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**ON THE BY-CATCH OF HARBOUR PORPOISE (*PHOCOENA PHOCOENA*) IN
GERMAN FISHERIES IN THE BALTIC AND THE NORTH SEA**

by

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ABSTRACT

The harbour porpoise is the only cetacean known to be incidentally taken by German fishing vessels. This paper reviews data on the by-catch of this species from a reporting scheme based on voluntary compliance by fishermen. More than 95% of the by-catches were taken in set net fisheries. Incidental takes were much better documented for the Western Baltic than for the North Sea. It is not possible to quantify the present level of by-catch. Current evidence suggests that the by-catch level in German fisheries is low both in the Western Baltic and the North Sea. It seems unlikely that the current level of by-catch in the German fisheries alone could exert a significant adverse effect on the stock off the German North Sea coast. The situation may be more precarious in the Western Baltic. Given the low abundance estimates, even a low number of by-catches may affect the stock adversely.

INTRODUCTION

Harbour porpoises (*Phocoena phocoena*) are subject to incidental takes in fisheries throughout most of their distributional range. The majority of porpoises is caught in gill and trammel nets. A minor portion dies in trawls and pound nets (IWC, 1992, Perrin et al., 1994). Incidental mortality during fishing operations has been considered as the major threat to some of the populations whilst declines may have also occurred due to other causes, such as pollution and disturbance, (Reijnders, 1992; IWC, 1995).

Incidental takes of harbour porpoise in fishing gear in the North Sea and the Baltic had been known for a long time (i.a. Ropelewski, 1957; Lindroth, 1962; Schultz, 1970; Schulze, 1987; Northridge, 1988). Growing concern that these by-catches might cause unsustainable reductions in populations has led to a number of more systematic studies from the 1980's onwards in order to

obtain better estimates of the magnitude of catches in fishing gear and their likely impact on the stocks (Clausen and Andersen, 1988; Skora et al., 1988; Lindstedt and Lindstedt, 1989; Kinze, 1990, 1994; Bjørge and Oien, 1990; Määtänen, 1990; Northridge, 1991; Berggren, 1994; Lowry and Teilmann, 1994).

Attempts to study the by-catch problem in German fisheries in more detail did not start before 1987, when a reporting scheme was established on a private initiative in a small region of Western Kiel Bight (Western Baltic) (Benke et al., 1991). This scheme was extended to cover the entire Baltic and North Sea coasts of Germany from 1990 onwards (Benke and Siebert, 1994). By-catch reporting is not compulsory to fishermen, but is based on voluntary compliance. However, in Schleswig-Holstein (northernmost state of Germany) which harbours a major portion of the German fishing fleet operating with set nets, a bounty of 50.- DM (appr. 35 US \$) is paid to fishermen for the delivery of a carcass and ancillary catch information provided. Preliminary results from this reporting scheme have been described by Kremer and Schulze (1990), Benke et al. (1991) and Benke (1994). We report here on a more detailed analysis of this data set.

A SUMMARY OF GERMAN FISHERIES IN THE BALTIC AND THE NORTH SEA

A summary of German fisheries which may take harbour porpoise and other small cetaceans incidentally during their operations is provided in table 1. The beam trawl fisheries and the salmon drift net fishery have been excluded. The beam trawl fisheries targeting flatfish (plaice, *Pleuronectes platessa*, flounder, *Platichthys flesus*, and sole, *Solea solea*) offshore and brown shrimp (*Crangon crangon*) in the Wadden Sea are unlikely to take harbour porpoise due to the comparatively small size of their gear (7-9 m x 0.8 m). A small-scale salmon drift net fishery operates in the Baltic Proper. However, there is no evidence that harbour porpoise were incidentally taken in this fishery in the last 10 years (Mentjes, pers. comm.).

MATERIAL AND METHODS

The by-catch reporting scheme established in Western Kiel Bight (Benke et al., 1991) and local initiatives in other parts of the German coastlines to record sightings and strandings (Kremer et al., 1992, 1994) became part of a cooperative research project on small cetaceans in German waters

under the auspices of the 'Forschungs - und Technologiezentrum Westküste' of the University of Kiel from 1990 onwards. The project which focuses on harbour porpoise incorporates a wide range of studies from the estimation of basic biological parameters, such as reproduction, growth and feeding, to the impacts of xenobiotics and by-catches in fisheries on the stocks, in order to make optimal use of carcasses washed ashore and specimens incidentally taken in fisheries.

Whenever possible, the following information was collected: date, location of stranding or by-catch, type of fishing gear, water depth, condition of carcass, total body length, sex, maturity, girth, body weight, organ weight and blubber thickness. Routinely, a gross-pathological examination was performed on each carcass and tissue samples were taken for a wide range of studies. A sample of teeth in a string was removed from the middle section of the mandible. Ageing was carried out according to Kremer (1987). Information, though sometimes incomplete or only fragmentary, was available to us on 442 specimens from the North Sea and on 206 specimens from the Baltic (table 2).

RESULTS

Geographical Distribution of By-catches

The number of porpoises incidentally caught and stranded by region and coastline are provided in table 2.

Baltic

By-catches outnumbered strandings in the Baltic in some years or made up a considerable proportion of the porpoises reported to us (table 2, fig. 1). All by-catches were directly reported either by fishermen or local fishermen's associations. The proportion of carcasses found ashore with some evidence of being discarded during fishing was low (fig. 1).

There were considerable regional differences in the reported by-catches. Most of the records came from Western Kiel Bight where a reporting scheme was already in operation since 1987 (Benke et

al., 1991). Significant by-catches from Eastern Kiel Bight were only reported in 1991 and 1992 (fig. 2). Reported by-catches in the eastern part of the Western Baltic (Mecklenburg Bight to Arkona) were low, although the number of strandings was comparable or even higher than in other parts of the Western Baltic (fig.2). With very few exceptions, by-catches occurred in the depth range 7-15m.

