Introduction
More than 10 species of rays and skates are found in the North Sea. In general little is known of their biology. This poster summarizes some information on the four most abundant species: Starry ray (*Raja radiata*), Cuckoo ray (*R. naevus*), Spotted ray (*R. montagui*) and Roker or Thornback ray (*R. clavata*). *R. radiata* is the most abundant species, representing 80% of the total biomass (Figure 1). Currently the landings of all rays and skates from the North Sea, as reported to ICES, are about 5000 tonnes, although for the most recent years landings statistics are known to be incomplete. There has been a steady decline in landings since the early 1950's, when nearly 18000 tonnes were landed (Figure 2). The life history characteristics of elasmobranchs (large age- and length-at-maturity and low fecundity) make them especially vulnerable to exploitation. During the first half of this century there were trawl and long-liné fisheries directed towards rays and skates. Some long-lining is still carried out along the east coast of Britain but this fishing method is rarely used in the North Sea anymore. Rays and skates are a bycatch of the commercial demersal fisheries and most are thrown overboard as discards, only the largest ones being landed for consumption.

Distribution
*R. radiata*, a Boreal species, is widely distributed in the North Sea, north of 54 °N. *R. naevus*, *R. montagui* and *R. clavata* have a more limited distribution, the majority being found along the British coast, depending on the species. All three species are Lusitanian and reach the northern range of their distribution in the North Sea. *R. naevus* and *R. clavata* are concentrated in coastal areas in summer. The catches of *R. clavata* in particular are much lower in the summer than in the winter, which is probably linked with coastal spawning.

Length composition
Of the four species studied, *R. radiata* is the smallest and *R. clavata* the largest. Individuals as small as 7 cm were caught, although not in large numbers. Length at maturity of females (based on literature data) is indicated. *R. radiata* has a relatively higher proportion of mature specimens than the other species.
Feeding
As juveniles all four species mainly feed on crustaceans. There are differences in the length at which each species switches to eating fish (Figure 5). R. naevus and R. radiata switch at 15 and 25 cm, respectively, and both remain predominant fish eaters, whereas at 80 cm only half of what R. clavata consumes is fish. R. clavata never appears to be reliant on fish as a source of food. R. montagui switches at a length of 40 cm and consumes an increasing amount of fish with increasing length.

Life cycle
Raja species are oviparous and lay fertilised eggs enclosed in rigid egg capsules. There are species specific differences in the size at maturity and the number of eggs laid (Figure 6). The data are not complete for all species. R. clavata is known to spawn in shallow waters along the east coast of Britain. The distribution of spawning grounds for R. radiata, R. naevus and R. montagui in the North Sea is unknown.

Conclusions
Although the rays and skates are often regarded as one 'species', there are quite striking species specific differences in distribution, length-at-maturity, fecundity and feeding habits. These differences mean that there will also be species specific differences in tolerance to exploitation. It is therefore necessary to determine the level of exploitation per species as well as to improve our knowledge of their general biology.

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References
Biomass and species composition of Raja sp. in the North Sea 1977-1986

Landings of rays and skates - North Sea

Figure 1. Estimated biomass of rays and skates in the period 1977-1986. Data from Daan et al., 1990.

Figure 2. Total international landings of all rays and skates in the North Sea. Data from Bulletin Statistique (ICES Fisheries Statistics).

Figure 3. Average winter and summer distribution in 1985-1987 (Knijn et al., 1993). Data from the international Bottom Trawl Survey and a number of national surveys.
Figure 4. Average length-frequencies in February 1985-1987 (Krijn et al., 1993). Data from the International Bottom Trawl Survey.

Figure 5. Stomach content data in 1991. Data from ICES Stomach Sampling Project (Daan et al., 1993).