

WATERBIRDS AND AQUATIC RECREATION AT LAKE IJsselmeer, THE NETHERLANDS: THE POTENTIAL FOR CONFLICT

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The 170,000 ha Lake IJsselmeer area is a stronghold for internationally important numbers of waterbirds, and is also important for aquatic recreation. Research has been undertaken to investigate potential conflicts. An inventory was made of the occurrence of recreational use in time and space, of waterbird food resources and potentially suitable roosts, and of actual use by birds. This indicated that conflicts between recreation and waterbirds were particularly likely from April to October, and involve breeding and moulting birds, and those staging in late summer. Some areas were extensively used for recreation and there was evidence that birds avoided those parts most heavily used. In one area, where conflicts were likely, detailed observations showed reduced bird abundance and distributional shifts. It is suggested that management measures aimed at maintaining both wildlife and recreation uses within the lakes, should separate spatially the core areas of these functions.

Keywords: Aquatic Recreation, Disturbance, IJsselmeer, Waterbirds.

The Lake IJsselmeer area of The Netherlands, consisting of two large adjacent freshwater lakes totalling about 170,000 ha, is a stronghold for internationally important numbers of waterbirds. In winter, as many as 300,000 diving ducks rest and forage there, as well as several thousand sawbills *Mergus* spp. and Great Crested Grebes *Podiceps cristatus* (Van Eerden & Bij de Vaate 1984, Van Eerden & Zijlstra 1986, Noordhuis et al. 1995). The latter species assembles in huge moulting concentrations of up to 10,000 in late summer and autumn (Van Eerden & Bij de Vaate 1984, Piersma et al. 1986), along with up to 40,000 Tufted Duck *Aythya fuligula* and Pochard *A. ferina* (Van der Wal & Zomerdijs 1979), and well over 120,000 Black Terns *Chlidonias niger* (Schouten 1985). It is clear that Lake IJsselmeer plays a fundamental

role in the life-cycles of large numbers of waterbirds on a European or even western Palearctic scale (cf. Rose & Scott 1994, Meininger et al. 1995).

At the same time, however, the area is used extensively for a variety of human activities including various forms of recreation (eg sailing, boating, canoeing, windsurfing) (Ter Haar et al. 1995). Moreover, some local authorities are planning to expand facilities for recreation by providing more harbours and windsurfing beaches. These planned expansions are bound to lead to an increase in recreational pressure on both lakes, which in turn might diminish their value as feeding and resting places for breeding and staging waterbirds.

The international importance of the Lake IJsselmeer area for waterbirds has been

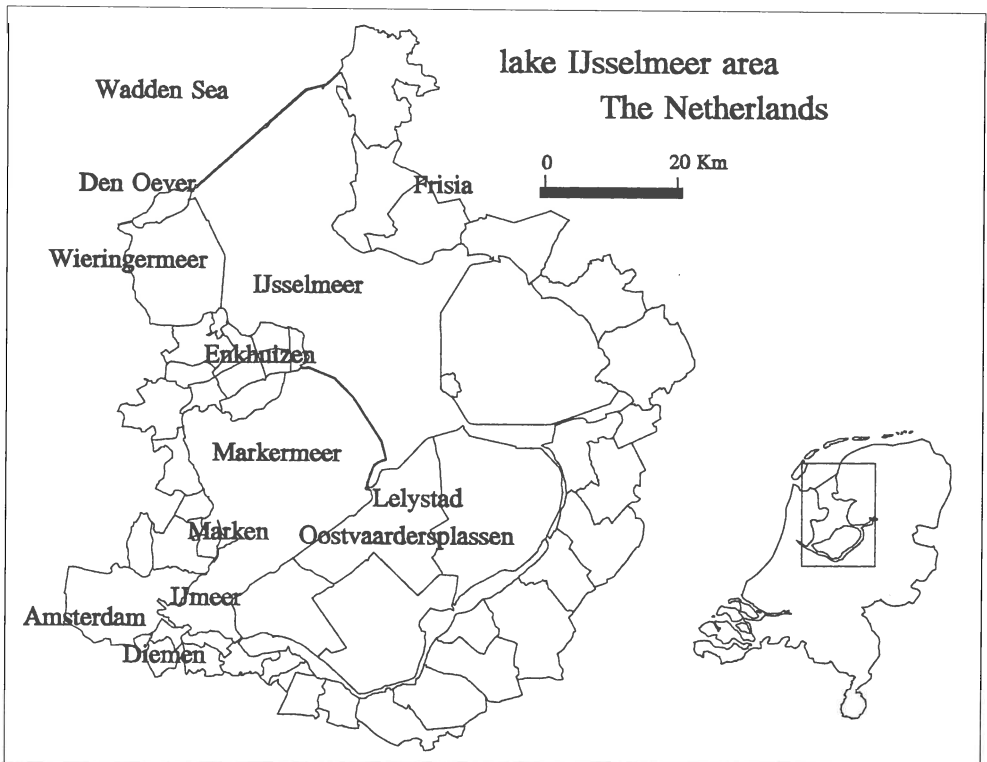
acknowledged; it is designated one of the nuclei in the so-called 'ecological infrastructure' that is the basis of all nature development activities in Dutch environmental politics. Therefore, an investigation has been undertaken to assess the scope of the actual, and potential conflicts between waterbirds and recreation (Van Harskamp & Henkens 1994, Platteeuw 1995, Henkens 1996). This paper describes the numerical distribution in time and space of the most important recreational activities, the spatial distribution of the waterbirds' food resources, potentially suitable waterbird roosts and the actual use of the area by waterbirds in time and space. Some examples of observed spatial effects of recreational activities on distribution are presented.