Annual variation in the number of by-catches in Western Kiel Bight may reflect annual differences in fishing effort. In 1993, for example, effort was low due to large numbers of crabs (*Carcinus maenas*) present in the area which attacked fish in the nets soon after capture making fishing unprofitable (Pfander, pers. comm.)

North Sea

Strandings outnumbered reported by-catches in the North Sea by far (table 2, fig. 1). Records of by-catches were confined to the coast of Schleswig-Holstein. Twenty-one specimens were identified as by-catches (table 2). However, only 3 of them were directly reported by German fishermen. These were caught in the vicinity of the island of Helgoland in set net fisheries on cod (2) and sole (1) in 1994. There was clear evidence from pathological examination and net marks on the body in another 18 porpoises washed ashore on the island of Sylt that they were taken during fishing operations and subsequently discarded. There was some evidence from skin lesions that another 37 specimens (mostly in 1992 and 1993) might have been also discards from the fishery (fig. 1).

By-catches in Relation to Gear Type

Information on the type of gear in which they were taken was available in 108 specimens:

set net	:	104 (96.3%)	North Sea, Baltic
pound net	:	2 (1.9%)	Baltic
fyke net	:	1 (0.9%)	Baltic
bottom (?) trawl	:	1 (0.9%)	Baltic

Most of the harbour porpoises taken in set nets in Western Kiel Bight came from gill nets and only few from trammel nets (Pfander, pers. comm.)

Two individuals caught in set nets in Western Kiel Bight and one of the two individuals entrapped in a pound net were released alive (Pfander, pers. comm.; Benke et al., 1991).

Composition of By-Catches

Life History Stages

More than 75% of the by-catches in the North Sea and the Baltic was comprised of juveniles of 1 year and less and subadults of 1-2 years (figs. 3 and 4). There was no trend apparent in the distribution of life history stages in by-catches from 1987 to 1994 off the Baltic coast of Schleswig-Holstein (fig. 5). By-catches off the Baltic coast of Schleswig-Holstein increased considerably between August and November when neonates and juveniles made up a substantial part of the by-catch (fig. 6).

Age Composition

The majority of strandings (53 and 62 % resp.) was comprised of individuals of 1 year and less both at the North Sea and the Baltic coasts (fig. 7). There were very few porpoises older than 12 years found dead ashore (fig. 7). A similar trend was apparent in the age composition of the by-catches, however, with an even higher proportion of specimens which were 1 year and less (fig. 4). The oldest individual taken incidentally in the Baltic was 16 years old (fig. 4).

DISCUSSION

The geographical origin of strandings and by-catches of harbour porpoise broadly reflects its distribution and areas of abundance in German waters. Most of them (68.5%) were recorded from the North Sea coast of Schleswig-Holstein (table 2) where harbour porpoise tend to aggregate in the vicinity of the islands of Sylt and Amrum (Benke and Siebert, 1994).

Harbour porpoise have almost disappeared from the Baltic Proper, the Gulf of Bothnia and the Gulf of Finland (Skora et al., 1988; Määttänen, 1990; Berggren, 1994) where they have been abundant until the 1950's and 1960's (i.a. Ropelewski, 1957; Lindroth, 1962; Määttänen, 1990). They are now observed regularly, albeit in low numbers, only in the Western Baltic (Heide-Jørgensen et al., 1993) and along the Swedish coast of the Baltic where small numbers are still taken in cod gillnets and salmon drift nets (Berggren, 1994). Few specimens are now found east of the island of Rügen (Skora, 1990). This decline towards the east is also reflected in the low numbers of porpoises taken incidentally during fishing in the Mecklenburg Bight/Arkona area. In contrast, the number of strandings in the eastern part is comparatively high even outnumbering those in the western part of the Western Baltic (table 2). However, most of these carcasses were in an advanced state of decomposition when washed ashore suggesting that they must have spent some time dead in the water (Moreno et al., 1993). They may have originated further to the west and drifted in an easterly direction with the prevailing westerly winds (Schulze, pers. comm.). Given their decomposed state, it was impossible to determine to what extent they were discarded by the fishery or died of other causes.

By-catches of harbour porpoise in the Baltic occurred each month. They increased considerably in July to September when calves are born (Schulze, 1987; Bandomir, 1993). This suggests that entanglement may be related to experience of the animals making young and less-experienced animals more vulnerable (Kinze, 1990). As a consequence, it is unlikely that the age composition of harbour porpoise taken incidentally is representative of the population in the Western Baltic.

There was a marked difference in the amount of by-catch reported from the North Sea and the Baltic coast. The by-catch was negligible in relation to the strandings off and at the North Sea coast. There is clear evidence that the by-catch of harbour porpoise off the North Sea coast of

Germany is underreported to a large extent given the regular occurrence of stranded specimens, for which there is evidence that they were discards from the fishery, and anecdotal records from fishermen on the occurrence of porpoise carcasses in otter and beam trawl hauls (Moreno, 1993). It should be noted, however, that these by-catches do not necessarily originate from German fishing vessels. Danish gill net fisheries on sole and gadoids and industrial fisheries on sandeel (*Ammodytes spp.*) with a high season in May to July and on sprat (*Sprattus sprattus*) in November and December operate off the German North Sea coast. The high season of the industrial fishery on sandeel partly overlaps with the calving season of harbour porpoise.

In contrast, the by-catch off the Baltic coast either exceeded the strandings or made up a substantial part of it. Given the low occurrence of stranded specimens with evidence of being discards from the fishery, the by-catch figure provided in table 2 is probably much closer to the true figure than in the North Sea. An estimated by-catch of 20 ± 10 porpoises per year by German fishing activities in the Baltic seems to be a realistic first approach assuming that appr. 50 % of the fishermen report on a by-catch (Moreno, 1993).

