons and a maximum of 600 tons. With the exception of summer, differences in the estimations of stock size between the other three seasons are not significant in consideration of their 95% confidence intervals. Differences in the estimated stock size with summer, and particularly between summer and spring and summer and autumn, are significant. These differences were presumed to be mainly due to seasonal migration

of this species.

This species is an Indian Ocean-West Pacific species that entered the east part of the Mediterranean Sea through the Suez Canal. It is known to be a demersal fish that normally thrives on sand and mud bottoms at a depth of 100 m or less. In view of the above, the majority of this species probably migrates from the southern portion of the Mediterranean Sea, outside the surveyed areas, to the northern portion (the East Mediterranean Sea in this survey) in summer when water temperatures are high (bottom strata water temperature of 20°C and above), and in the opposite direction during seasons when water temperatures are low (bottom strata water temperature of 20°C and below).

Table 5-1-3-3 Estimation of Stock Size of Brushtooth Lizardfish

Sub area	Stratum (m)	Stock size in tons (t)			
		Spring	Summer	Autumn	Winter
The Sea of Marmara	20~500	0	0	0	0
North Aegean Sea	20~500	0	0	0	0
South Aegean Sea	20~100	0.7	0	0	0
	101~500	0	0	0	0
	Sub total	0.7	0	0	0
West Mediterranean Sea	20~100	3.1	30.1	8.5	12.1
	101~500	0	0	0	0
	Sub total	3.1	30.1	8.5	12.1
East Mediterranean Sea	20~100	177.1	665.2	123.4	436.4
	101~200	20.3	3.8	0	59.5
	201~500	0	0	0	0
	Sub total	197.4	668.9	123.4	495.9
All area	20~100	180.9	695.3	131.9	448.5
	101~200	20.3	3.8	0	59.5
	201~500	0	0	0	0
	Total	201.2	699.1	131.9	508.0
* 95% confidence interval		± 69.6	± 368.3	± 96.1	± 1,025.2

* 95% confidence interval was calculated to total stock size.

(2) Hake *Merluccius merluccius*

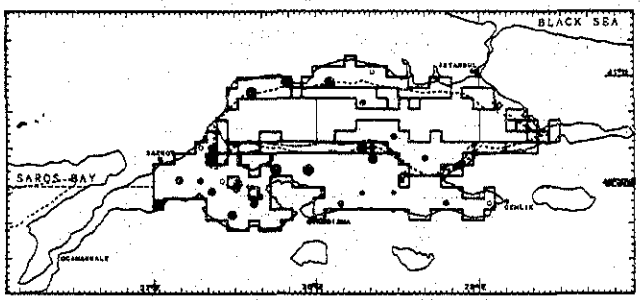
1) Distribution

This species was widely distributed over the entire survey area throughout all seasons (Figs. 5-1-3-2-1 to 5-1-3-2-4). In addition, the appearance frequency was generally stable at 70-85% throughout all areas surveyed in each season (Table 5-1-3-4).

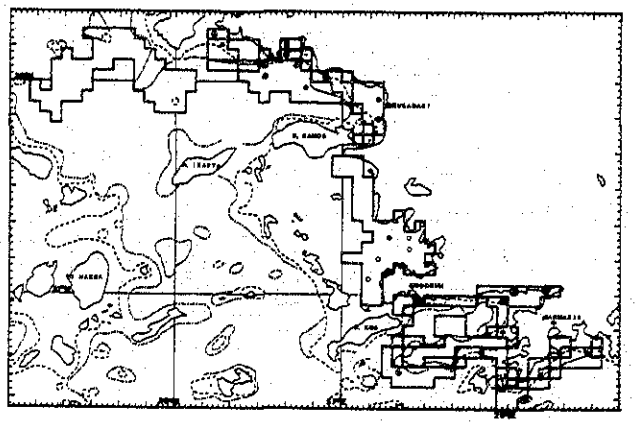
Table 5-1-3-4 Appearance Frequency of Hake*

Sub area	Stratum (m)	Appearance Frequency (%)			
		Spring	Summer	Autumn	Winter
The Sea of Marmara	20~100	81	91	81	93
	101~200	100	75	100	100
	201~500	100	100	100	100
	Sub total	85	89	85	95
North Aegean Sea	20~100	85	89	84	83
	101~200	88	94	91	100
	201~500	100	90	100	100
	Sub total	89	90	89	91
South Aegean Sea	20~100	67	54	77	60
	101~200	100	100	100	75
	201~500	100	70	70	100
	Sub total	83	68	79	77
West Mediterranean Sea	20~100	75	0	25	0
	101~200	100	100	67	100
	201~500	100	100	67	100
	Sub total	90	60	50	67
East Mediterranean Sea	20~100	58	4	61	75
	101~200	57	86	100	67
	201~500	100	75	100	100
	Sub total	63	29	74	80
All area	20~100	74	60	74	78
	101~200	85	92	93	91
	201~500	100	85	88	100
	Total	81	72	81	86

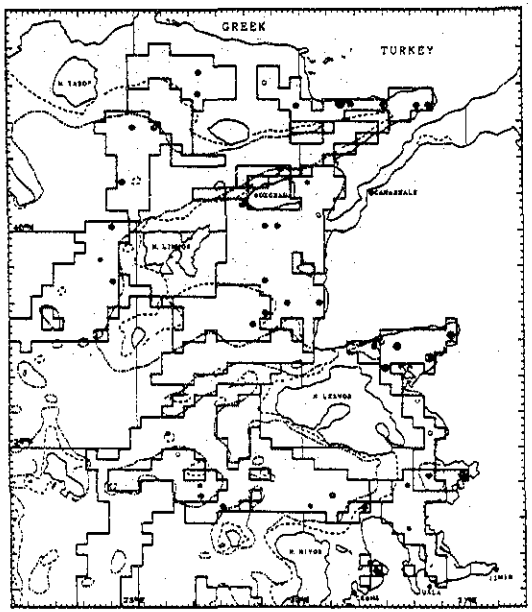
* Appearance frequency: No. caught / No. of trawls x 100%



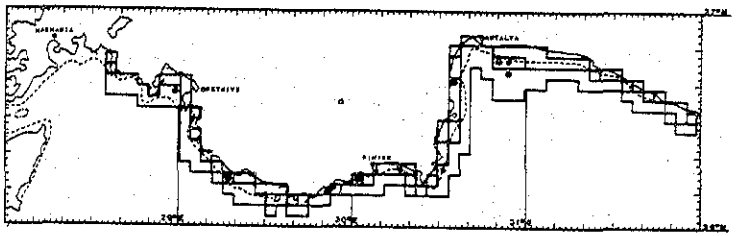
The Sea of Marmara



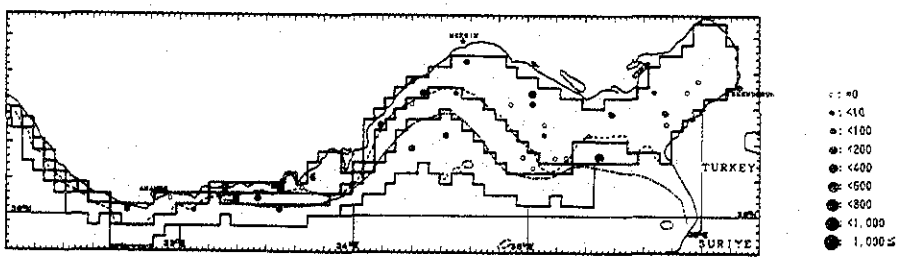
South Aegean Sea



North Aegean Sea

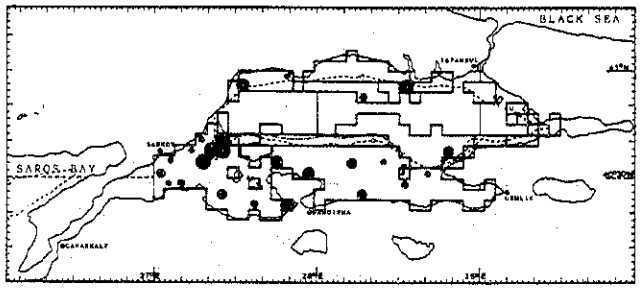


West Mediterranean Sea

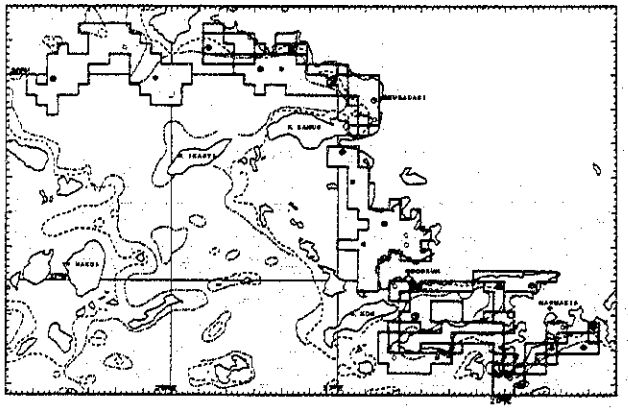


East Mediterranean Sea

Fig.5-1-3-2-1 The catch in kg of hake *Merluccius merluccius* at each stations in the spring season survey



The Sea of Marmara



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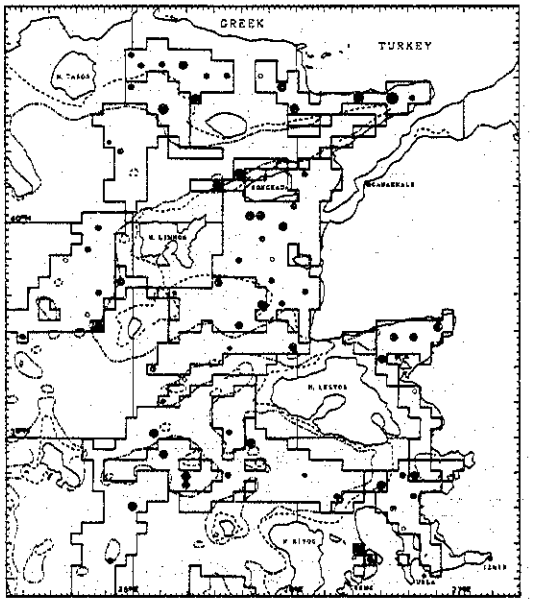
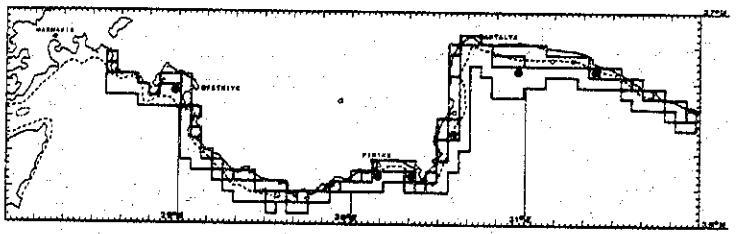
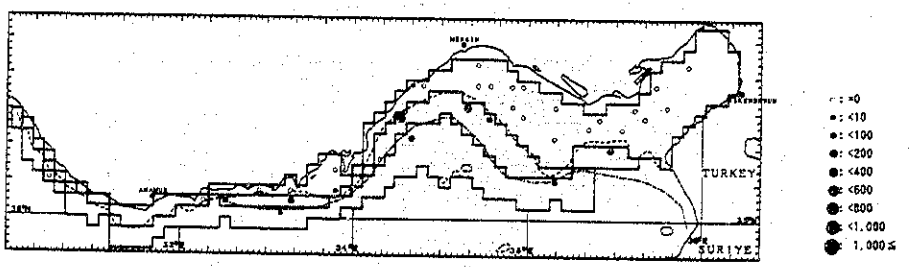


North Aegean Sea

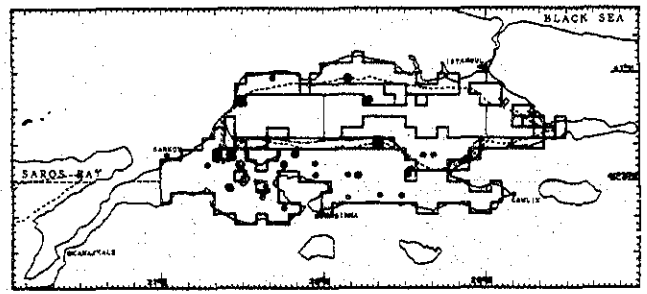


West Mediterranean Sea



East Mediterranean Sea

Fig. 5-1-3-2-2 The catch in kg of hake *Merluccius merluccius* at each stations in the summer season survey



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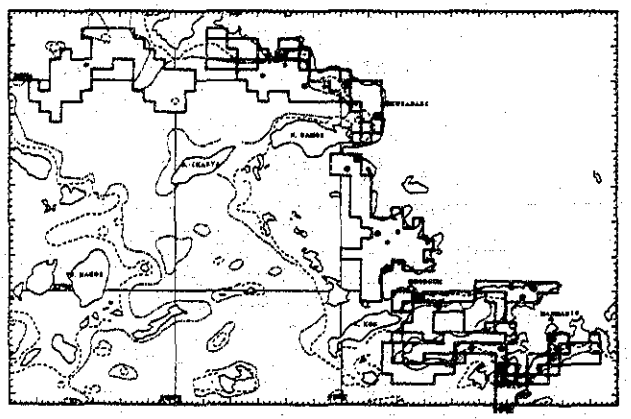
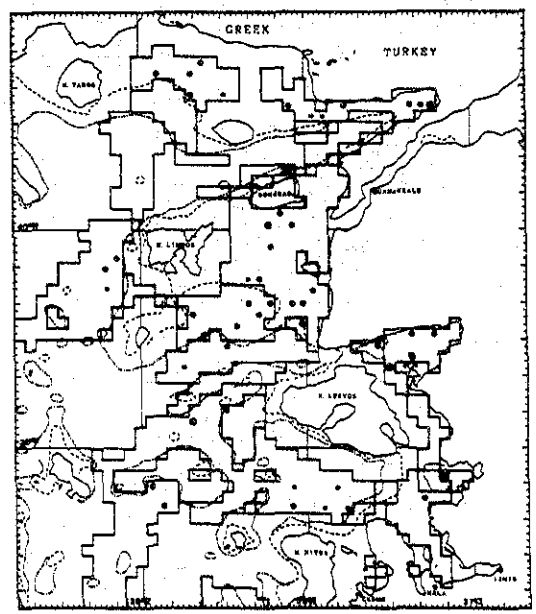