Methods

The spatial distribution of recreational activities in the Lake IJsselmeer area is described in a number of ways. First, an inventory was carried out of all yachting harbours around both lakes and their capacity in the years 1993 and 1994. Furthermore, all recreational vessels were surveyed by plane during a number of fine sunny days in 1993 (Heidemij 1993). Windsurfers were not included in these surveys but an impression of their spatial distribution was gained from a single aerial survey in August 1986 (Biemans 1989).

Since aerial surveys of the actual use that aquatic tourists make of Lake IJsselmeer are only carried out on favourable days, it was impossible to use these data for reliable estimates of temporal fluctuations. Both

Figure 1. Map of the study area; topographic names mentioned in the text are indicated.



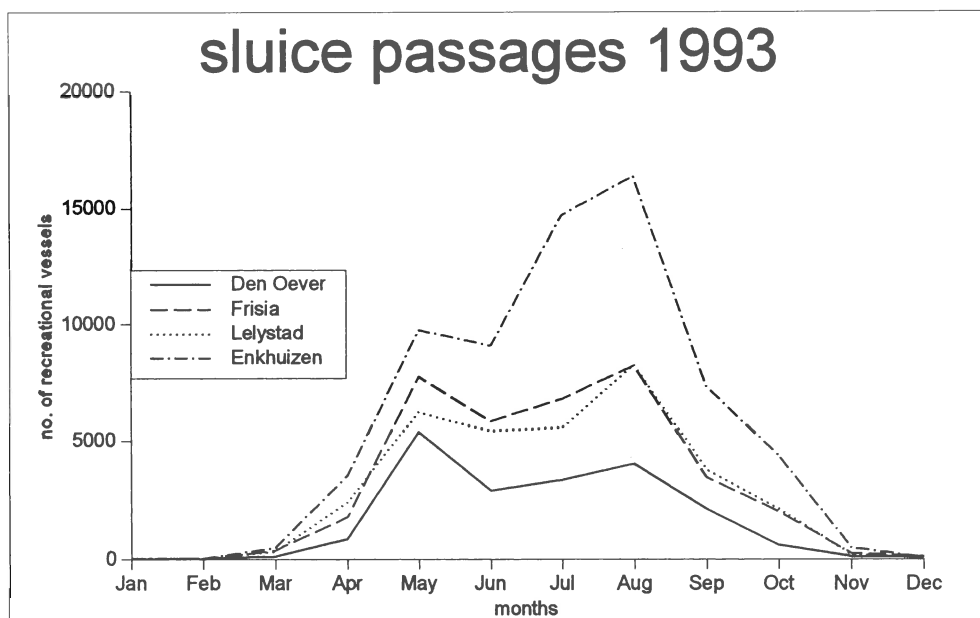


Figure 2. Seasonal pattern of recreational use of lake IJsselmeer, according to numbers of vessels passing through the four main sluices.

fluctuations within the year and over a series of years, have therefore been described by the number of passages through four of the main sluices connecting the two lakes and connecting Lake IJsselmeer with the neighbouring Wadden Sea (RVWS Directorate Flevoland 1989-94). For this recording, a distinction was made between sailing ships, motor yachts and an 'other' category.

The spatial and temporal distribution of waterbirds on Lake IJsselmeer was recorded by monthly aerial surveys. During these surveys the entire coastline was covered, while loops were flown over the open water to obtain information on bird numbers (Van Eerden & Zijlstra 1986, Winter 1994, Koffijberg & Van Eerden 1995). The data gathered during these censuses provide information on the locations of the most important roosting and foraging sites in use by waterbirds during daytime.

In late summer 1994, and during the entire recreational season of 1995, direct observations were carried out simultaneously on the

distributional patterns of waterbirds and recreational activities. During 13 days, a continuous watch, from dawn until dusk, was kept at three points along the coast of the most south-western corner of the Lake IJsselmeer area (called IJmeer; **Figure 1**). This is one of the most extensively used stretches of water for recreation. Every 15 minutes, a scan was made during which recreational vessels and the different species of waterbirds were counted in various sectors with the aim of establishing the extent to which recreation affected bird distribution. Moreover, all direct reactions by birds to the appearance of aquatic tourists were registered, including estimates of distance at which disturbance took place and the nature of the reaction (eg taking cover, flying off to another sector, leaving the site altogether). The three observation points were selected to represent varying recreational pressure, allowing comparisons of relatively quiet patches with those more intensively visited. Moreover, quiet days could be compared against days with

lots of tourists, and quiet periods within the same day could be compared to periods with much recreational pressure.