Our analysis of the by-catch in German fisheries, though still based on a limited material, corroborates results from studies elsewhere (Perrin et al., 1994) in that harbour porpoise are particularly vulnerable to sink set nets (gill and trammel nets) although porpoises should principally be capable of detecting multimono-filament nets (Au and Jones, 1991) at least at short distance. Gill nets set in the Western Baltic on cod in recent years have an estimated effective fishing height of 2 - 3m. Nets set on sole in the North Sea are much more flat and estimated effective fishing height is not more than 0.3 - 0.5 m (Mentjes, pers. comm.). However, there is a tendency of using nets with a greater effective fishing height in both areas in recent years to increase the catch of gadoids.

Gear other than set nets appear to be of less importance. Bottom trawls operated by medium-sized fishing vessels (ca. 10-23 m long) have a comparatively small mouth opening and a high noise level associated with the performance of the trawl. They may be detected more easily and avoided by harbour porpoise. The situation may be different in midwater trawling (single and pair) which is commonly used in the Danish industrial fishery off the German coast. Midwater trawls, particularly

pair midwater trawls have a much bigger mouth opening and the noise level produced during midwater trawling is much lower.

Catches in pound nets which are set to catch herring in inshore waters of the Western Baltic have been recorded twice. In many cases, animals entrapped in pound nets can be released alive (Lowry and Teilmann, 1994). Salmon drift nets set by German fishermen in the Baltic Proper caught harbour porpoise regularly in the 1950's and 1960's (Thurrow, pers. comm.). There is no evidence that porpoises have been taken in the last ten years (Mentjes, pers. comm.). However, harbour porpoise are apparently still taken in small numbers in the Swedish drift net fishery on salmon (Berggren, 1994). This is likely due to the scarcity of harbour porpoises in the Baltic Proper in the last decades.

A total of 7000 porpoises has been estimated as being taken annually in the Danish fishery (Lowry and Teilmann, 1994). Previous estimates of the number of harbour porpoise incidentally taken in German fisheries in the North Sea were based on questionnaires sent to fishermen and very incomplete information on fishing effort and its distribution in the area. They were in the order of 30 - 110 porpoises taken each year (Moreno, 1993). At present, our data do not enable us to refine this estimate. However, there is some evidence that the by-catch by German fisheries is towards the lower end of that range or may be even less. Set net operations by German fishermen in the North Sea are limited to a fishery on sole from April to August conducted by fishing boats from the Baltic and a fishery on cod and flatfish year round in the vicinity of the island of Helgoland carried out by local fishermen. Gill nets used in the sole fishery are flat and have an estimated effective fishing height of only 0.3 - 0.5 m due to the habits of the target species. Fishing effort exerted in the high season in 1994 (May) was ca. 150 km of nets set per day, but is usually less. Extensive experimental fishing on sole by a research vessel over a number of years in this area never resulted in a by-catch of harbour porpoise (Mentjes, pers. comm.). A low by-catch of small cetaceans has also been reported from the Danish set net fishery on sole (Jonas and Teilmann, 1994). The gill net fishery around Helgoland is a very localised fishery. Sightings of harbour porpoise in this area were much more sparse than further to the north (Benke and Siebert, 1994).

Harbour porpoise have a limited ability for population growth (Polachek, 1989; Woodley and Read, 1990) making them vulnerable to incidental catches in fisheries. The low precision of our current estimates of the level of by-catch in German fisheries makes it very speculative to assess its

impact on the stocks. It seems unlikely that the current level of by-catch in the German fisheries alone could exert a significant adverse effect on the stock off the German North Sea coast given the low level of fishing effort of the German set net fishery in that area and the preliminary abundance estimate from the SCANS (Small Cetacean Abundance in the North Sea) survey in July 1994. The situation may be more precarious in the Western Baltic. Current abundance estimates for its western part (Kiel Bight) were 132 - 331 harbour porpoises in 1991 and 46 - 166 in 1992 (Heide-Jørgensen et al., 1993).

The European Union has recognised the need to conserve cetaceans. The Council Directive 92/43/EEC on the Conservation of Natural Habitats and Wild Flora and Fauna requires Member States to take action to protect all species of whales in EU waters.

There are currently no conservation measures in force in German fisheries which aim specifically at reducing the by-catch of harbour porpoise and other small cetaceans. A number of restrictions have been introduced recently to limit the set net fishery in coastal waters of Schleswig-Holstein to some extent. No setting of nets is allowed within 200 m of the shoreline. Hobby fishermen have to refrain from setting gill and trammel nets.

Germany is a Party to ASCOBANS (Agreement on Small Cetaceans of the Baltic and the North Seas). The Conservation and Management Plan of the Agreement requests Members i.a. to carry out investigations in order to better estimate the level of by-catch of small cetaceans in their fisheries. These estimates are unlikely to be obtained from reporting schemes based on voluntary compliance by fishermen. As a consequence, the Bundesforschungsanstalt für Fischerei (Federal Research Centre for Fisheries) supported by EU funds will extend its existing scheme of scientific observation onboard German fishing vessels in the North Sea considerably in order to improve the monitoring the by-catch of non-target species including small cetaceans. Particular emphasis will be placed on the set net fisheries in the German Bight and midwater trawling on pelagic fish stocks in the central and northern North Sea. First results from this project should be available in a year's time.