South Aegean Sea



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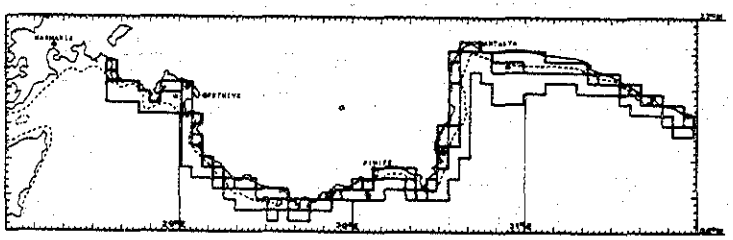
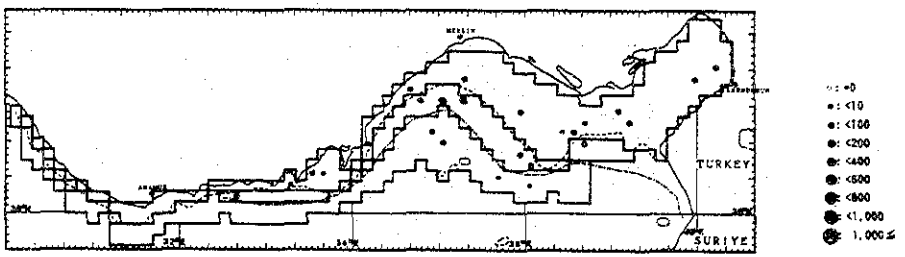
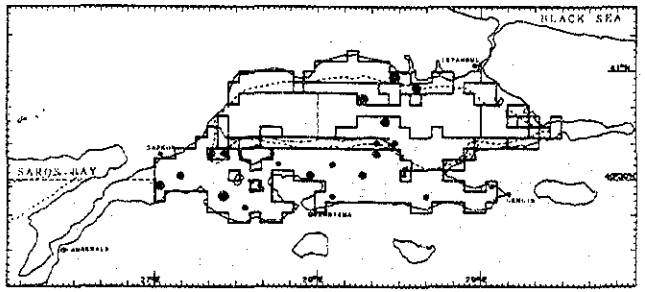


West Mediterranean Sea

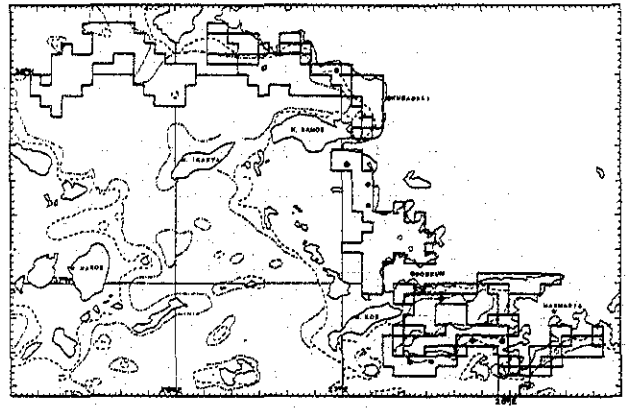


East Mediterranean Sea

Fig.5-1-3-2-3 The catch in kg of hake *Merluccius merluccius* at each stations in the autumn season survey



The Sea of Marmara



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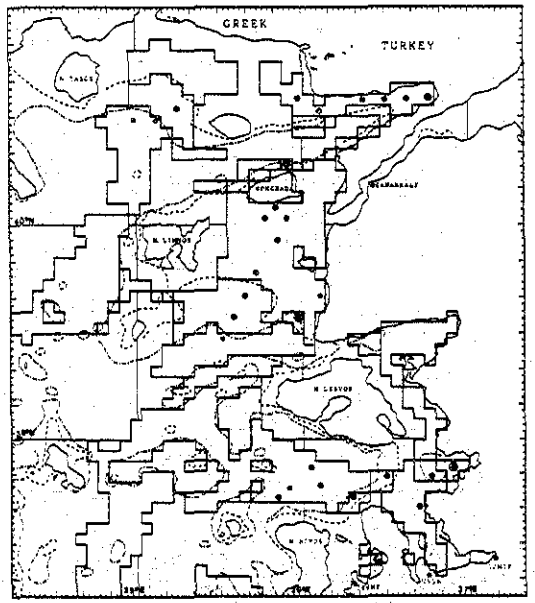
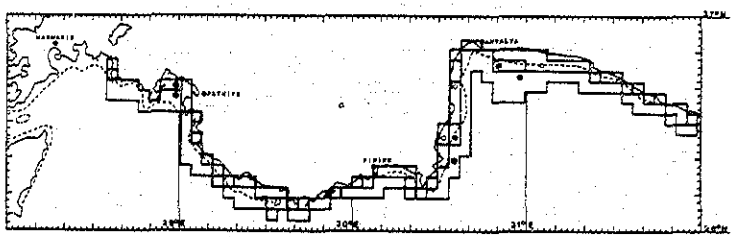
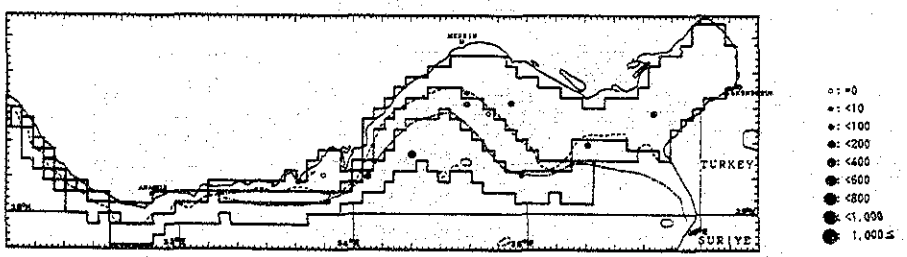


North Aegean Sea



West Mediterranean Sea



East Mediterranean Sea

Fig.5-1-3-2-4 The catch in kg of hake *Merluccius merluccius* at each stations in the winter season survey

When the CPUA of this species in all areas was compared between seasons, the CPUA was found to be high in summer, and 1/2 to 1/3 of that level in the other three seasons. In a comparison of CPUA between sub areas, the CPUA values were the highest in The Sea of Marmara at all strata and throughout all seasons. The range of CPUA values for each season and for each stratum in The Sea of Marmara was 48-1,421 (with the majority of strata demonstrating CPUA of 101 or more). Seasonal fluctuations in CPUA in sub areas were high in the summer in The Sea of Marmara, the North Aegean Sea and West Mediterranean Sea, and low in the other three seasons. The CPUA values in the East Mediterranean Sea were the opposite of those in the above three areas, being low in summer and high in the other three seasons. The CPUA values in the South Aegean Sea were generally constant throughout the four seasons (Table 5-1-3-5).

Table 5-1-3-5 Catch Per Unit Area of Hake

Sub area	Stratum (m)	Mean catch in kg/km			
		Spring	Summer	Autumn	Winter
The Sea of Marmara	20~100	198.0	432.6	92.5	128.3
	101~200	341.9	1,421.0	237.6	76.6
	201~500	47.7	331.1	117.0	189.1
	Sub total	197.2	566.6	112.0	124.9
North Aegean Sea	20~100	59.1	131.9	47.3	50.2
	101~200	32.3	157.5	24.6	61.5
	201~500	26.6	86.1	30.8	18.2
	Sub total	46.1	124.8	39.1	46.0
South Aegean Sea	20~100	41.8	13.7	39.8	6.5
	101~200	47.2	87.5	58.2	30.8
	201~500	13.3	28.0	10.1	45.7
	Sub total	35.7	32.0	32.4	27.5
West Mediterranean Sea	20~100	27.1	0	0	0
	101~200	23.0	33.0	28.8	13.5
	201~500	26.4	153.3	11.1	38.0
	Sub total	25.6	55.9	12.0	17.2
East Mediterranean Sea	20~100	24.6	0	21.8	26.5
	101~200	64.9	66.6	66.7	21.2
	201~500	26.3	21.9	21.8	71.5
	Sub total	32.8	17.2	31.0	38.4
All area	20~100	86.2	146.1	47.7	66.9
	101~200	80.0	257.6	63.7	44.7
	201~500	25.9	82.3	29.5	50.7
	Total	72.6	154.9	46.8	57.9

2) Stock Size

The estimations of the stock size of hake are indicated in Table 5-1-3-6. The stock size of this species was the highest among all 21 important species throughout all seasons. With respect to the total stock size by season, the maximum stock size was demonstrated in the summer at 6,963 tons (95% confidence interval: ±2,360 tons, CV: 14%), while there were no large differences between the other three seasons. The stock in spring was 2,818 tons (95% confidence interval: ±668 tons, CV: 12%), that in autumn was 2,174 tons (95% confidence interval: ±584 tons, CV: 12%), and that in winter was 2,608 tons (95% confidence interval: ±715 tons, CV: 13%). The percentage of the total stock size in The Sea of Marmara and the North Aegean Sea with respect to the total stock size was extremely high, demonstrating a range of 75-90% throughout all seasons. The stock size was large at strata of 20-100 m throughout all seasons for both sea areas, with this species accounting for 60-80% of total stock size in The Sea of Marmara, and 40-60% in the North Aegean Sea.

The difference in the stock size estimations between summer and other seasons was approximately 4,000-5,000 tons. This difference was nearly equal to the sum of the differences in the stock size between summer and the other seasons in The Sea of Marmara and the North Aegean Sea. Based on this result, the difference in the estimations of stock size between summer and the other seasons is believed to be due to seasonal migration to the outside of surveyed area of this species that thrive in The Sea of Marmara and the North Aegean Sea. This species is observed in normal numbers in the Mediterranean Sea, and thrives in intermediate strata or on the bottom at depths of 100 m or more. This species is known to thrive in schools in deep water in the winter, while migrating closer to shore in the summer. Based on this information, the majority of this species, that thrives at depths of 100 m or less in The Sea of Marmara and the North Aegean Sea in the summer when large stock size is recorded, is presumed to move to deeper water after the fall or migrate into the Aegean Sea having a larger area due to the small area of sea areas having a depth of 101 m or more in The Sea of Marmara. Conversely, this species is presumed to migrate from deep water to shallow water along the coast in the summer. In addition, the bottom strata water temperature and salinity at depths of 50 m or more in both areas were generally stable at 13-16°C and 38-39 throughout the year. Thus, it is unlikely that these are factors affecting seasonal migration of this species, but rather this migration is probably related to breeding behavior.

Table 5-1-3-6 Estimation of Stock Size of Hake

Sub area	Stratum (m)	Stock size in tons (t)			
		Spring	Summer	Autumn	Winter
The Sea of Marmara	20~100	974.7	2,348.6	478.1	775.3
	101~200	205.5	854.0	142.8	46.1
	201~500	63.6	441.6	156.1	252.2
	Sub total	1,243.8	3,644.3	777.0	1,073.6
North Aegean Sea	20~100	543.4	1,126.7	408.8	417.1
	101~200	130.7	638.2	110.7	241.9
	201~500	265.8	859.7	311.3	208.4
	Sub total	939.9	2,624.6	830.9	867.4
South Aegean Sea	20~100	121.0	44.0	122.9	16.7
	101~200	55.1	106.8	71.1	34.6
	201~500	59.2	124.4	45.1	203.2
	Sub total	235.2	275.2	239.0	254.5
West Mediterranean Sea	20~100	30.2	0	0	0
	101~200	13.6	19.6	17.1	8.0
	201~500	38.1	220.7	16.0	54.7
	Sub total	81.9	240.3	33.1	62.7
East Mediterranean Sea	20~100	145.6	0	129.4	156.8
	101~200	114.3	130.5	117.5	37.4
	201~500	57.2	47.8	47.5	155.7
	Sub total	317.0	178.2	294.4	349.9
All area	20~100	1,814.8	3,519.3	1,139.2	1,365.9
	101~200	519.2	1,749.1	459.2	368.0
	201~500	483.8	1,694.2	576.0	874.2
	Total	2,817.9	6,962.6	2,174.4	2,608.1
* 95% confidence interval		± 667.5	±2,360.1	± 583.7	± 715.2

* 95% confidence interval was calculated to total stock size.

3) Comber *Serranus cabrilla*

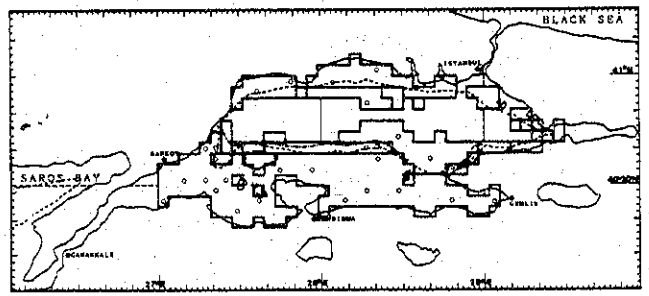
1) Distribution

This species was distributed in the Aegean Sea and Mediterranean Sea at depths of 200 m or less throughout all seasons (Figs. 5-1-3-3-1 to 5-1-3-3-4). The appearance frequency of this species tended to be high in the South Aegean Sea. The appearance frequencies for all areas was roughly 30% throughout all seasons (Table 5-1-3-7).