Resting and feeding habitats and bird distribution

Waterbirds in Lake IJsselmeer may utilise three different food types. Diving ducks *Aythya* spp. forage mainly for Zebra Mussels *Dreissena polymorpha* or, during the wing-moult, for a variety of small gastropods (eg *Potamopyrgus jenkinsii*) and chironomid larvae (De Leeuw & Van Eerden 1996). Great Crested Grebes, Cormorants *Phalacrocorax carbo*, Common Terns *Sterna hirundo* and most of the visiting Black Terns are (almost) exclusively fish consumers, particularly exploiting the enormous local population of the small salmonid Smelt *Osmerus eperlanus* or, especially in the case of the Cormorant, other fish species like Ruffe *Gymnocephalus cernuus*, Perch *Perca fluviatilis* and Roach *Rutilus rutilus*. Finally dabbling ducks and Mute Swans *Cygnus olor* and,

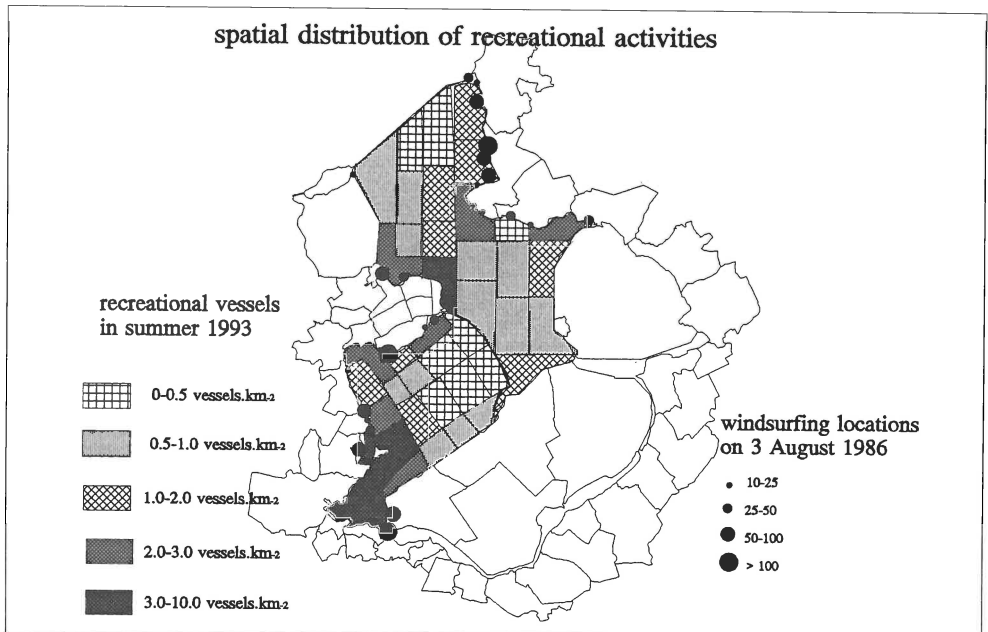
in summer, most of the Coots *Fulica atra* are herbivorous and exploit the stands of sessile algae along the dykes surrounding the lakes or the scarce patches of pondweeds *Potamogeton* spp. or *Charophyta*, in the shallowest parts; alternatively, they only use the lakes as a resting place and exploit surrounding agricultural land (Van Eerden & Bij de Vaate 1984). The distribution of Zebra Mussels and chironomid larvae were mapped by Van Eerden & Bij de Vaate (1984) and by Bij de Vaate & Greijndanus-Klaas (1995). Distribution maps of Smelt and other fish species were not available, while aquatic vegetation in Lake IJsselmeer has been mapped by Hartog et al. (1995).

Results

Spatial and temporal distribution of aquatic recreation and waterbirds

The monthly fluctuations in numbers of recreational vessels passing through the four

Figure 3. Spatial distribution of recreational activities, based on aerial surveys of recreational vessels for the offshore area in 1993 and on a single aerial survey of windsurfing locations for the coastal area in 1986 (Heidemij 1993, Biemans 1989).



main sluices in the Lake IJsselmeer area in 1993, indicated that after a period of virtually no recreational activity during January to March, the number of vessels increased from April onwards to peak between May and August (**Figure 2**). This was especially so at the sluice passages at Lorentz in the north-east, between Lake IJsselmeer and the Wadden Sea, which reached a high peak in July and August. In September, numbers remained relatively high but by October they had dropped to near winter levels.

Recreation in the Lake IJsselmeer area seemed to be particularly concentrated along the south-west and north-east coasts. (**Figure 3**). This pattern coincides roughly with the presence of the most important yachting harbours, mainly situated at the typical 17th century harbour towns north of Amsterdam and on the Frisian coast. Windsurfing was also carried out primarily from beaches along the south-west and north-east fringes (**Figure 3**).