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Legends to Figures

Figure 1: By-catches and strandings of harbour porpoise (*Phocoena phocoena*) off and at the German coasts of the North Sea and the Baltic in 1990-1994

Figure 2: By-catches of harbour porpoise (*Phocoena phocoena*) reported by German fishermen from different areas of the Western Baltic in 1990-1994

Figure 3: Composition of the by-catch of harbour porpoise (*Phocoena phocoena*) off the North Sea and the Baltic coasts of Schleswig-Holstein (Germany). Numbers on top of the column denote sample size

Figure 4: Age composition of by-catches of harbour porpoise (*Phocoena phocoena*) off the North Sea and the Baltic coasts of Schleswig-Holstein (Germany)

Figure 5: Distribution of life history stages of harbour porpoise (*Phocoena phocoena*) on by-catches off the Baltic coast of Schleswig-Holstein (Germany) in 1987-1994. Numbers on top of the column denote sample size

Figure 6: Distribution of life history stages of harbour porpoise (*Phocoena phocoena*) by month in by-catches off the Baltic coast of Schleswig-Holstein (Germany) in 1987-1994

Figure 7: Age composition of strandings of harbour porpoise (*Phocoena phocoena*) at the North Sea and the Baltic coasts of Schleswig-Holstein (Germany)

Table 1: German fisheries with a potential for by-catch of small cetaceans in the Baltic, North Sea and West of the British Isles

Target species	ICES Areas	Fishing season	Gear type	No. of vessels
Herring (<i>Clupea harengus</i>)	III c, d	March - May	gill net pound net midwater trawl	200
Cod (<i>Gadus morhua</i>)	III c III d	Oct - May Jan - June	trawl gill net	50 - 100
Flounder (<i>Platichthys flesus</i>)	III c, d	Jan, July - Oct	bottom trawl	30
Herring (<i>Clupea harengus</i>)	IV V b, VI a, b	May - Oct July - Nov	midwater trawl	3 - 8 freezer trawlers
Mackerel (<i>Scomber scombrus</i>)	V b, VI	Sept - March	midwater trawl	3 - 6
Gadids, flatfish	III a, IV a, IV b	all year	bottom trawl	30 - 40
Cod (<i>Gadus morhua</i>)	IV b (mostly around Helgoland)	all year	gill net	20
Sole (<i>Solea solea</i>)	IV b	April - Aug	gill net	20 - 30

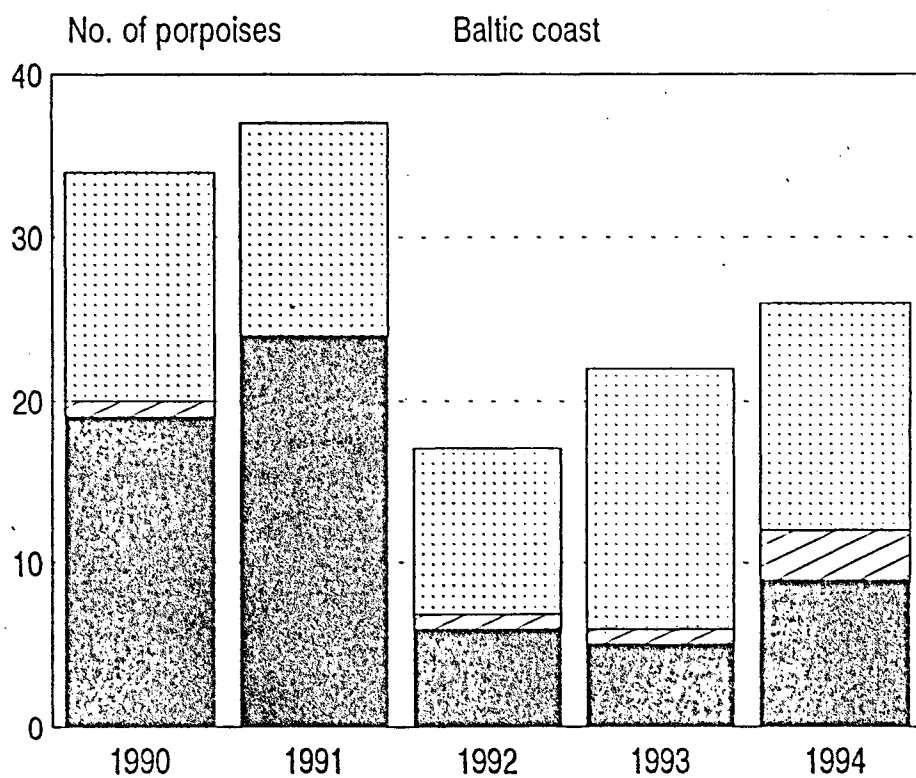
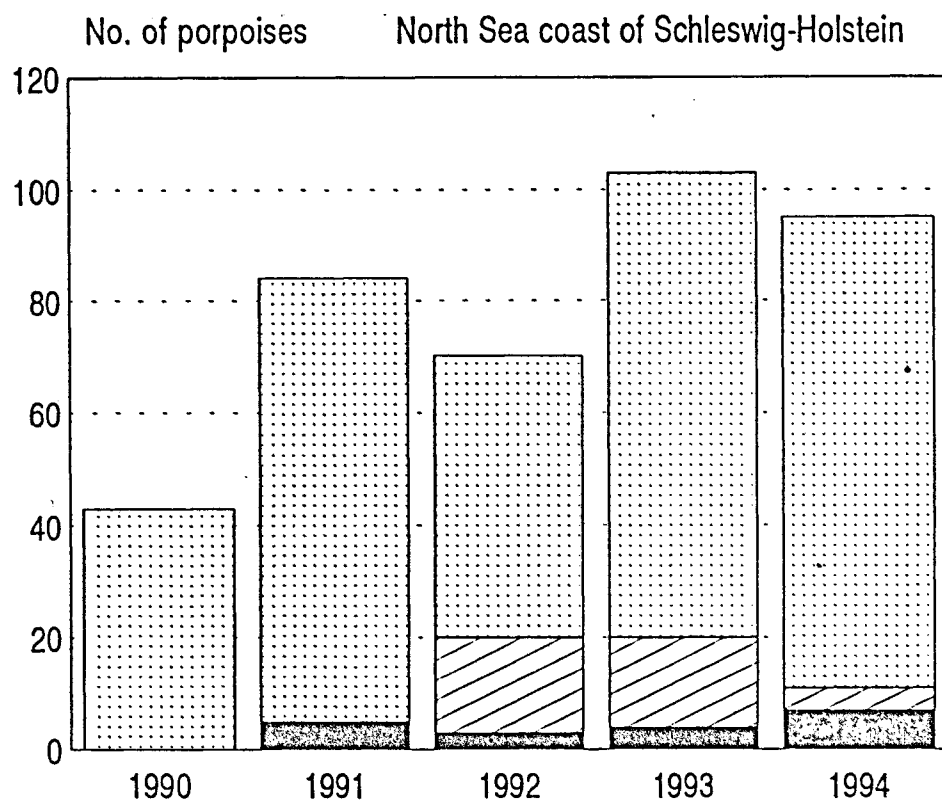
Table 2: Reported by-catches and strandings of harbour porpoise (*Phocoena phocoena*) off and at the North Sea and Baltic coasts of Germany