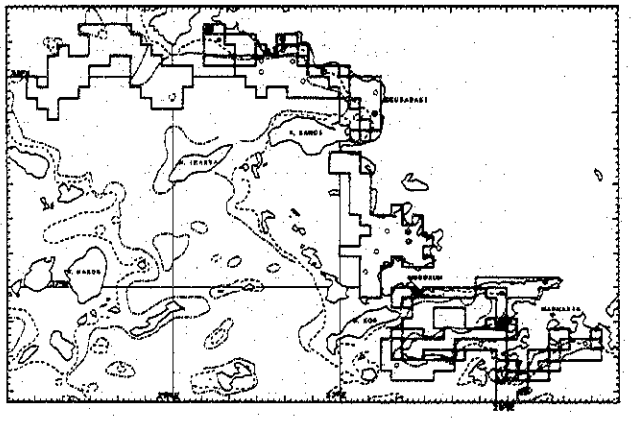
Table 5-1-3-7 Appearance Frequency of Comber*

Sub area	Stratum (m)	Appearance Frequency (%)			
		Spring	Summer	Autumn	Winter
The Sea of Marmara	20~500	0	0	0	0
North Aegean Sea	20~100	52	63	59	50
	101~200	38	38	55	38
	201~500	0	0	0	0
	Sub total	38	40	45	36
South Aegean Sea	20~100	67	92	31	80
	101~200	80	60	40	75
	201~500	0	0	0	0
	Sub total	52	54	22	54
West Mediterranean Sea	20~100	50	75	50	33
	101~200	0	33	33	33
	201~500	0	0	0	0
	Sub total	20	40	30	22
East Mediterranean Sea	20~100	33	17	13	25
	101~200	14	57	14	67
	201~500	0	0	0	0
	Sub total	26	23	12	30
All area	20~100	36	42	30	33
	101~200	31	40	35	43
	201~500	0	0	0	0
	Total	29	32	25	28

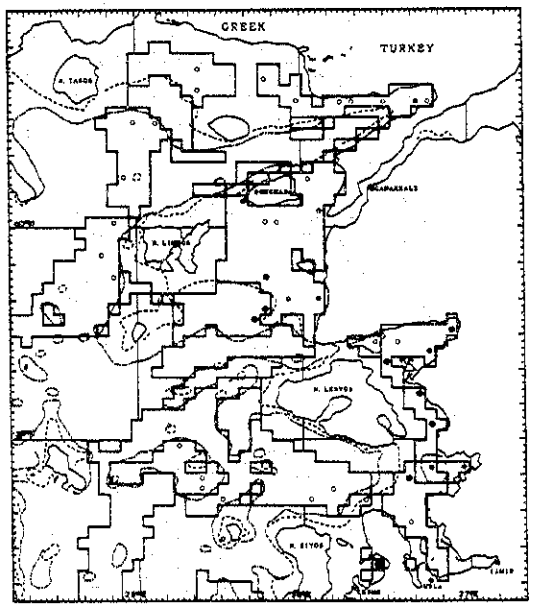
* Appearance frequency: No. caught / No. of trawls x 100%



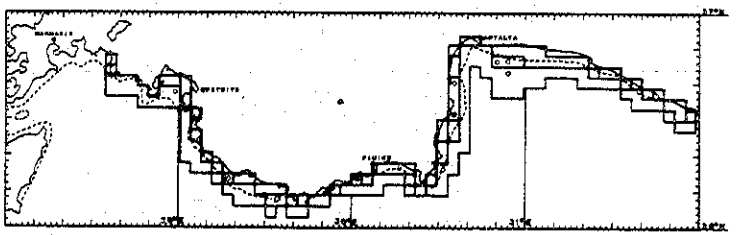
The Sea of Marmara



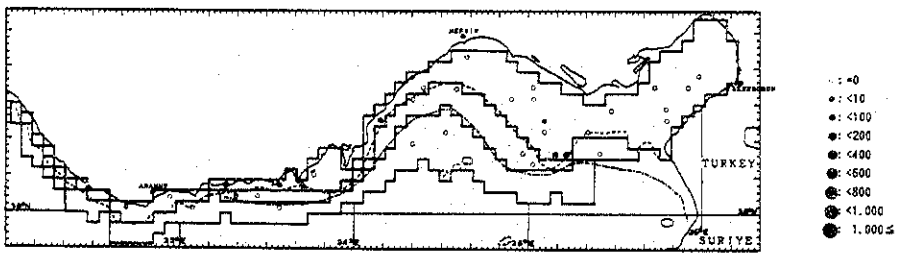
South Aegean Sea



North Aegean Sea

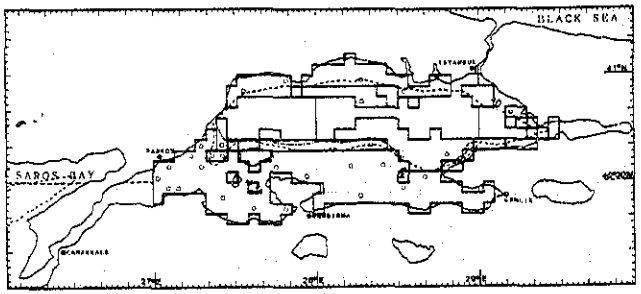


West Mediterranean Sea

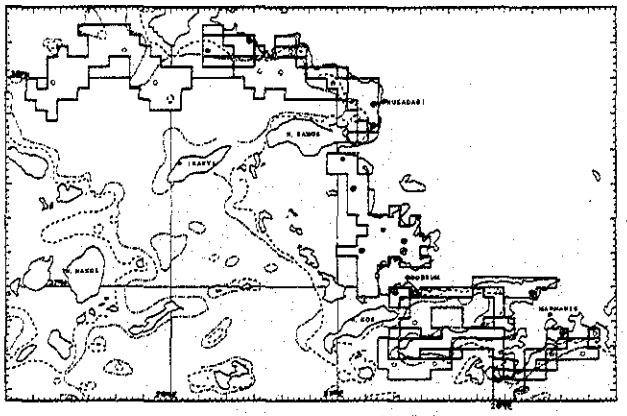


East Mediterranean Sea

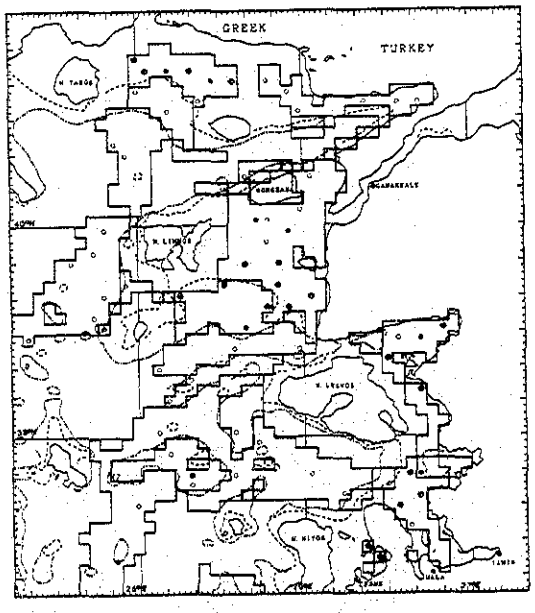
Fig.5-1-3-3-1 The catchin kg of comber *Serranus cabrilla* at each stations in the spring season survey



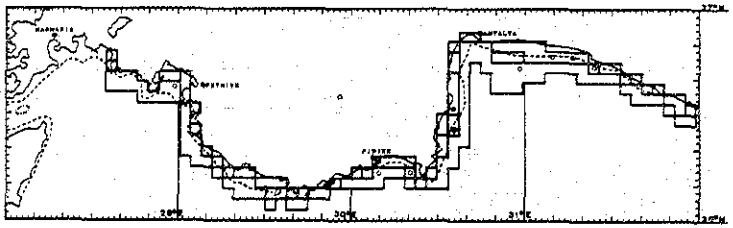
The Sea of Marmara



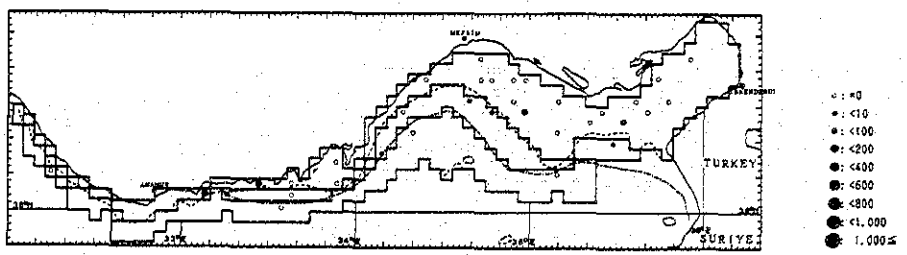
South Aegean Sea



North Aegean Sea

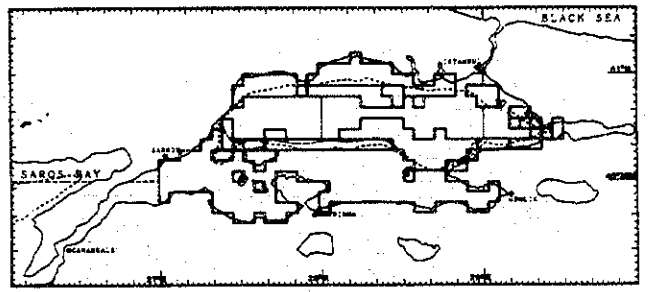


West Mediterranean Sea

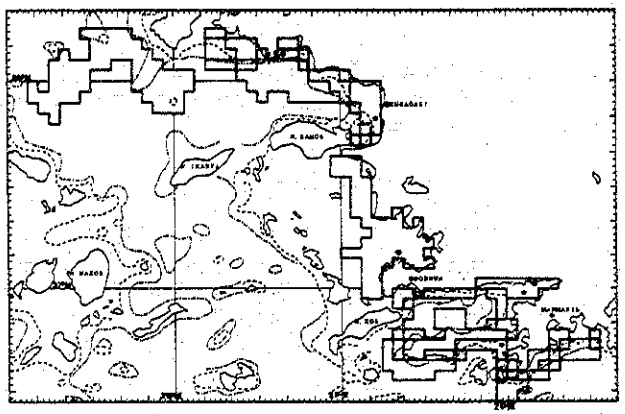


East Mediterranean Sea

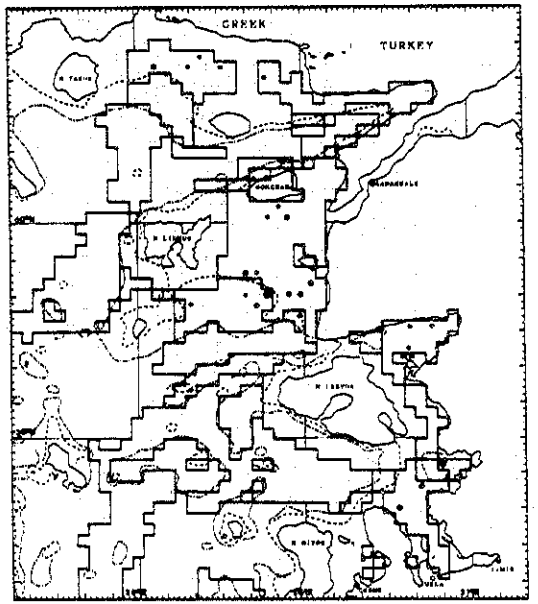
Fig.5-1-3-3-2 The catch in kg of comber *Serranus cabrilla* at each stations in the summer season survey



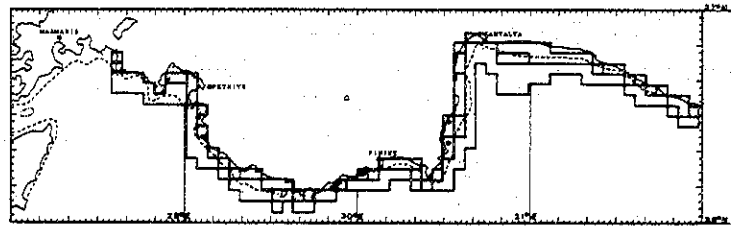
The Sea of Marmara



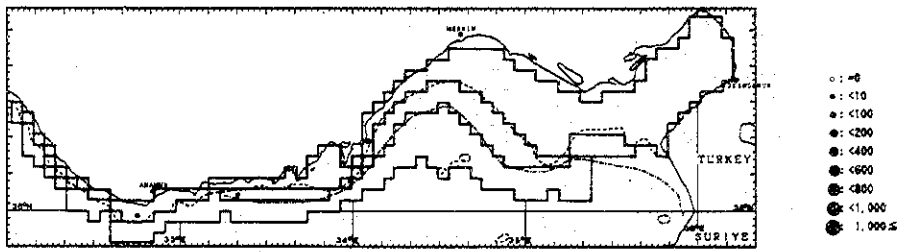
South Aegean Sea



North Aegean Sea

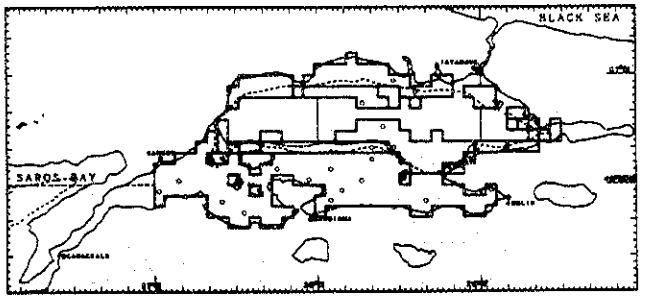


West Mediterranean Sea

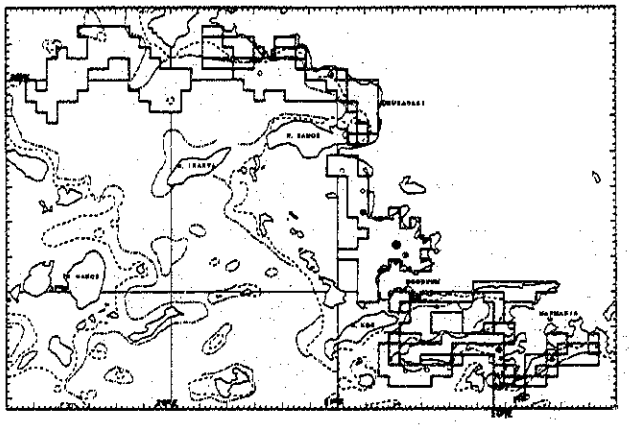


East Mediterranean Sea

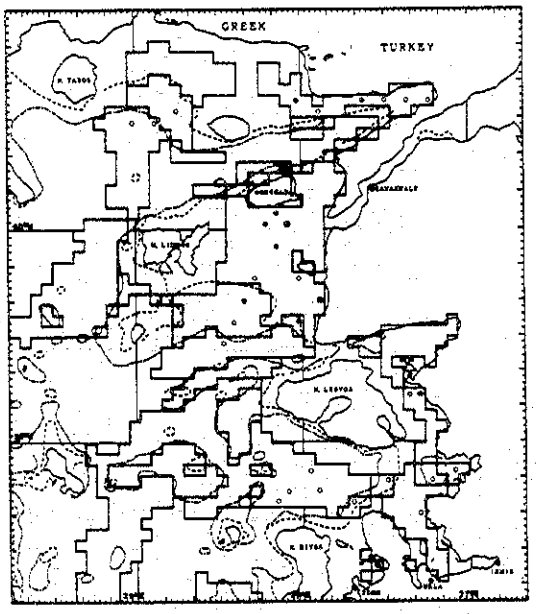
Fig.5-1-3-3-3 The catch in kg of comber *Serranus cabrilla* at each stations in the autumn season survey



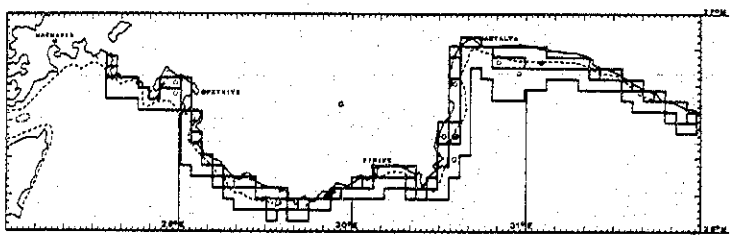
The Sea of Marmara



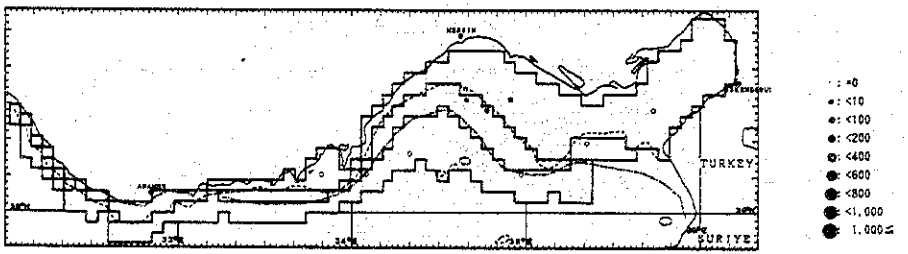
South Aegean Sea



North Aegean Sea



West Mediterranean Sea



East Mediterranean Sea

Fig.5-1-3-3-4 The catch in kg of comber *Serranus cabrilla* at each stations in the winter season survey

The CPUA values of this species in all areas were 10 or less throughout all seasons, while comparison between seasons revealed CPUA to be high in spring and summer, and low in autumn and winter. In addition, comparison of CPUA between strata revealed that CPUA tended to be high in spring and summer at strata of 20-100 m, and high in autumn and winter at strata of 101-200 m. Comparison of CPUA by sub area revealed that CPUA tended to be high in the South Aegean Sea throughout all seasons (Table 5-1-3-8).