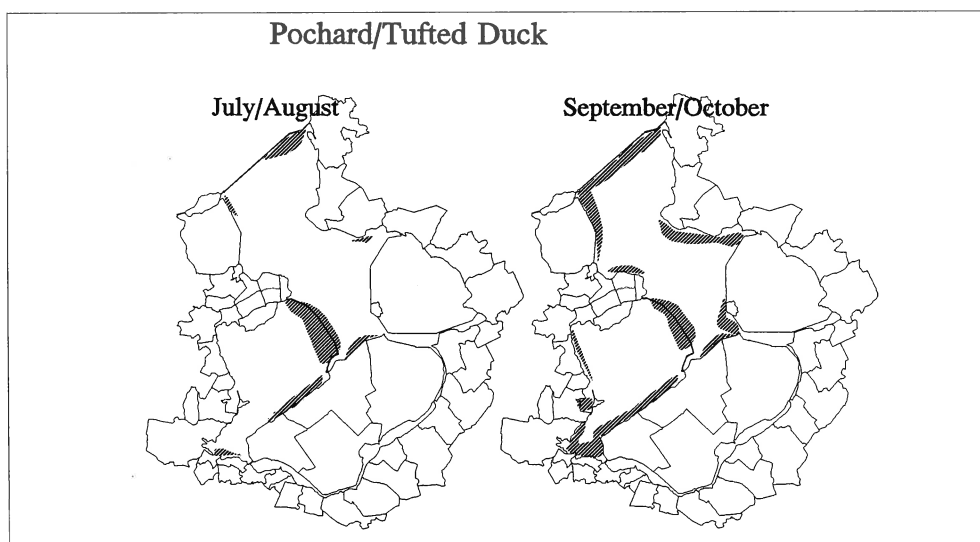
The main avian consumers of benthic fauna - Pochard and Tufted Duck - were relatively scarce in Lake IJsselmeer in spring and early summer. Only Tufted Ducks were present in April in large concentrations of well over 1,000

individuals in the south-western part of the area. These birds have mostly moved away to their breeding areas by May. The numbers of benthic feeders started to increase from July onwards with a distinct concentration in July and August of both Pochard and Tufted Duck (up to 10,000 and 20,000 birds, respectively) along the dyke separating the two lakes. By September, when many birds have finished their wing-moult, concentrations of both Pochard and Tufted Duck also appeared at IJmeer in the south-west (**Figure 4**).

Piscivorous birds seemed to be more attracted to the northernmost of the two lakes. Numbers of Great Crested Grebes were relatively small from April to June, but increased rapidly from July onwards. In August and September some tens of thousands of grebes arrive at Lake IJsselmeer from a wide hinterland to undergo wing-moult (Piersma *et al.* 1986). Major concentrations were then found along the southern Frisian coast and, to a lesser extent, along the dykes separating the two lakes and that separating the area from the Wadden Sea (**Figure 5**).

Cormorants used much the same areas as Great Crested Grebes but were present in

Figure 4. Main daylight concentrations at lake IJsselmeer of Pochard *Aythya ferina* and Tufted Duck *A. fuligula* at lake IJsselmeer in July/August and September/October.



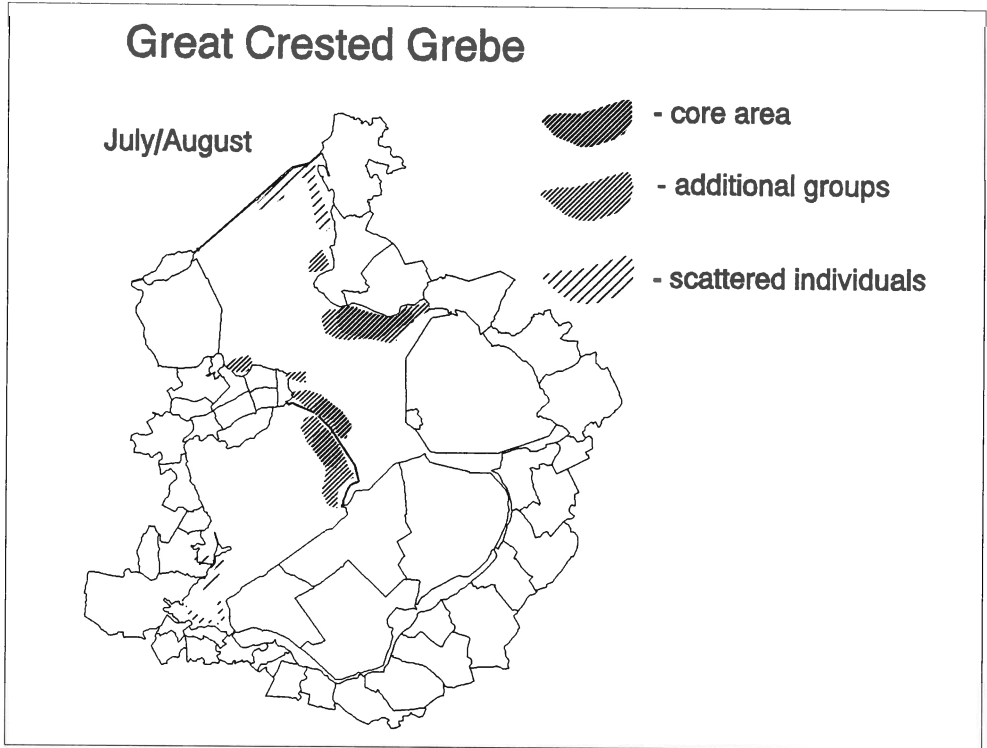


Figure 5. Main daylight concentrations at lake IJsselmeer of Great Crested Grebes *Podiceps cristatus* in July/August.

considerable numbers in all months from April to October. During their breeding season (March-July), they used the southern lake more extensively than Great Crested Grebes, mainly because of the presence of three large breeding colonies along the southern fringe of the area, holding well over 12,000 pairs (Van Eerden & Gregersen 1995). Apparently good fishing sites for Cormorants in the southern lake are found in the extreme south-west corner near Amsterdam where, especially in April and May, relatively high numbers (flocks of several thousands) were frequently seen fishing (Figure 6).