Year	North Sea				Baltic			
	Lower Saxonia		Schleswig-Holstein		Schleswig-Holstein		Meckl.-Prepomerania	
	By-catch	Strandings	By-catch	Strandings	By-catch	Strandings	By-catch	Strandings
1987	-	-	-	-	16 ¹⁾²⁾	-	-	-
1988	-	-	-	-	10 ¹⁾	-	-	-
1989	-	-	-	-	7 ¹⁾	-	-	-
1990	-	-	0	62	20	3	0	12
1991	0	9	5	79	24 ²⁾	8	1	5
1992	0	6	3	68	6	9	0	2
1993	0	5	6	94	4	7	1	10
1994	0	3	7	95	8	5	1	12
Σ	0	23	21	398	95	32	3	41

¹⁾ almost exclusively from a small region (54°32'N - 54°50'N/09°52'E - 10°10'E) in Western Kiel Bight

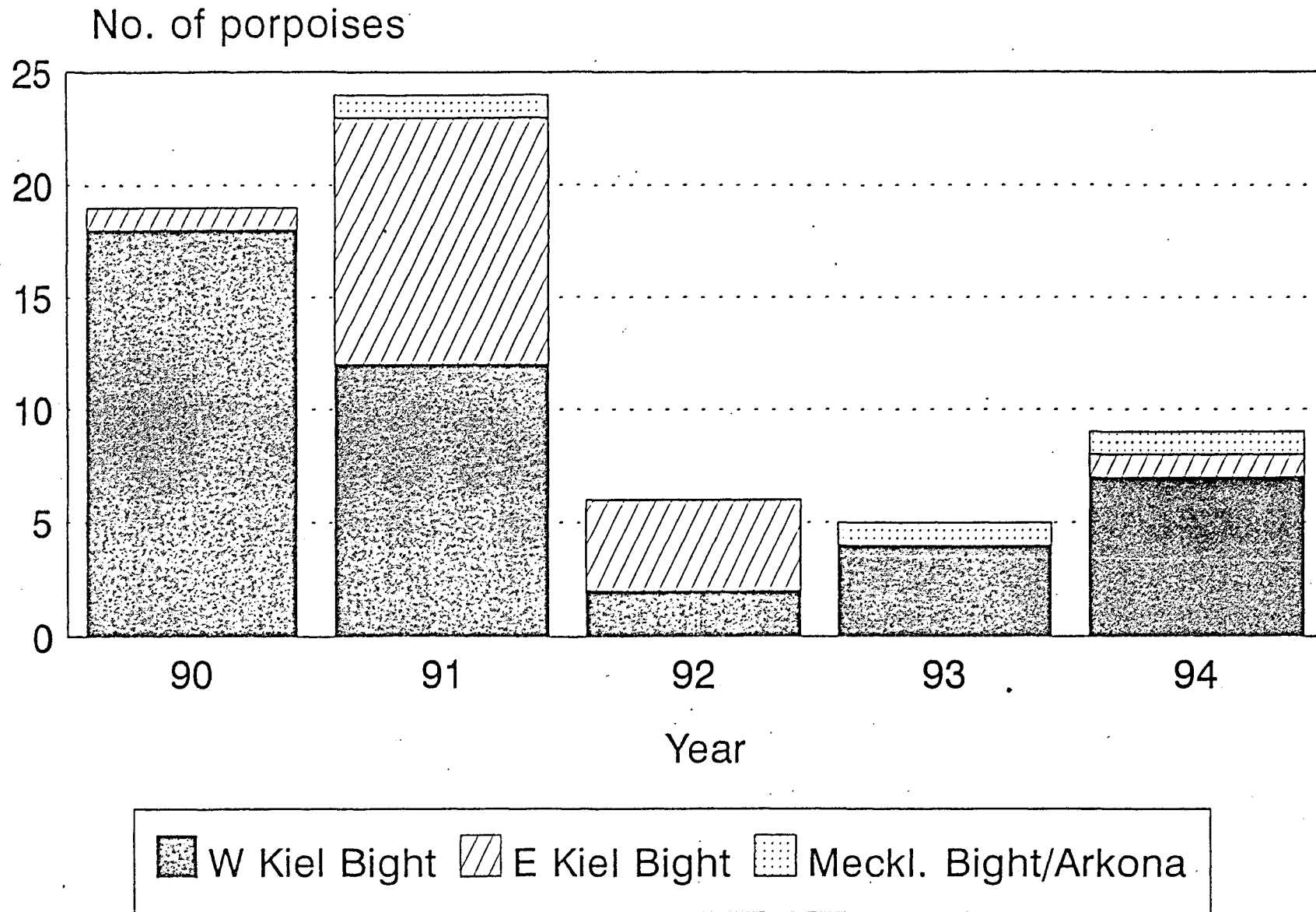
²⁾ In addition, 1 specimen (< 1 year old) was reported from the Kattegat