Table 5-1-3-8 Catch Per Unit Area of Comber

Sub area	Stratum (m)	Mean catch in kg/km²			
		Spring	Summer	Autumn	Winter
The Sea of Marmara	20~500	0	0	0	0
North Aegean Sea	20~100	8.1	16.5	8.8	4.5
	101~200	6.2	7.6	15.4	1.9
	201~500	0	0	0	0
	Sub total	5.8	9.9	8.0	3.0
South Aegean Sea	20~100	57.9	44.3	2.6	43.0
	101~200	8.7	2.1	1.4	15.6
	201~500	0	0	0	0
	Sub total	31.0	20.9	1.4	19.7
West Mediterranean Sea	20~100	0	1.8	1.3	1.4
	101~200	0	5.6	0.6	16.3
	201~500	0	0	0	0
	Sub total	0	2.4	0.7	5.9
East Mediterranean Sea	20~100	5.3	2.9	0.6	0.6
	101~200	0	1.5	0.3	0.9
	201~500	0	0	0	0
	Sub total	3.6	2.3	0.5	0.5
All area	20~100	13.1	12.6	3.6	6.0
	101~200	4.2	4.5	6.1	6.1
	201~500	0	0	0	0
	Total	8.7	8.0	3.3	4.7

2) Stock Size

The estimations of the stock size of Comber are indicated in Table 5-1-3-9. The estimations of the total stock size consisted of 387 tons in spring (95% confidence interval: ±380 tons, CV: 45%), 341 tons in summer (95% confidence interval: ±125 tons, CV: 18%), 164 tons in autumn (95% confidence interval: ±107 tons, CV: 30%) and 290 tons in winter (95% confidence interval: ±393 tons, CV: 49%). The percentage of the stock size in the Aegean Sea (the sea area combining the North Aegean Sea and South Aegean Sea) with respect to the total stock size was overwhelmingly high at 90% or more throughout all seasons.

Differences in the stock size estimations between seasons were roughly 100-200 tons, which are not significant in consideration of the 95% confidence interval of each season.

Table 5-1-3-9 Estimations of Stock Size of Comber

Sub area	Stratum (m)	Stock size in tons (t)			
		Spring	Summer	Autumn	Winter
The Sea of Maraara	20~500	0	0	0	0
North Aegean Sea	20~100	67.9	141.0	87.3	39.0
	101~200	25.2	30.9	59.7	6.9
	201~500	0	0	0	0
	Sub total	93.1	171.9	147.0	45.8
South Aegean Sea	20~100	251.2	142.1	9.6	211.0
	101~200	10.9	2.6	1.7	16.7
	201~500	0	0	0	0
	Sub total	262.1	144.7	11.3	227.7
West Mediterranean Sea	20~100	0	2.0	1.4	1.5
	101~200	0	3.3	0.4	9.7
	201~500	0	0	0	0
	Sub total	0	5.3	1.8	11.2
East Mediterranean Sea	20~100	31.3	17.2	3.5	3.6
	101~200	0	2.2	0.5	1.5
	201~500	0	0	0	0
	Sub total	31.3	19.4	4.0	5.1
All area	20~100	350.4	302.3	101.8	255.1
	101~200	36.1	39.1	62.2	34.8
	201~500	0	0	0	0
	Total	386.5	341.4	164.0	289.8
* 95% confidence interval		± 380.3	± 125.1	± 106.9	± 393.1

* 95% confidence interval was calculated to total stock size.

(4) Painted Comber *Serranus scriba*

1) Distribution

This species appeared only slightly, being limited to depths of 100 m or less in the North Aegean Sea and West Mediterranean Sea in spring, and the North Aegean Sea in summer and winter (Figs. 5-1-3-4-1 to 5-1-3-4-4). In addition, the appearance frequency of this species was extremely low, at 2% or less, with respect to all areas (Table 5-1-3-10).

Table 5-1-3-10 Appearance Frequency of Painted Comber*

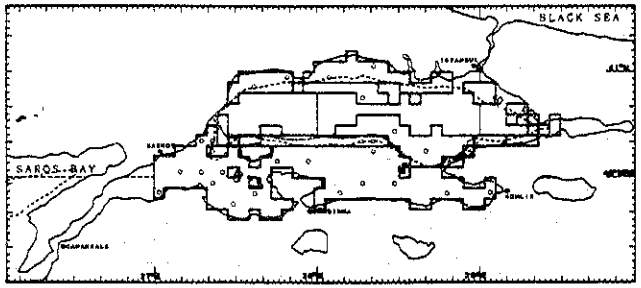
Sub area	Stratum (m)	Appearance Frequency (%)			
		Spring	Summer	Autumn	Winter
The Sea of Marmara	20~500	0	0	0	0
North Aegean Sea	20~100	8	3	0	11
	101~500	0	0	0	0
	Sub total	5	2	0	6
South Aegean Sea	20~500	0	0	0	0
West Mediterranean Sea	20~100	25	0	0	0
	101~500	0	0	0	0
	Sub total	10	0	0	0
East Mediterranean Sea	20~500	0	0	0	0
All area	20~100	4	1	0	5
	101~500	0	0	0	0
	Total	2	1	0	2

* Appearance frequency: No. caught / No. of trawls x 100%

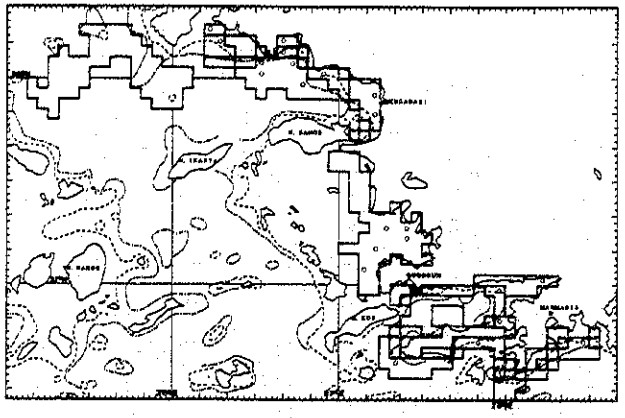
The CPUA values of this species were extremely low (Table 5-1-3-11).

Table 5-1-3-11 Catch Per Unit Area of Painted Comber

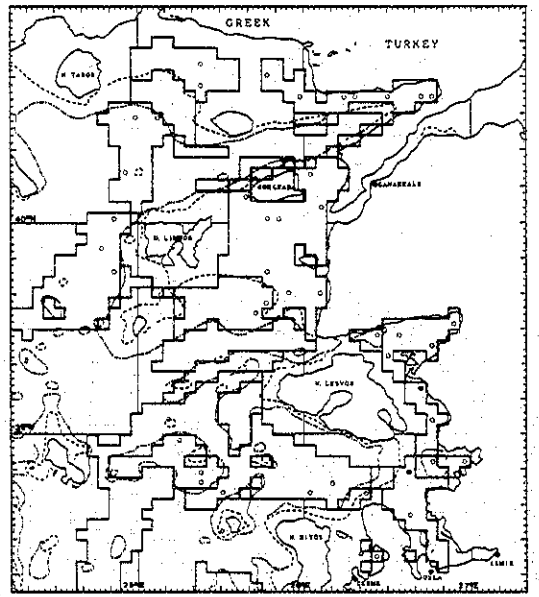
Sub area	Stratum (m)	Mean catch in kg/km²			
		Spring	Summer	Autumn	Winter
The Sea of Marmara	20~500	0	0	0	0
North Aegean Sea	20~100	0.8	5.9	0	0.5
	101~500	0	0	0	0
	Sub total	0.4	2.9	0	0.3
South Aegean Sea	20~500	0	0	0	0
West Mediterranean Sea	20~500	0	0	0	0
East Mediterranean Sea	20~500	0	0	0	0
All area	20~100	0.3	2.1	0	0.2
	101~500	0	0	0	0
	Total	0.2	1.2	0	0.1



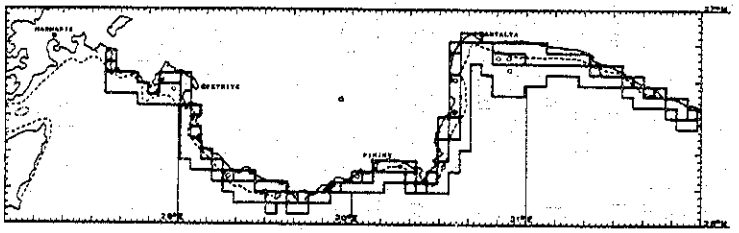
The Sea of Marmara



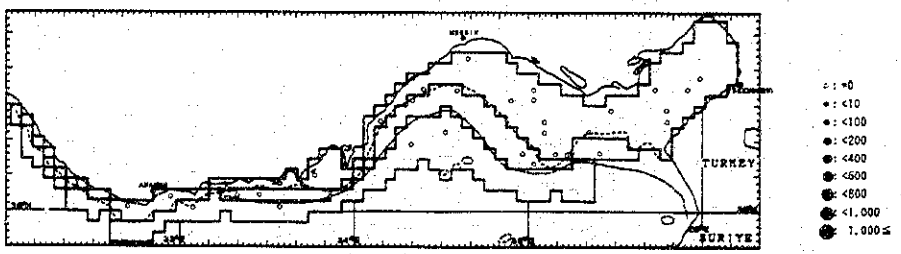
South Aegean Sea



North Aegean Sea

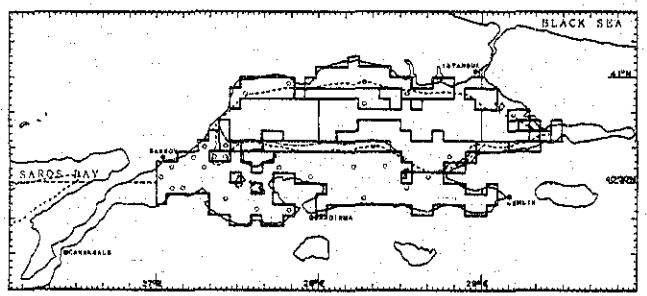


West Mediterranean Sea

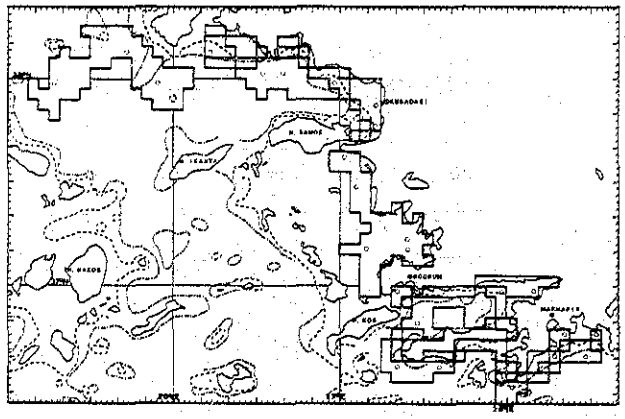


East Mediterranean Sea

Fig. 5-1-3-4-1 The catch in kg of painted comber *Serranus scriba* at each stations in the spring season survey



The Sea of Marmara



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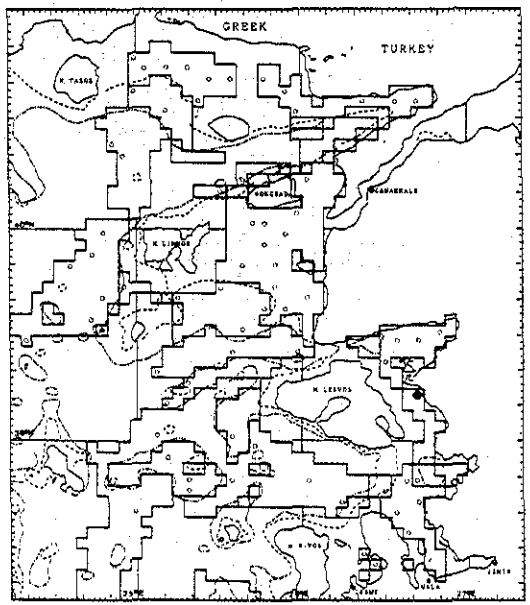