Between April and June most Common Terns were observed in the southernmost part of the northern lake, in the immediate vicinity of a large colony situated at the sluice complex connecting the two lakes. By July, but even more so by August, large numbers of Common

Terns from other breeding areas visit the northern lake, before leaving for their African winter quarters. These birds showed a distinct preference for the north-west part of the northern lake. Common Terns are joined in late summer by up to 120,000 Black Terns on their way from central and eastern Europe and western Russia to Africa. During their stop-over at Lake IJsselmeer, these birds moult to winter plumage and put on body reserves for the rest of their trip. The highest concentrations of foraging birds were found in the north-west part of the northern lake, along with the Common Terns. An apparent concentration in the south-west refers to a day-roost where birds take a rest between their foraging activities.

Herbivorous waterbirds were rather uncommon in summer. Coots showed a scattered distribution with concentrations

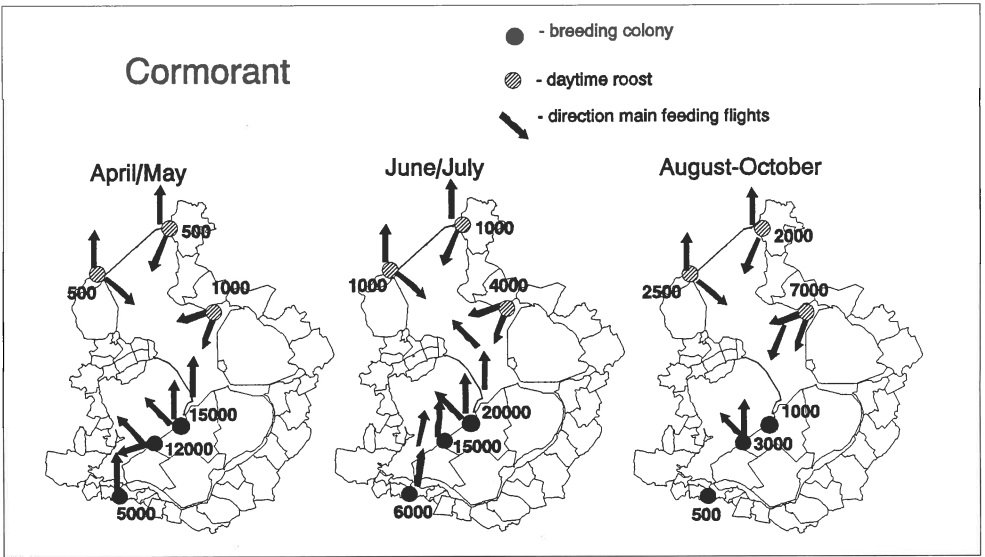


Figure 6. Spatial use of lake IJsselmeer by Cormorants *Phalacrocorax carbo* in April/May, June/July and August-October. Numbers refer to individuals, both for breeding colonies and for daytime roosts; arrows indicate main foraging flight directions.

from July to October in the shallowest waters near Marken and along the Frisian coast, where the best patches of pondweeds are found. Herbivores are further represented by thousands of Mute Swans present during the moult and about 1,000 Gadwalls *Anas strepera*. Both are found mainly along the dykes that either separate the two lakes or separate the Lake IJsselmeer area from the Wadden Sea. Mute Swans arrived in May (mainly immature and non-breeding individuals) and left the area from September onwards.

Comparing patterns in avian distribution and recreational use

During the months of maximum recreational use of the Lake IJsselmeer area (May-August), Pochard and Tufted Duck are numerous only in the period of their wing-moult from mid-July to late September (De Leeuw & Van Eerden 1996). During this period, both species concentrated in parts where recreation was less frequent (compare **Figures 3** and **4**). Although diving ducks mainly forage at night, thus avoiding recreational activities, the flightless moulting

birds feed during daytime as well. Unlike in winter, these diving ducks spend an entire 24 hours at the foraging grounds which lay relatively far from the dykes. The site preference for the eastern part of Lake Markermeer, shown by Pochard and Tufted Duck while moulting, may therefore be explained either by their different diet at this time (mainly small gastropods and chironomid larvae) or by the relative quiet of this site in summer. The distribution of small gastropods in the IJsselmeer area is largely unknown, but there are indications that the preferred moulting sites do indeed hold good food resources (M. R. Van Eerden, *pers. comm.*). However, the best foraging grounds for chironomid larvae and Zebra Mussels are closer to zones with higher recreational pressure (compare **Figures 3** and **7**). When the numbers of aquatic tourists start decreasing in September, both Pochard and Tufted Duck, having regained their ability to fly, appeared in high concentrations in the IJmeer area, which was one of the most crowded parts in the two previous months. Diving ducks thus tended to concentrate during wing-moult in the least