By-catches and strandings of harbour porpoise (*Phocoena phocoena*)
off and at the German coasts of the North Sea and the Baltic

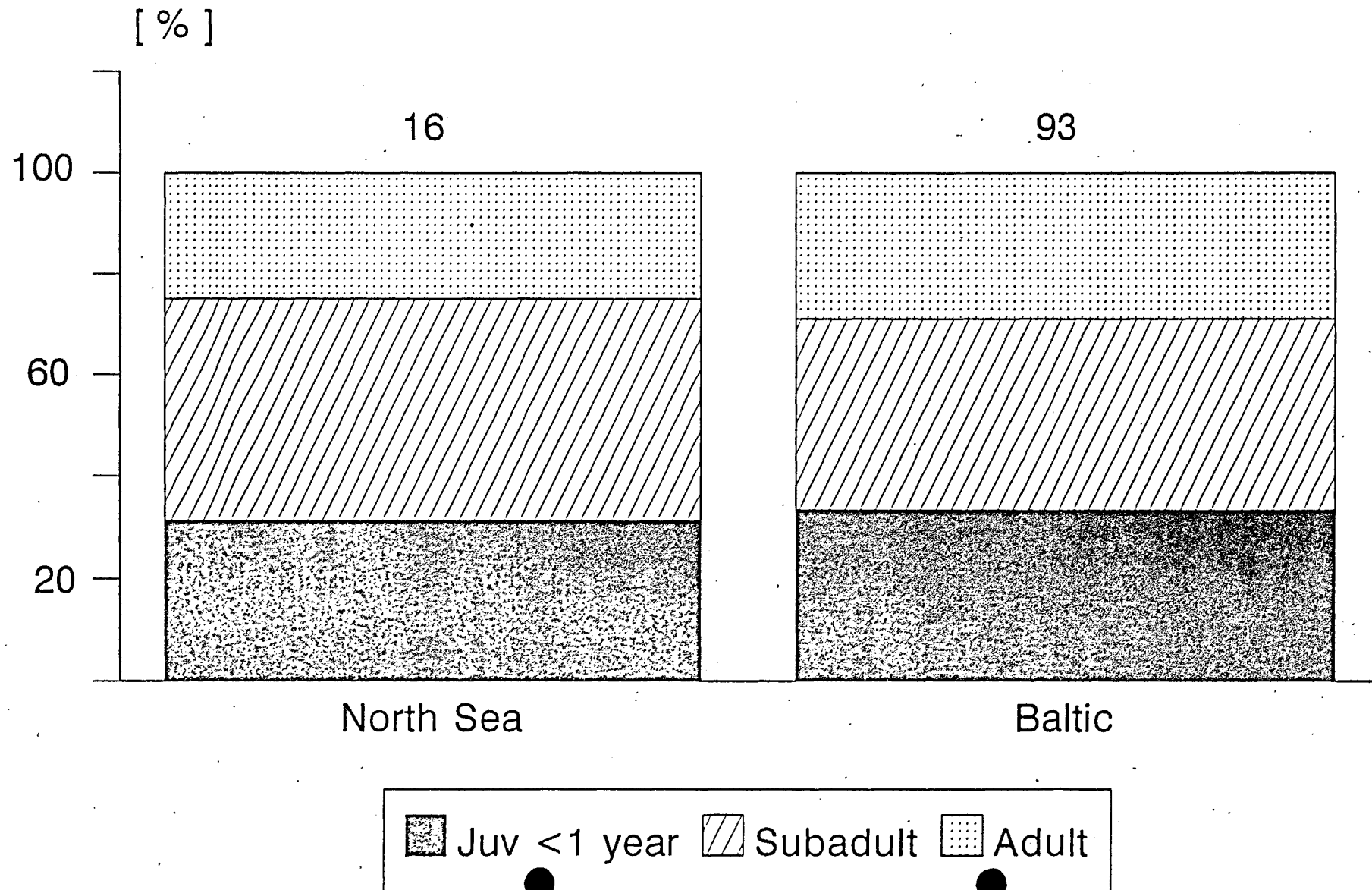


■ By-catch ▨ By-catch ? ▤ Strandings

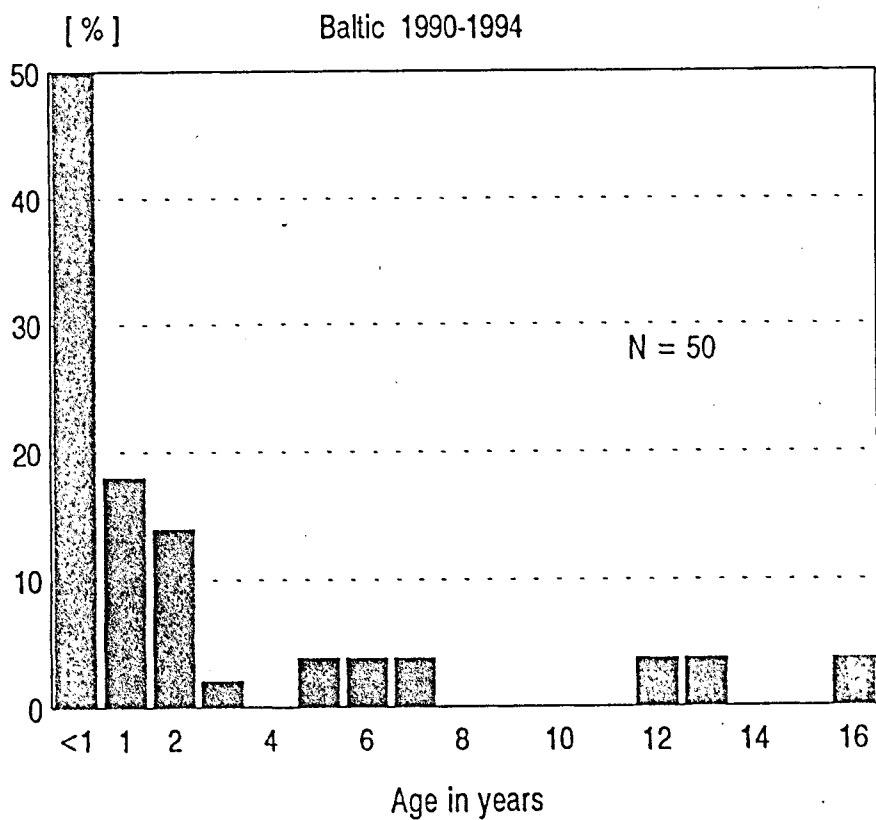
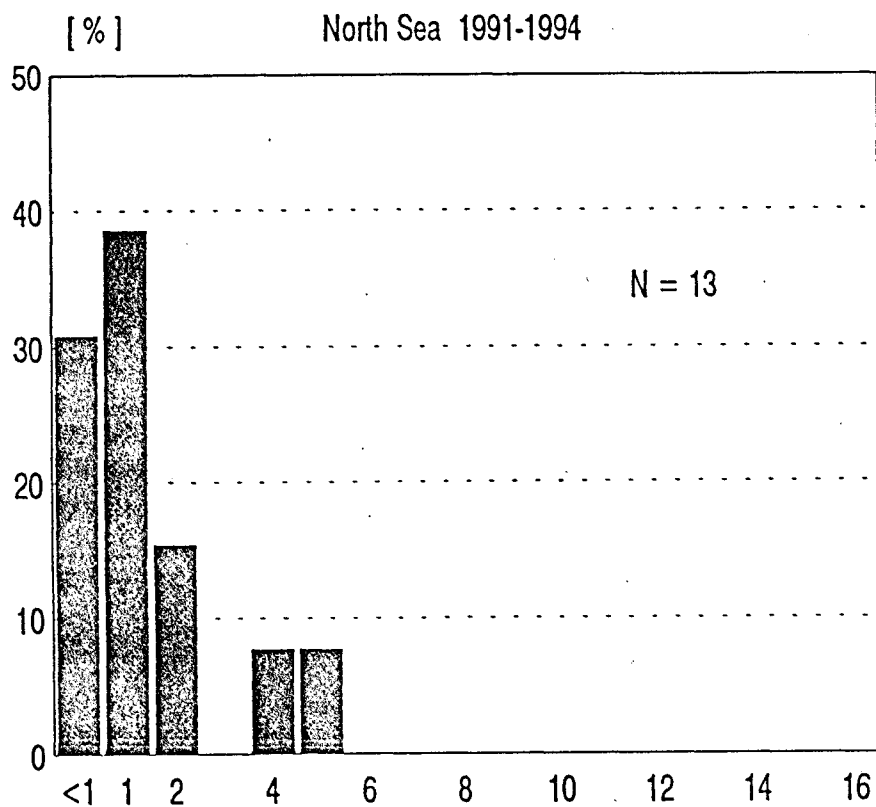