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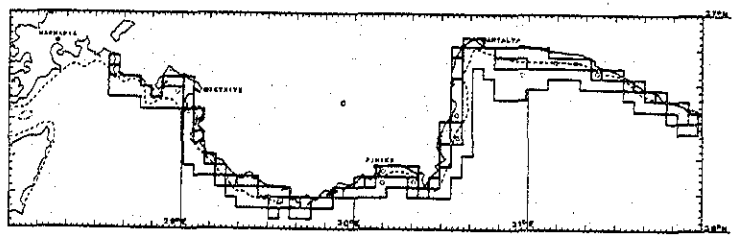
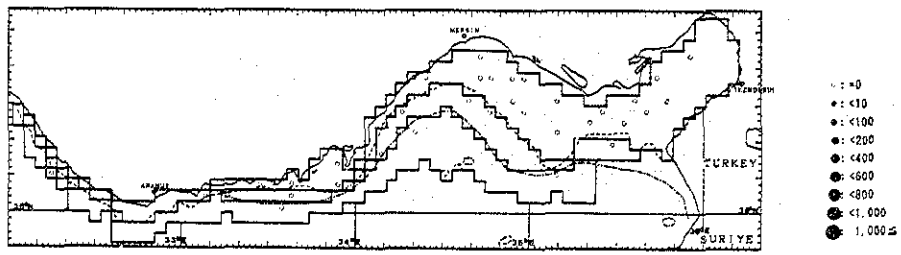
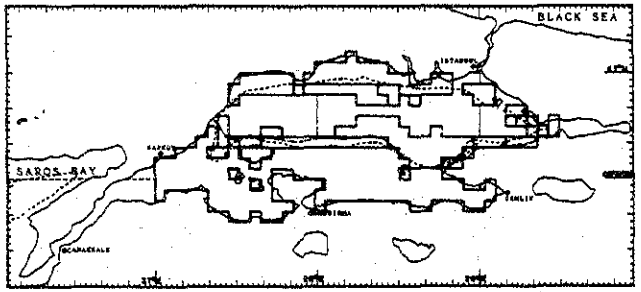


West Mediterranean Sea

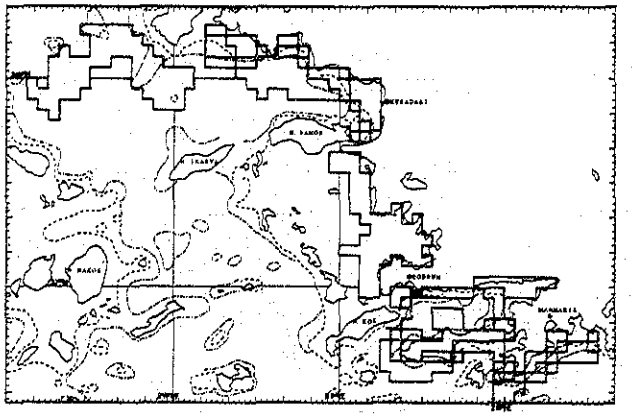


East Mediterranean Sea

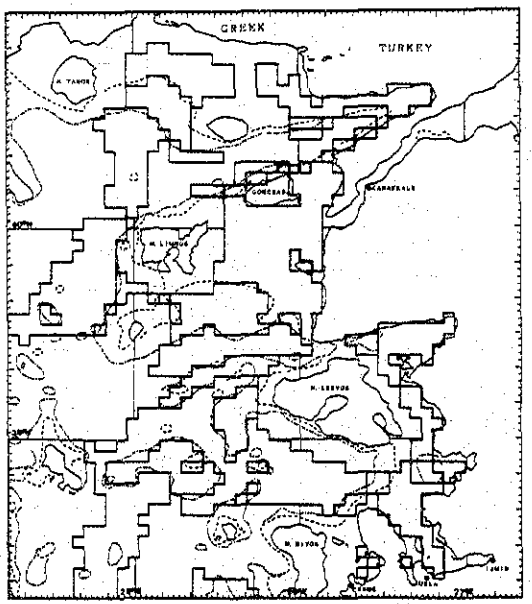
Fig.5-1-3-4-2 The catch in kg of painted comber *Serranus scriba* at each stations in the summer season survey



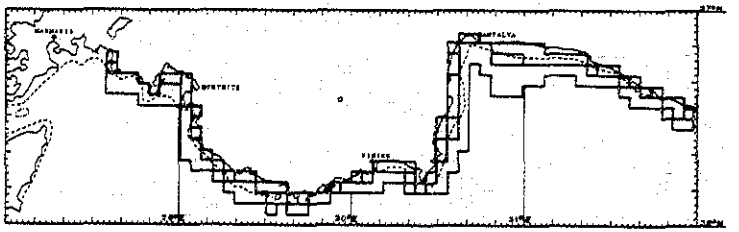
The Sea of Marmara



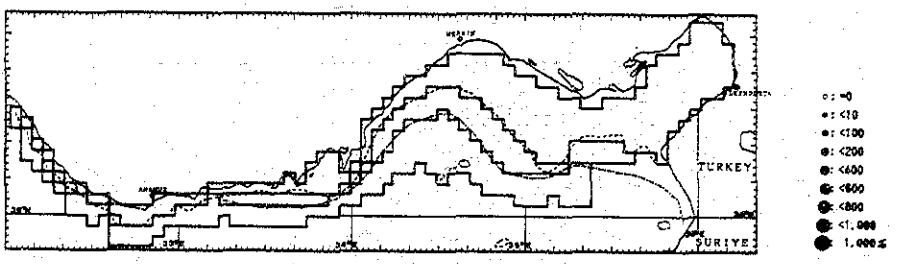
South Aegean Sea



North Aegean Sea

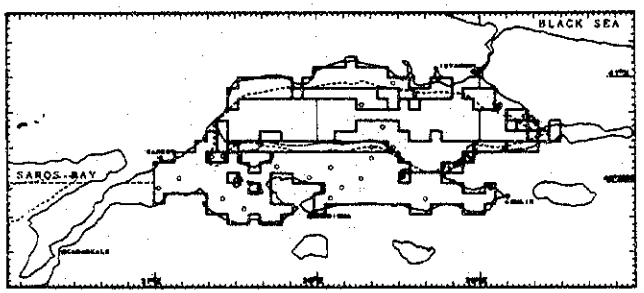


West Mediterranean Sea

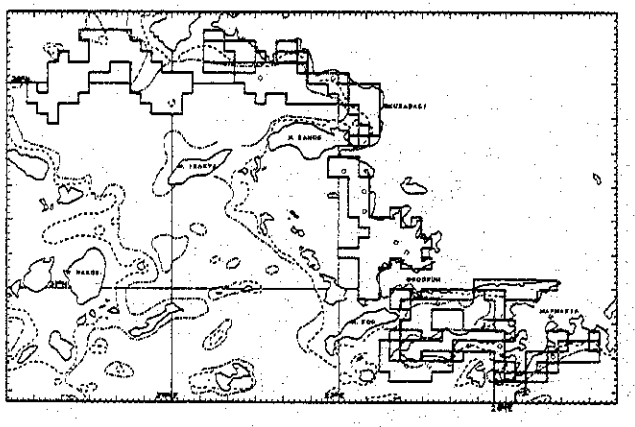


East Mediterranean Sea

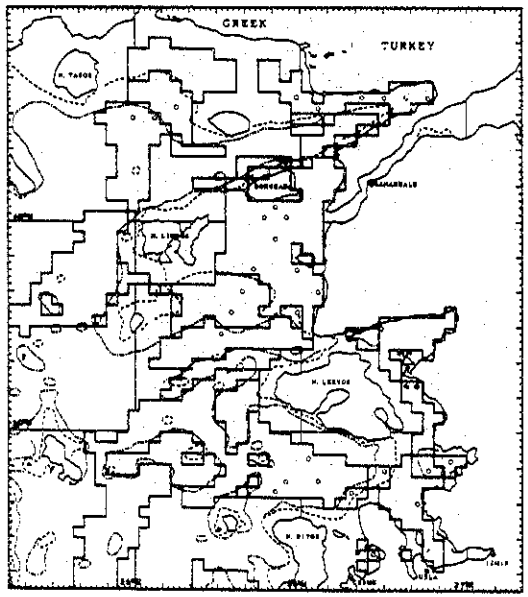
Fig.5-1-3-4-3 The catch in kg of painted comber *Serranus scriba* at each stations in the autumn season survey



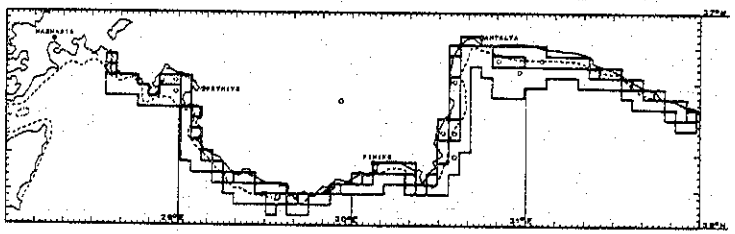
The Sea of Marmara



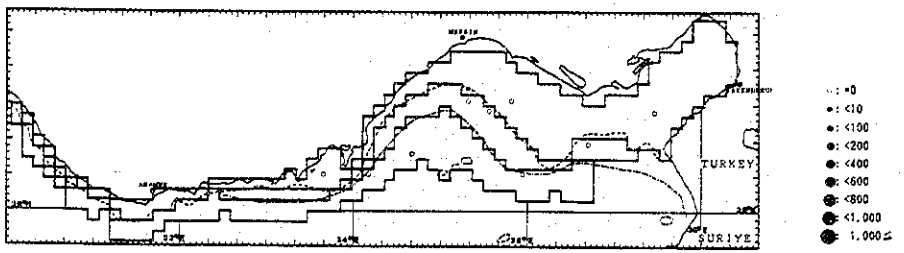
South Aegean Sea



North Aegean Sea



West Mediterranean Sea



East Mediterranean Sea

Fig.5-1-3-4-4 The catch in kg of painted comber *Serranus scriba* at each stations in the winter season survey

2) Stock Size

The estimations of the stock size of Painted comber are indicated in Table 5-1-3-12. The estimations of the total stock size (all of which is the stock size of strata of 20-100 m in the North Aegean Sea) was extremely low in each season, consisting of 6 tons in spring (95% confidence interval: ±8 tons, CV: 69%), 50 tons in summer (95% confidence interval: ±102 tons, CV: 100%), 0 tons in autumn (not one fish of these species was caught) and 7 tons in winter (95% confidence interval: ±10 tons, CV: 74%).

Differences in the stock size estimations according to season were not significant in consideration of the 95% confidence interval of each season. Since this species is a species that thrives in rocks and eelgrass bed along coastlines at depths of 150 m or less, it was thought that by conducting stock size surveys to include the above areas unsuitable for trawling by strengthening the equipment of the trawling gear, it would be possible to obtain more accurate estimations.

Table 5-1-3-12 Estimations of Stock Size of Painted Comber

Sub area	Stratum (m)	Stock size in tons (t)			
		Spring	Summer	Autumn	Winter
The Sea of Marmara	20~500	0	0	0	0
North Aegean Sea	20~100	5.7	50.4	0	6.6
	101~500	0	0	0	0
	Sub total	5.7	50.4	0	6.6
South Aegean Sea	20~500	0	0	0	0
West Mediterranean Sea	20~500	0	0	0	0
East Mediterranean Sea	20~500	0	0	0	0
All area	20~100	5.7	50.4	0	6.6
	101~500	0	0	0	0
	Total	5.7	50.4	0	6.6
* 95% confidence interval		± 8.1	± 102.4	± 0	± 10.3

* 95% *confidence interval was calculated to total stock size.*

(5) Atlantic Horse-Mackerel *Trachurus trachurus*

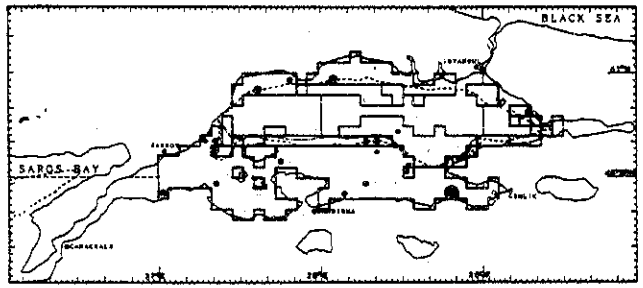
1) Distribution

This species was distributed throughout all surveyed areas in all seasons (Figs. 5-1-3-5-1 to 5-1-3-5-4). In addition, the appearance frequency of this species in all areas was within a range of 50-75% throughout all seasons (Table 5-1-3-13).