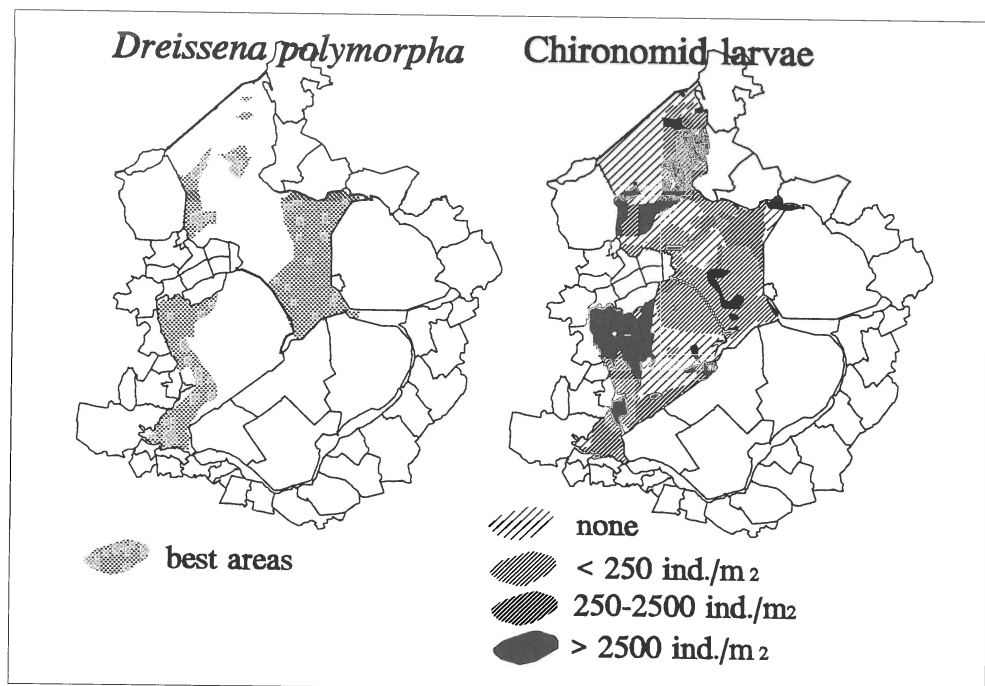


Figure 7. Spatial distribution of some important waterbird food resources: Zebra Mussel *Dreissena polymorpha* according to Van Eerden & Bij de Vaate (1984) and Bij de Vaate & Greijdanus-Klaas (1995), chironomid larvae according to Van Eerden & Bij de Vaate (1984).

disturbed areas, but it remains unknown whether food preference or avoidance of human disturbance is the main reason for this phenomenon.

Moulting concentrations of non-breeding Mute Swans were also found primarily along the central dyke separating IJsselmeer and Markermeer and along that separating IJsselmeer from the Wadden Sea. Sessile algae, *Bangia* and *Cladophora*, their main food at this time, are not confined to the moulting dykes (Van Dijk & Van Eerden 1991). Therefore, it seems likely that the site preference of moulting Mute Swans is at least partly influenced by patterns of recreational use.

Among the piscivorous birds, the Cormorant showed a remarkable shift in preferred feeding sites from June onwards. While in April and May, large foraging groups were observed regularly in the south-west corner of the lakes,

this part was largely abandoned in June and July. In the latter months, the birds fishing the southern lake were seen farther out on the lake. Either the relative availability of suitable prey in the extreme south-west had reduced by this time (eg due to food depletion by the birds themselves), or the regular presence of high densities of recreational vessels impedes the landing of large groups of Cormorants. It seems likely that the birds try to reduce the flying distance between the colony and the fishing grounds as much as possible in order to save energy and enhance reproductive success (Platteeuw & Van Eerden 1995, Platteeuw *et al.* 1995). Later in the summer, Cormorants were mainly seen in and along the northern lake with a distinct concentration on the southern Frisian coast, where large roosts are found at offshore banks where recreation is forbidden.

Other piscivorous birds, like grebes and

terns, also concentrated in the northern lake. Moulting Great Crested Grebes are probably affected by recreation since during the day, they mainly rest in recreation-free zones. Their foraging activity, which is more widely spread, is highly concentrated around dawn and dusk, when Smelt show maximum availability near the surface (Piersma *et al.* 1988, Van Eerden *et al.* 1993) and recreational activities are negligible. This indicates that the resting grebes do need quiet conditions. Foraging terns do not seem to actively avoid the main areas of recreation, but day-time roosts are only found at sites where tourists have no access.

Simultaneous patterns of spatial use

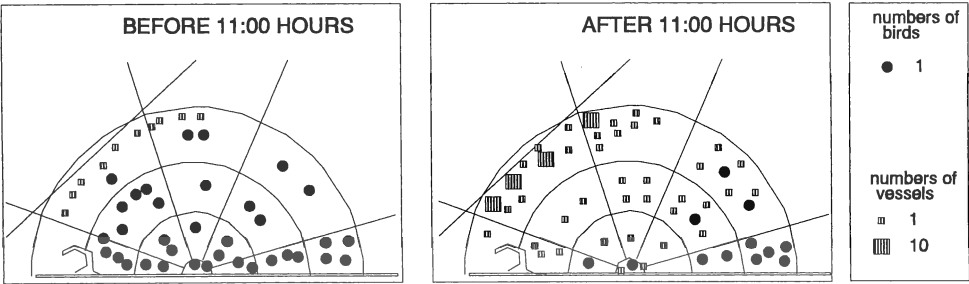
At all three points along the IJmeer coast, waterbird numbers were relatively low during May to August (on average, <50 individual birds per site per day). Daily maximum numbers were distinctly higher in April, with the last winter visitors still present, and in September, when autumn migration had begun. Whether this phenomenon was due to the high recreational pressure during the height of the season remains unclear; there is a lack of data from a comparable area without any recreation.