By-catches of harbour porpoise (*Phocoena phocoena*) reported by German fishermen from different parts of the Western Baltic in 1990-1994



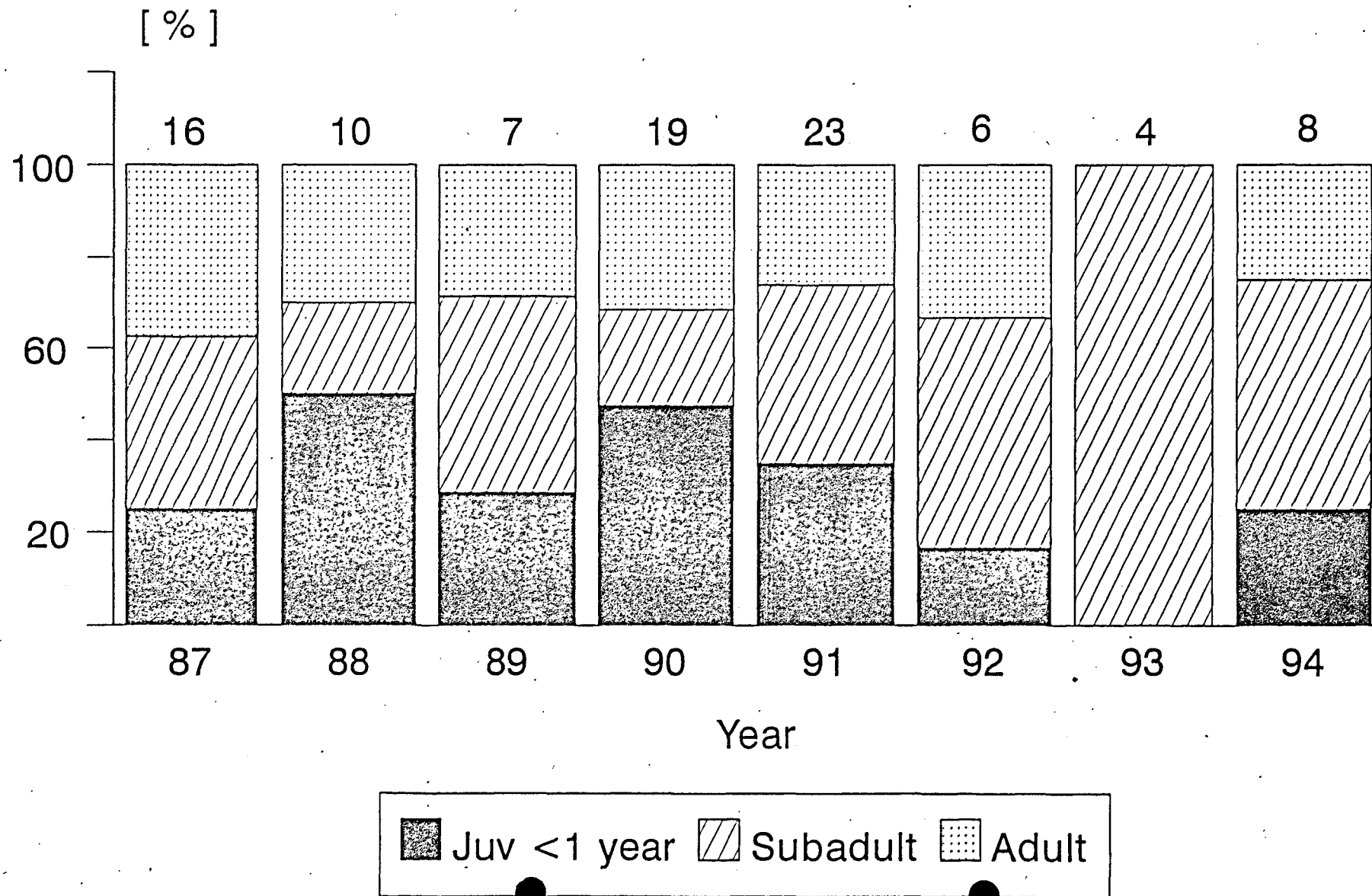
Composition of the by-catch of harbour porpoise (*Phocoena phocoena*) off the North Sea and the Baltic coasts of Schleswig-Holstein (Germany)