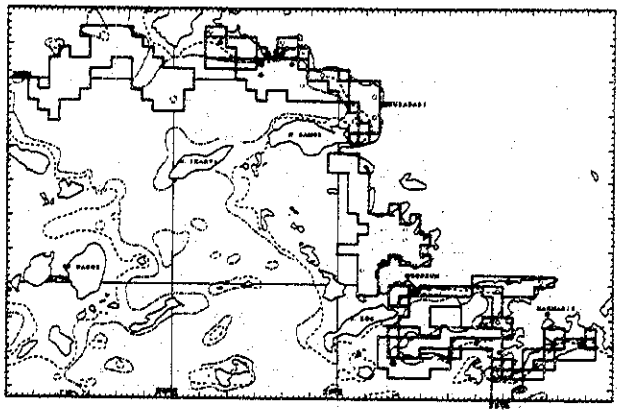
Table 5-1-3-13 Appearance Frequency of Atlantic Horse-Mackerel*

Sub area	Stratum (m)	Appearance Frequency (%)			
		Spring	Summer	Autumn	Winter
The Sea of Marmara	20~100	57	64	76	93
	101~200	100	100	100	100
	201~500	33	50	33	33
	Sub total	59	68	74	86
North Aegean Sea	20~100	48	66	75	61
	101~200	88	94	73	75
	201~500	40	60	46	72
	Sub total	53	71	68	67
South Aegean Sea	20~100	8	69	100	20
	101~200	60	80	100	75
	201~500	83	60	40	100
	Sub total	39	68	79	62
West Mediterranean Sea	20~100	0	50	25	100
	101~200	67	33	67	100
	201~500	67	67	33	67
	Sub total	40	50	40	89
East Mediterranean Sea	20~100	36	42	65	50
	101~200	29	86	100	100
	201~500	50	100	75	100
	Sub total	37	57	74	80
All area	20~100	40	59	74	69
	101~200	65	86	86	86
	201~500	54	64	46	75
	Total	47	66	70	75

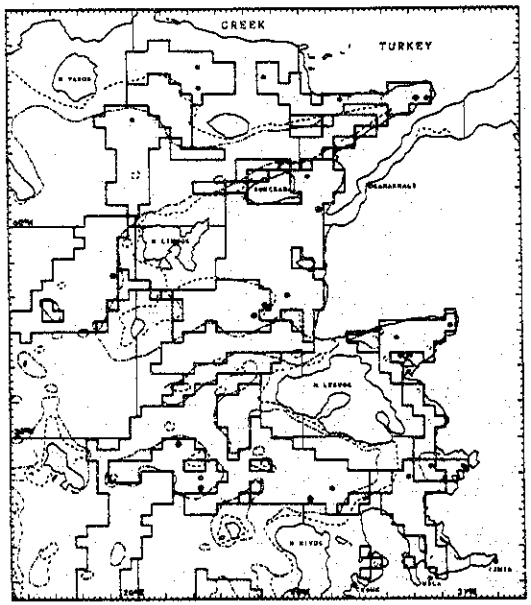
* Appearance frequency: No. caught / No. of trolls x 100%



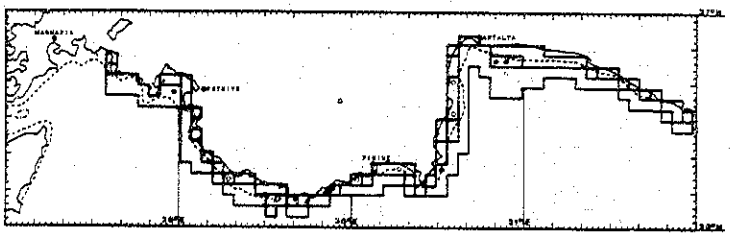
The Sea of Marmara



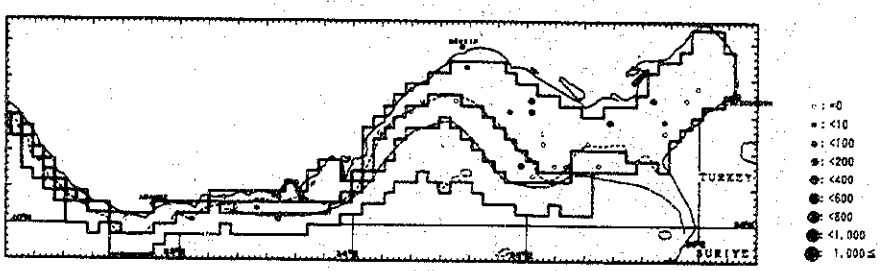
South Aegean Sea



North Aegean Sea

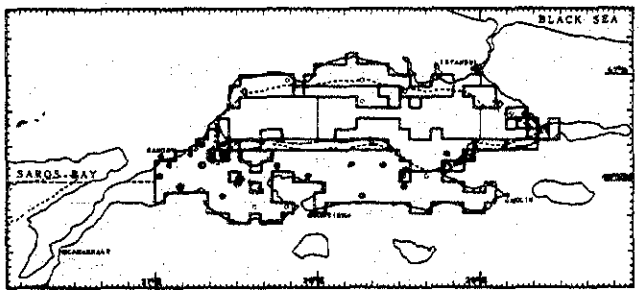


West Mediterranean Sea

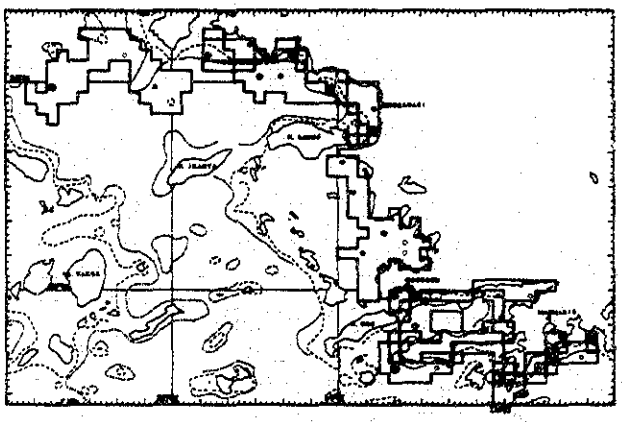


East Mediterranean Sea

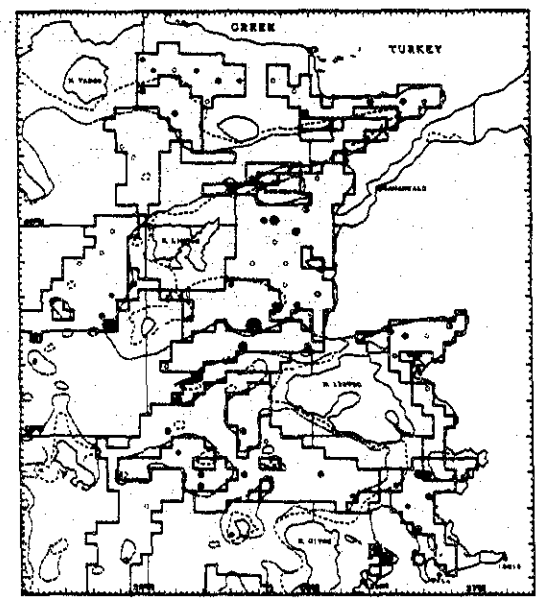
Fig.5-1-3-5-1 The catch in kg of Atlantic horse-mackerel *Trachurus trachurus* at each stations in the spring season survey



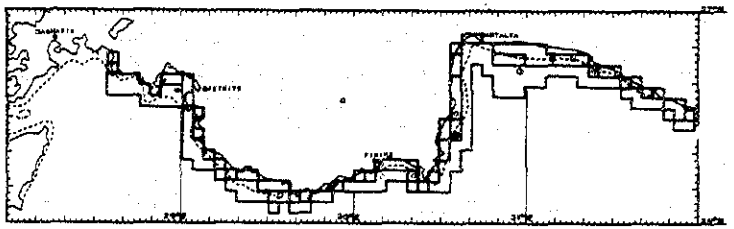
The Sea of Marmara



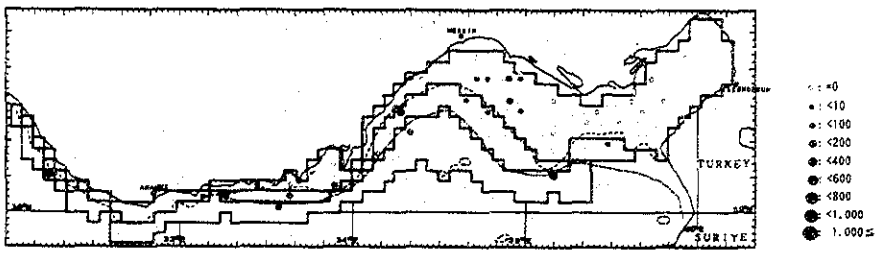
South Aegean Sea



North Aegean Sea

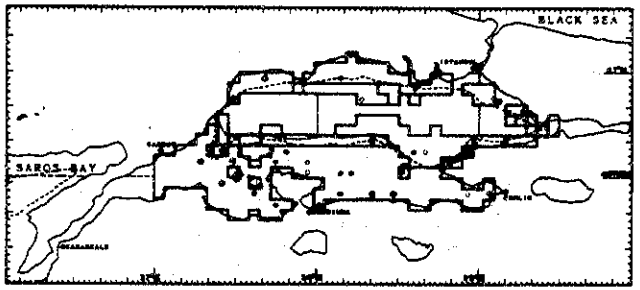


West Mediterranean Sea

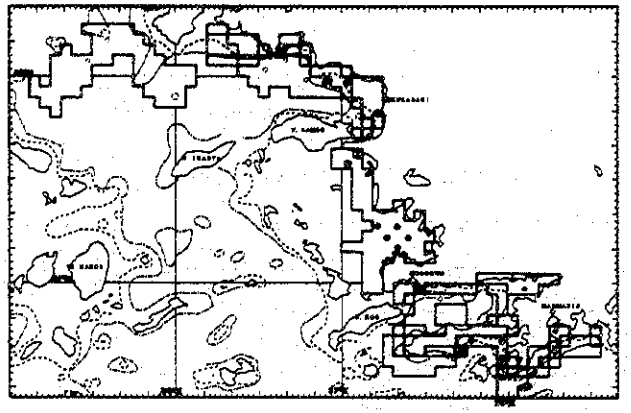


East Mediterranean Sea

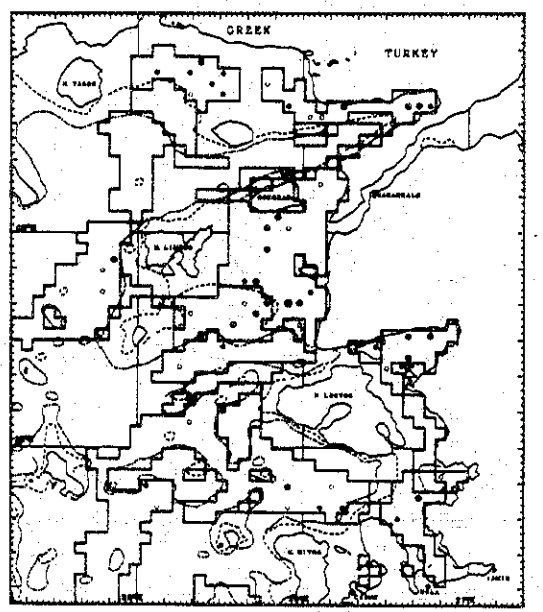
Fig.5-1-3-5-2 The catch in kg of Atlantic horse-mackerel *Trachurus trachurus* at each stations in the summer season survey



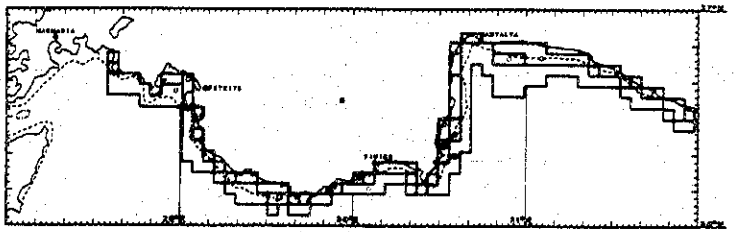
The Sea of Marmara



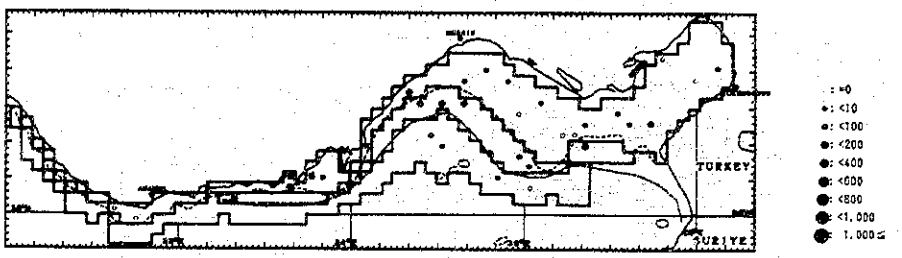
South Aegean Sea



North Aegean Sea

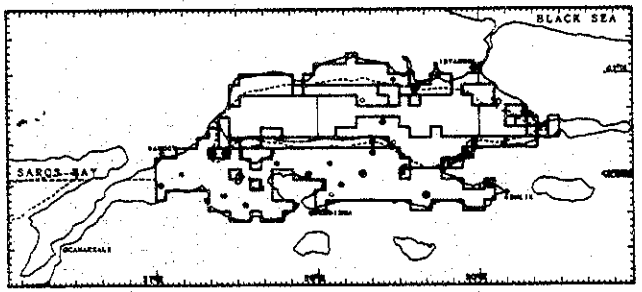


West Mediterranean Sea

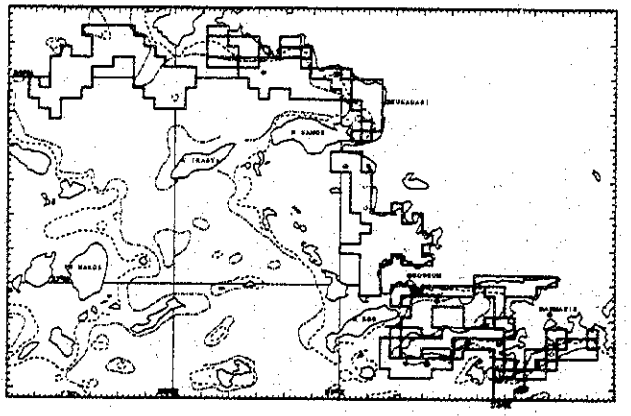


East Mediterranean Sea

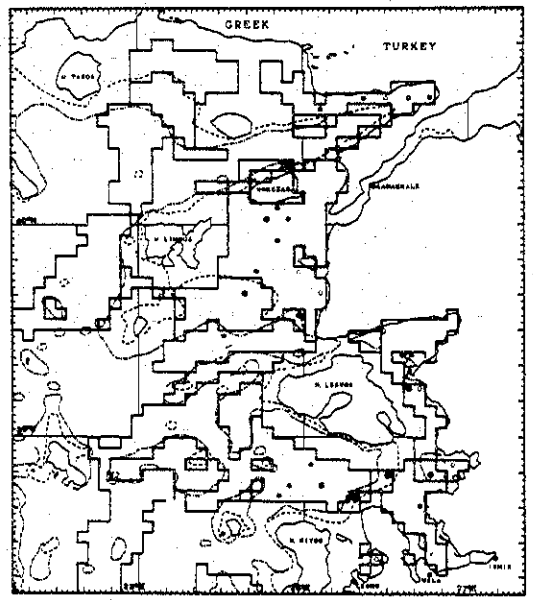
Fig.5-1-3-5-3 The catch in kg of Atlantic horse-mackerel *Trachurus trachurus* at each stations in the autumn season survey



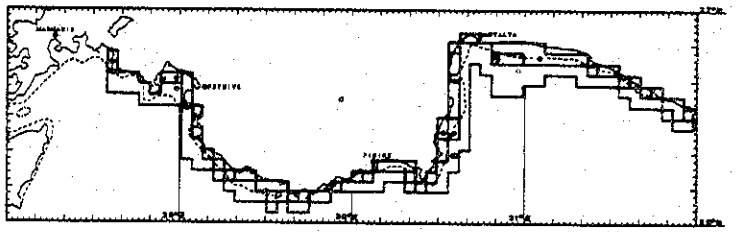
The Sea of Marmara



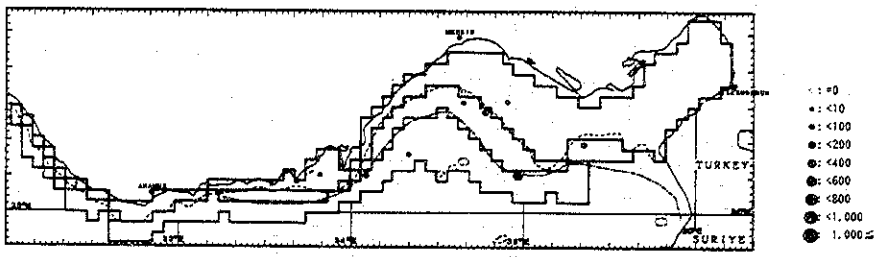
South Aegean Sea



North Aegean Sea



West Mediterranean Sea



East Mediterranean Sea

Fig.5-1-3-5-4 The catch in kg of Atlantic horse-mackerel *Trachurus trachurus* at each stations in the winter season survey

The CPUA of this species in all areas surveyed was high at 31 in summer, and somewhat lower values of 16-21 in the other three seasons. In addition, comparison of CPUA between strata indicated that CPUA tended to be high at depths of 100 m or less in the spring, and high at depths of 201 m or more from summer to winter. Next, when the CPUA values were compared among sub areas, CPUA was high in The Sea of Marmara in the spring and winter, and high in the Aegean Sea in the summer and autumn (Table 5-1-3-14).