Recreation was most intense at IJmeerdijk in the south-east of IJsselmeer (well over 90 vessels in one scan) and lowest at Diemen in the south. Durgerdam, located in the west, showed intermediate densities of vessels. As a

rule, most recreational activity at IJmeerdijk occurred between 11:00 and 19:00 and most of it consisted of catamarans and windsurfers operating relatively close inshore. A comparison of the average spatial distribution of both birds and vessels before and after 11:00 on 28 May 1995, the busiest day with catamarans and windsurfers on record, clearly indicated that many waterbirds at IJmeerdijk abandoned the area occupied by aquatic tourism, and some sought refuge along the dyke (Figure 8). On the same day the number of birds at the quiet spot of Diemen increased after 11:00 hours, while at Durgerdam a slight increase in vessel density within 1.5 km seemed to have resulted in an increased concentration of the birds present in a limited number of groups. This example was typical for each of the days on which IJmeerdijk was visited by high numbers of tourists. In general, periods in which catamarans and/or windsurfers were active at IJmeerdijk produced significantly lower local bird numbers than the periods immediately before (Student's *t*-test, $P < 0.005$). Moreover, the total number of birds at IJmeerdijk showed a significantly negative correlation with the number of catamarans/windsurfers active (Spearman Rank Correlation, $P < 0.05$).

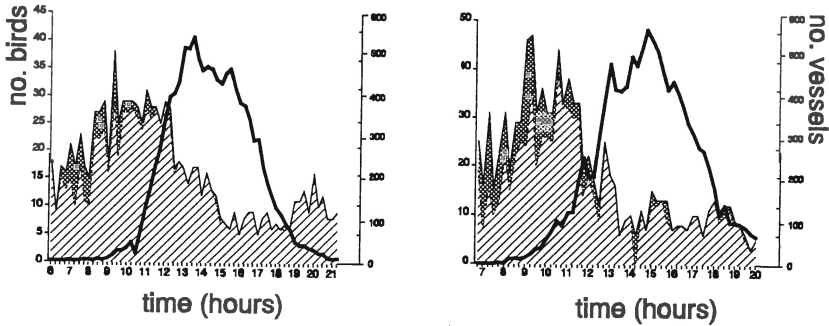
One of the most numerous bird species on the open water was the Great Crested Grebe. This species is generally mentioned as a relatively confident bird with respect to humans and out of 63 confrontations between

Figure 8. Simultaneous spatial distribution patterns of recreational vessels and waterbirds at the same observation site along the IJmeer coast before and after 11:00 hours. With increasing recreational density the birds tend to disappear offshore and seek shelter close along the coast.



Great Crested Grebes and recreational vessels

IJmeerdijk



Diemen

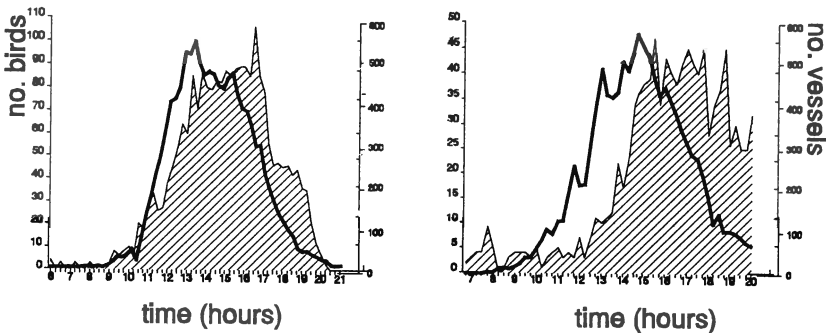


Figure 9. Simultaneous temporal distribution on two different days in 1995 of recreational vessels on IJmeer as a whole and of Great Crested Grebes at a crowded site (IJmeerdijk) and at a quiet site (Diemen). The solid line indicates the numbers of vessels, while the shaded areas indicate the numbers of grebes (darkest shading indicating proportion of birds in navigation zone). While at IJmeerdijk grebe numbers decrease sharply when total numbers of vessels rise, at Diemen numbers increase from about an hour after the onset of the increase in recreational density.