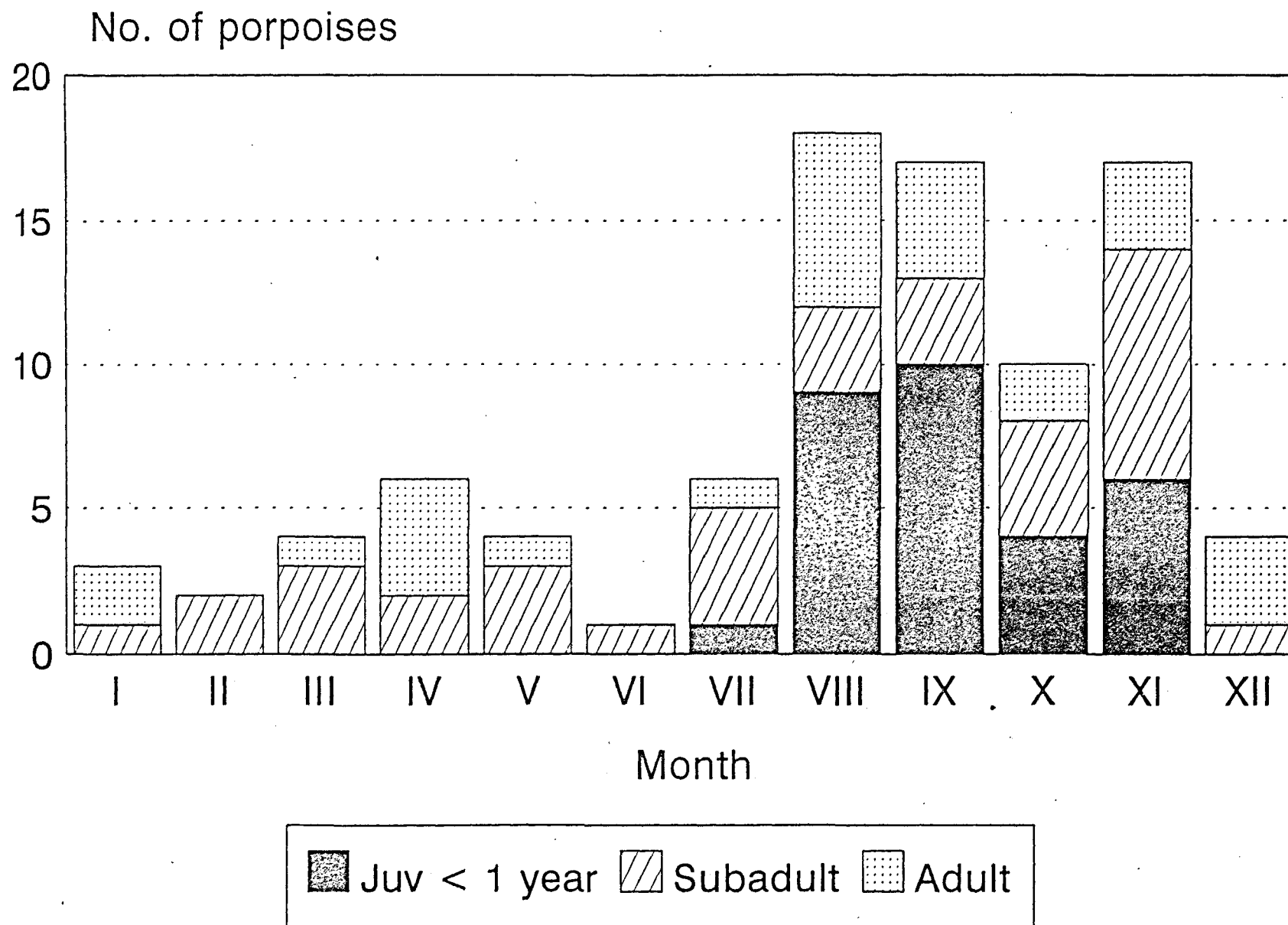
Age composition of by-catches of harbour porpoise (*Phocoena phocoena*)
in German fisheries in the North Sea and the Baltic



Distribution of life history stages of harbour porpoise (*Phocoena phocoena*) in by-catches off the Baltic coast of Schleswig-Holstein in 1987-1994



Distribution of life history stages of harbour porpoise (*Phocoena phocoena*) by month
in by-catches off the Baltic coast of Schleswig-Holstein in 1987-1994



Age composition of strandings of harbour porpoise (*Phocoena phocoena*)
at the North Sea and the Baltic coast of Schleswig-Holstein (Germany)