Table 5-1-3-14 Catch Per Unit Area of Atlantic Horse-Mackerel

Sub area	Stratum (m)	Mean catch in kg/km²			
		Spring	Summer	Autumn	Winter
The Sea of Marmara	20~100	68.2	29.6	11.9	55.5
	101~200	19.2	14.3	36.7	15.8
	201~500	0	8.4	0.4	6.3
	Sub total	54.2	25.9	13.5	45.3
North Aegean Sea	20~100	5.7	25.2	17.5	5.3
	101~200	10.0	101.2	40.6	36.6
	201~500	6.4	36.7	4.4	4.6
	Sub total	6.7	45.6	19.0	12.3
South Aegean Sea	20~100	6.2	8.0	82.1	2.2
	101~200	0.7	9.7	34.3	23.1
	201~500	13.1	58.3	10.2	7.5
	Sub total	6.7	26.3	47.2	10.4
West Mediterranean Sea	20~100	0	7.0	1.5	1.0
	101~200	2.9	20.5	3.8	7.4
	201~500	3.8	15.5	4.5	5.9
	Sub total	2.0	13.6	3.1	4.8
East Mediterranean Sea	20~100	6.8	4.2	3.4	0.9
	101~200	1.6	22.4	16.5	15.2
	201~500	8.5	73.9	3.9	82.9
	Sub total	6.0	16.0	6.2	29.8
All area	20~100	22.6	18.1	20.9	21.4
	101~200	6.8	54.6	29.3	23.2
	201~500	7.1	43.0	5.7	18.7
	Total	16.3	31.3	19.2	21.2

2) Stock Size

The estimations of the stock size of Atlantic horse-mackerel are indicated in Table 5-1-3-15. The total stock size was 791 tons in spring (95% confidence interval: ±647 tons, CV: 40%), 1,741 tons in summer (95% confidence interval: ±749 tons, CV: 21%), 845 tons in autumn (95% confidence interval: ±277 tons, CV: 16%) and 933 tons in winter (95% confidence interval: ±685 tons, CV: 27%). The stock size estimations in summer were the highest, while those of the other three seasons were roughly 1/2 that amount. Comparison of the stock size by strata in all areas indicated that the stock size reached a maximum at strata of

20-100 m in the spring and autumn, and at strata of 201-500 m in the summer. In winter, the stock sizes were roughly the same for all strata. Comparison of the stock size by sub area revealed the stock size to be high in The Sea of Marmara in spring, in the North Aegean Sea in summer, in the South and North Aegean Sea in autumn, and in The Sea of Marmara and the North Aegean Sea in winter.

The difference in the stock size between summer and the other three seasons was just under 1,000 tons. This difference is not significant in consideration of the 95% confidence intervals of each season. This species is a migratory species both geographically and vertically. Since it is also known to migrate to coastal areas in summer and to deeper water of 501 m or more in winter, the estimation of stock size is believed to be greatly affected by time, location and method of survey.

Table 5-1-3-15 Estimation of Stock Size of Atlantic Horse-Mackerel

Sub area	Stratum (m)	Stock size in tons (t)			
		Spring	Summer	Autumn	Winter
The Sea of Marmara	20~100	485.2	160.9	61.8	290.3
	101~200	11.6	8.6	22.1	9.5
	201~500	0	11.2	0.6	8.4
	Sub total	496.7	180.7	84.4	308.1
North Aegean Sea	20~100	42.1	215.6	146.4	44.6
	101~200	40.4	409.9	157.2	214.4
	201~500	64.3	366.4	42.1	68.6
	Sub total	146.8	992.0	345.7	327.7
South Aegean Sea	20~100	18.9	25.7	259.7	5.6
	101~200	1.0	11.8	41.9	30.7
	201~500	58.0	259.4	45.3	33.6
	Sub total	78.0	296.9	346.9	69.9
West Mediterranean Sea	20~100	0	7.8	1.7	1.2
	101~200	1.7	12.2	2.2	4.4
	201~500	5.5	22.3	6.4	8.5
	Sub total	7.2	42.3	10.3	14.0
East Mediterranean Sea	20~100	40.4	25.0	20.3	5.3
	101~200	2.9	43.7	29.2	26.8
	201~500	18.5	160.8	8.5	180.6
	Sub total	61.8	229.6	58.0	212.7
All area	20~100	586.6	435.0	489.8	347.1
	101~200	57.5	486.2	252.6	285.8
	201~500	146.3	820.2	102.9	299.6
	Total	790.5	1,741.4	845.3	932.5
* 95% confidence interval		± 647.4	± 748.6	± 277.3	± 685.4

* 95% confidence interval was calculated to total stock size.

(6) Red Mullet *Mullus barbatus*

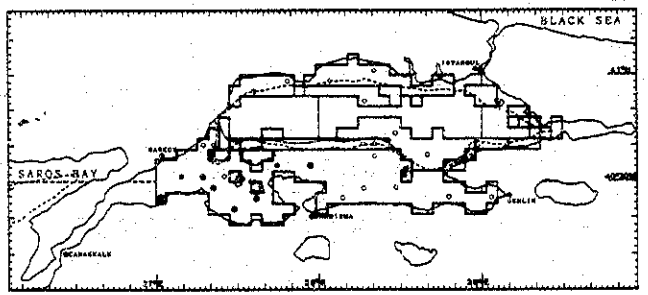
1) Distribution

This species was distributed throughout all areas surveyed. However, the distribution of this species in The Sea of Marmara was limited to the southwest portion of that area at a depth of 200 m or less (Figs. 5-1-3-6-1 to 5-1-3-6-4). The appearance frequency of this species in all areas was just over 60% throughout all seasons (Table 5-1-3-16).

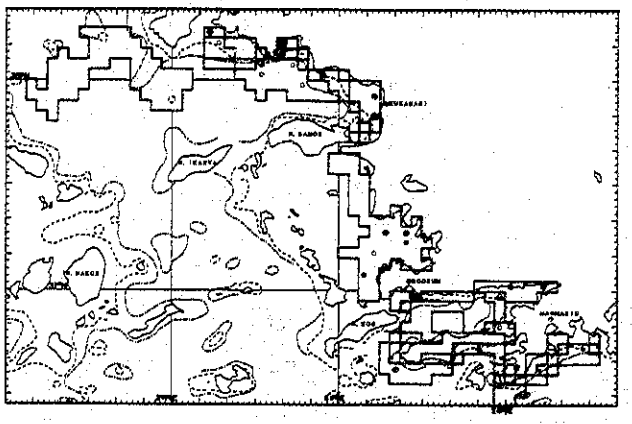
Table 5-1-3-16 Appearance Frequency of Red Mullet*

Sub area	Stratum (m)	Appearance Frequency (%)			
		Spring	Summer	Autumn	Winter
The Sea of Marmara	20~100	43	41	52	47
	101~200	33	25	0	0
	201~500	0	0	0	0
	Sub total	37	36	41	33
North Aegean Sea	20~100	82	89	91	100
	101~200	88	69	82	100
	201~500	20	5	0	0
	Sub total	69	61	68	79
South Aegean Sea	20~100	83	100	85	100
	101~200	80	100	80	100
	201~500	50	0	10	0
	Sub total	74	64	57	69
West Mediterranean Sea	20~100	100	75	100	100
	101~200	67	100	67	100
	201~500	67	0	0	0
	Sub total	80	60	60	67
East Mediterranean Sea	20~100	50	83	83	100
	101~200	100	86	100	100
	201~500	75	50	75	33
	Sub total	63	80	85	80
All area	20~100	65	78	80	82
	101~200	81	74	76	86
	201~500	39	8	12	5
	Total	63	61	65	65

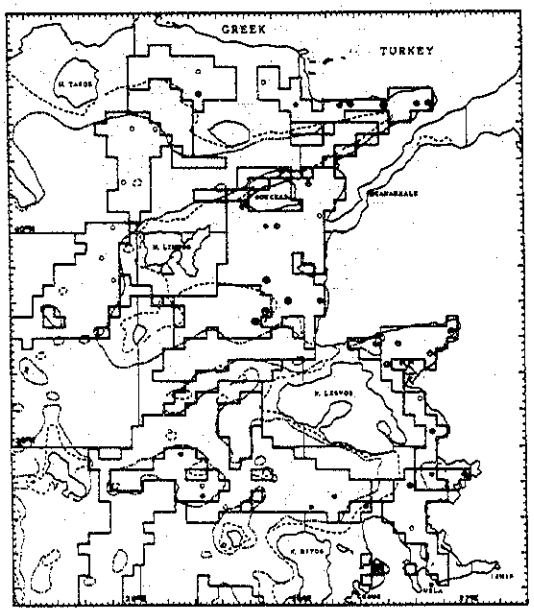
* Appearance frequency: No. caught / No. of trawls x 100%



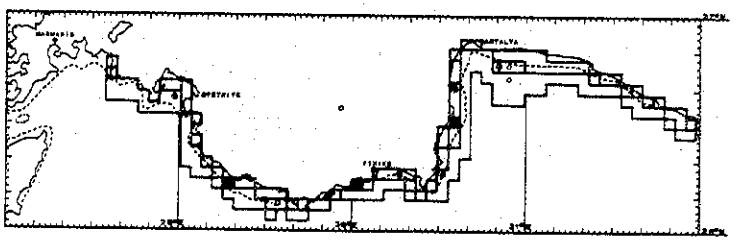
The Sea of Marmara



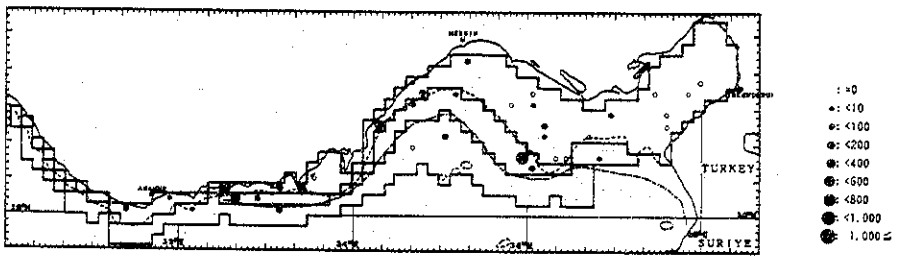
South Aegean Sea



North Aegean Sea

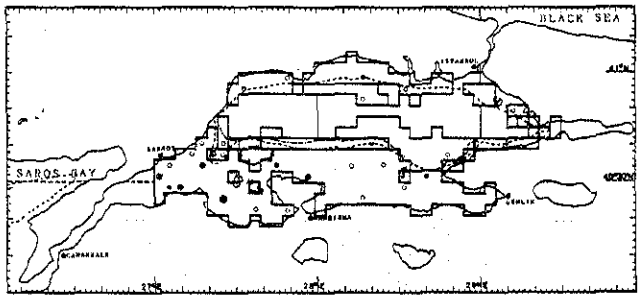


West Mediterranean Sea

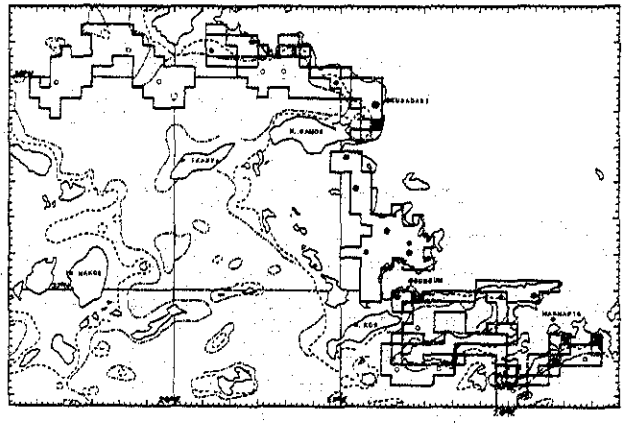


East Mediterranean Sea

Fig.5-1-3-6-1 The catch in kg of red mullet *Mullus barbatus* at each stations in the spring season survey



The Sea of Marmara



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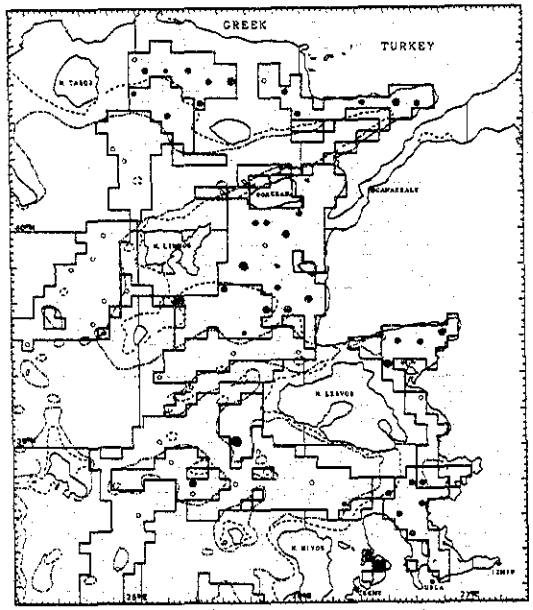
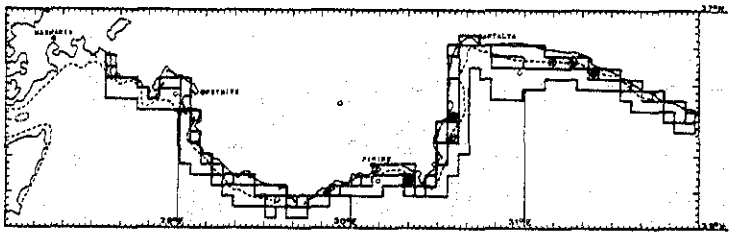
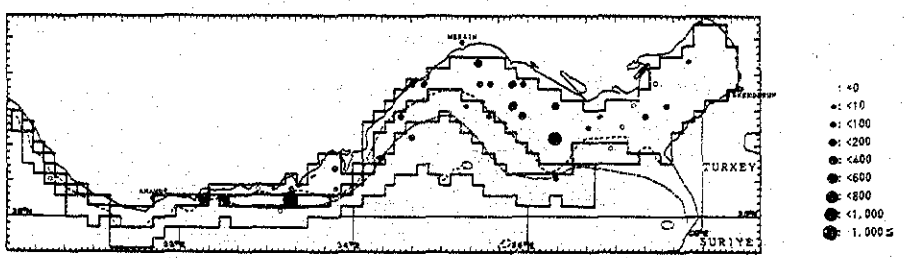


North Aegean Sea

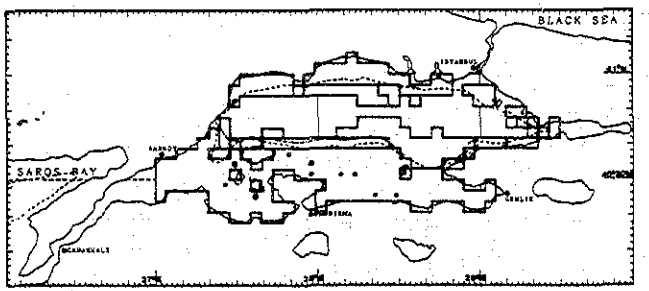


West Mediterranean Sea

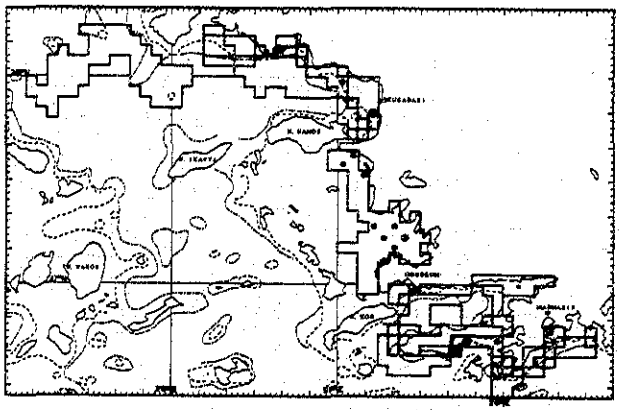


East Mediterranean Sea

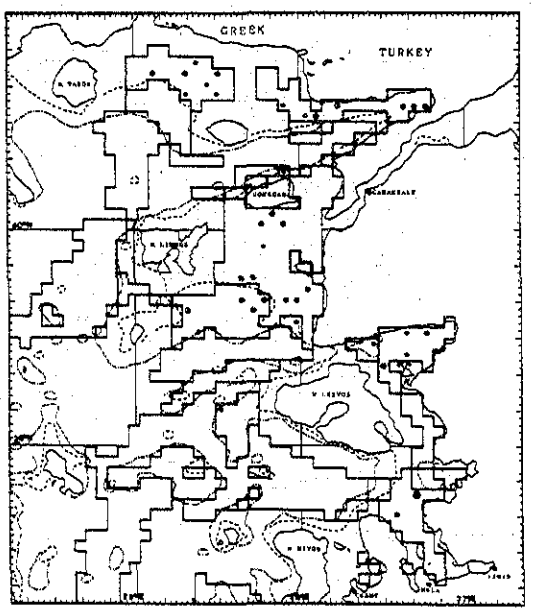
Fig.5-1-3-6-2 The catch in kg of red mullet *Mullus barbatus* at each stations in the summer season survey



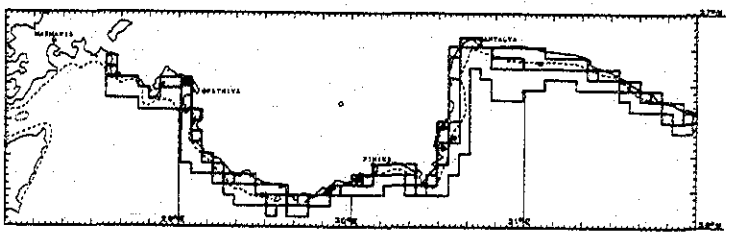
The Sea of Marmara



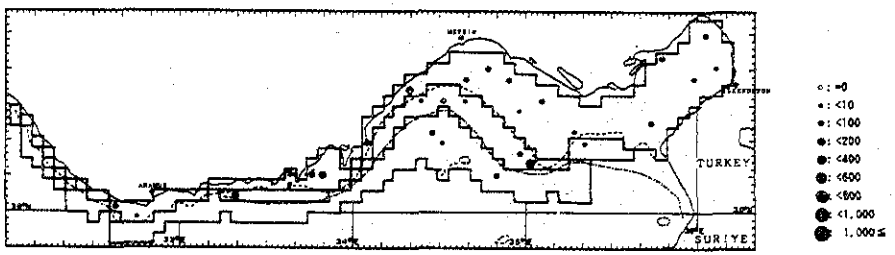
South Aegean Sea



North Aegean Sea

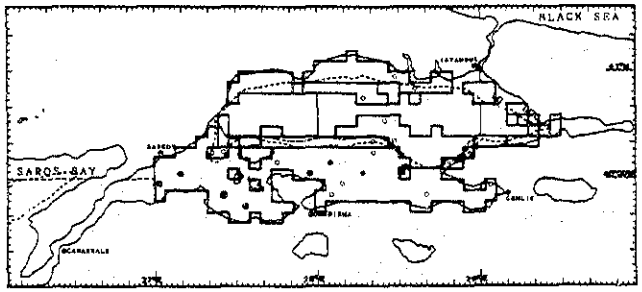


West Mediterranean Sea

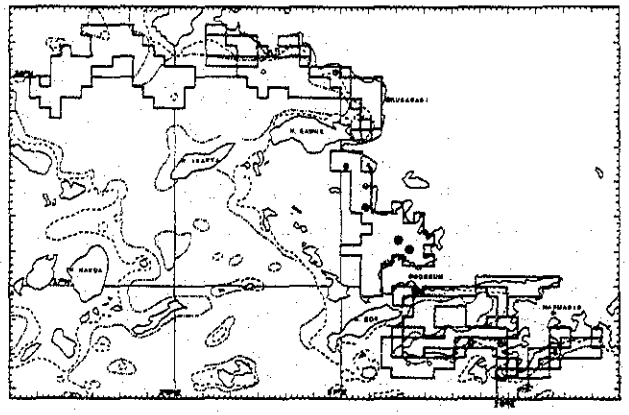


East Mediterranean Sea

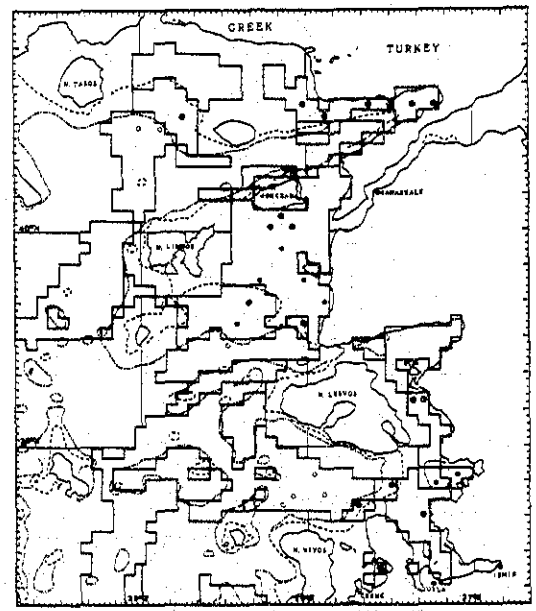
Fig.5-1-3-6-3 The catch in kg of red mullet *Mullus barbatus* at each stations in the autumn season survey



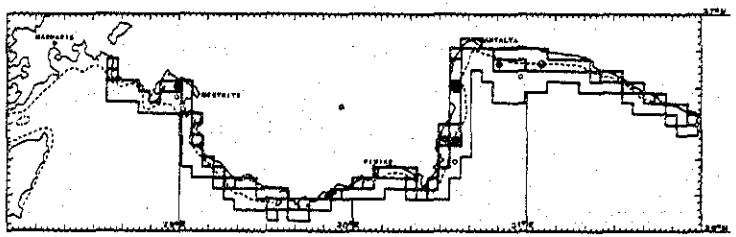
The Sea of Marmara



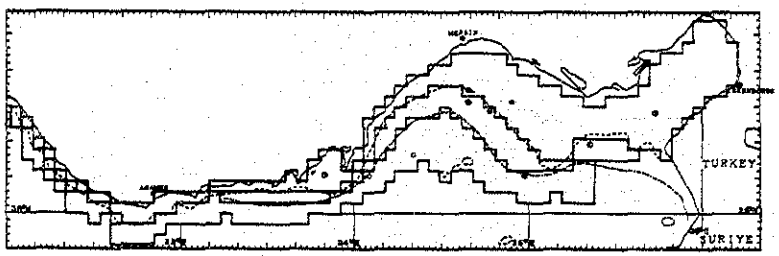
South Aegean Sea



North Aegean Sea



West Mediterranean Sea



East Mediterranean Sea

Fig.5-1-3-6-4 The catch in kg of red mullet *Mullus barbatus* at each stations in the winter season survey

The CPUA of this species in all areas surveyed was high at 60 in the summer followed by 43 in the spring, 36 in winter, and 27 in autumn. In looking at the CPUA values by strata in all areas, the CPUA was 30-80 at depths of 200 m or less, and 10 or less at depths of 201 m or more. The CPUA values by sub area tended to be high from the South Aegean Sea to the Mediterranean Sea, and low in the North Aegean Sea and The Sea of Marmara (Table 5-3-1-17).

Table 5-3-1-17 Catch Per Unit Area of Red Mullet

Sub area	Stratum (m)	Mean catch in kg/km²			
		Spring	Summer	Autumn	Winter
The Sea of Marmara	20~100	14.3	14.6	4.4	23.4
	101~200	0	7.2	0	0
	201~500	0	0	0	0
	Sub total	14.3	12.5	3.4	17.9
North Aegean Sea	20~100	57.6	76.3	30.1	35.1
	101~200	39.7	65.0	16.9	40.0
	201~500	1.2	0.3	0	0
	Sub total	40.5	52.3	20.6	28.7
South Aegean Sea	20~100	60.7	123.4	63.6	111.0
	101~200	35.2	21.6	83.3	67.4
	201~500	9.3	0	5.7	0
	Sub total	41.2	61.2	46.1	59.1
West Mediterranean Sea	20~100	156.7	153.4	93.7	210.1
	101~200	23.1	45.9	10.6	47.1
	201~500	26.7	0	0	0
	Sub total	77.6	75.1	40.7	85.7
East Mediterranean Sea	20~100	54.0	93.9	28.2	29.6
	101~200	167.5	192.1	75.7	19.3
	201~500	35.6	9.2	11.5	12.1
	Sub total	74.6	106.3	36.0	21.2
All area	20~100	51.4	76.1	31.4	50.1
	101~200	50.7	79.2	40.6	36.7
	201~500	9.1	1.1	3.2	2.0
	Total	42.6	59.9	27.0	36.0

2) Stock Size

The estimations of the stock size of red mullet are indicated in Table 5-1-3-18. The stock size of this species was the second highest among the 21 important species after hake throughout all seasons. The total stock size was 1,866 tons in spring (95% confidence interval: ±603 tons, CV: 16%), 2,585 tons in summer (95% confidence interval: ±979 tons, CV: 17%), 1,126 tons in autumn (95% confidence interval: ±332 tons, CV: 14%) and 1,631 tons in winter (95% confidence interval: ±686 tons, CV: 19%). The percentage of the total stock size for each season at strata of 20-100 m was 60-80%. The majority of the stock size was observed in the Aegean Sea and East Mediterranean Sea.

Although the difference in the stock size between seasons was

roughly 500-1,500 tons, this is not thought to be a significant difference in consideration of the 95% confidence intervals of each season. It is known that this species is a gregarious species that thrives on muddy bottoms of the continental shelf at depths down to 300 m. Since stock size is affected by the size and distribution of the schools.

Table 5-1-3-18 Estimation of Stock Size of Red Mullet

Sub area	Stratum (m)	Stock size in tons (t)			
		Spring	Summer	Autumn	Winter
The Sea of Marmara	20~100	70.3	79.1	22.8	111.1
	101~200	0	4.3	0	0
	201~500	0	0	0	0
	Sub total	70.3	83.4	22.8	111.1
North Aegean Sea	20~100	459.7	651.3	272.6	299.5
	101~200	160.9	263.5	67.2	156.5
	201~500	11.8	2.8	0	0
	Sub total	632.3	917.6	339.8	456.0
South Aegean Sea	20~100	158.5	396.2	199.6	476.3
	101~200	43.3	26.4	101.7	89.3
	201~500	41.6	0	25.1	0
	Sub total	243.3	422.6	326.4	565.6
West Mediterranean Sea	20~100	174.9	171.2	104.7	234.5
	101~200	13.7	27.2	6.3	28.0
	201~500	38.4	0	0	0
	Sub total	227.0	198.4	111.0	262.5
East Mediterranean Sea	20~100	319.8	556.3	167.0	175.4
	101~200	295.2	386.8	133.4	34.0
	201~500	77.5	20.0	25.1	26.3
	Sub total	692.5	963.1	325.6	235.7
All area	20~100	1,183.1	1,854.1	766.7	1,296.9
	101~200	513.0	708.2	308.6	307.7
	201~500	169.3	22.8	50.2	26.3
	Total	1,865.5	2,585.1	1,125.6	1,630.9
* 95% confidence interval		± 603.3	± 979.0	± 332.3	± 685.5

* 95% confidence interval was calculated to total stock size.