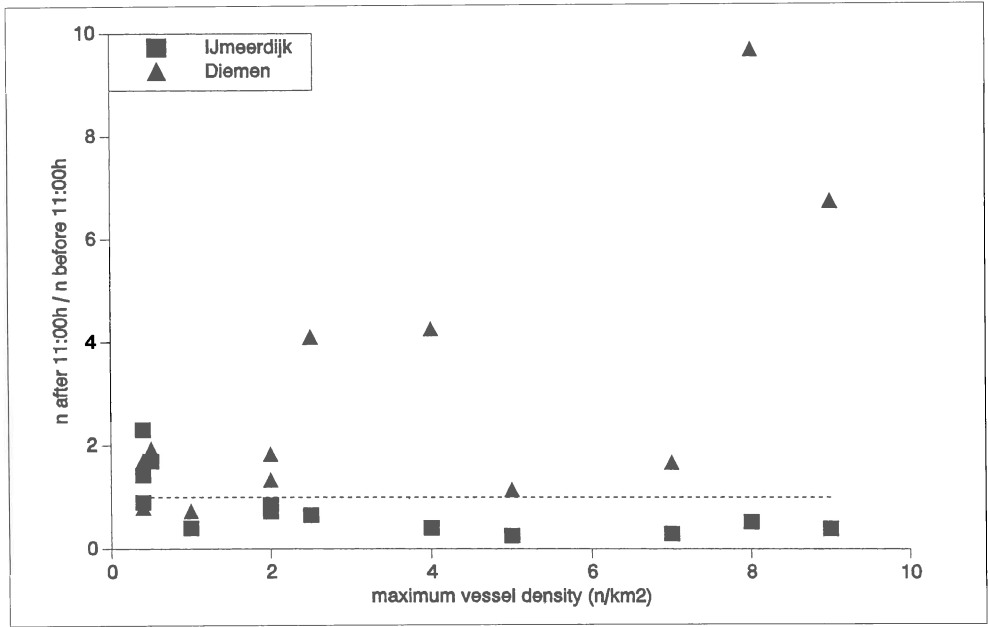
grebes and potential sources of disturbance, the birds showed no visible reaction on six occasions and in only four cases did they fly away. Temporarily flying off, immediately followed by landing, was observed in eight more cases. Thus, in 71% of all grebe-tourist confrontations, the birds reacted by swimming or diving away from the source of disturbance.

Nonetheless, the distribution of Great Crested Grebes changed markedly over the day when there was a high presence of recreational vessels on IJmeer. While grebe numbers decreased at the most crowded site of IJmeerdijk, they gradually increased at the quiet site of Diemen, generally about an hour after the onset of the recreation peak (**Figure 9**).

The change in numbers of grebes present at both sites after 11:00 with respect to the period before, was strongly dependent on the overall vessel density on IJmeer. At IJmeerdijk the fraction of birds still present after 11:00 decreased with increasing recreational activities while the reverse was true for Diemen. Correlations between vessel density on IJmeer as a whole and grebe numbers per site were significantly negative for IJmeerdijk (Spearman Rank Correlation, $P<0.005$) and significantly positive for Diemen ($P<0.05$). Peak occurrences of recreational vessels on IJmeer seemed to cause Great Crested Grebes to swim away from the open water and look for shelter in the quiet zones along the southern coast. Strong onshore winds may also force the grebes to seek shelter at Diemen, leaving the numbers of catamarans and windsurfers unaffected, but this phenomenon was observed on calm days as well.

Some indications were found that the presence of aquatic recreation might also affect the large flocks of socially-fishing Cormorants in the area. Most observations of fishing flocks took place in the early morning before the arrival of people. Landing flocks of over 1,000 individuals were never observed in the presence of recreational vessels and only once a flock of 350 birds was seen landing when there was a density of 1.5 vessels per km². Six landing flocks in the category of 10-250 Cormorants were noted at densities between 0.2 and 0.7 vessels per km² and just one flock (50-100 birds) landed at a density of 3 vessels per km², attracted by offal from a commercial fishing boat. Once present, flocks of fishing Cormorants were somewhat less reactionary to relatively high densities of recreational users but, even then, out of 43 records, the only three flocks containing over 2,000 individuals were seen at densities of a mere 0.5 vessels per km²

Figure 10. Numbers of fishing flocks of Cormorants of different size classes coinciding with varying densities of recreational vessels. It is appreciated that flocks of over 250 individuals were only observed when maximum vessel density did not exceed three vessels per km² and flocks of over 2,000 individuals were only observed at vessel densities below one per km².



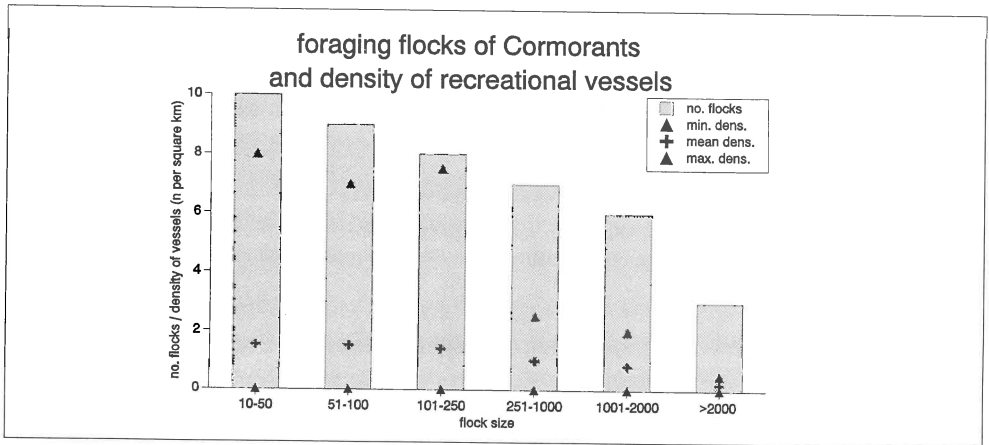


Figure 11. Relationship between yearly recreational use (number of vessels passing through the sluices) and avian use (number of waterbird-days between April and October) in the period 1980-1993.

or less (Figure 10). So the presence of recreation did not completely prevent foraging by Cormorants here, but did keep away the largest flocks.

Discussion

Lake IJsselmeer is both an internationally important waterbird area and an area used extensively for aquatic recreation. The highest numbers of waterbirds occur in winter, when recreational pressure is negligible. Thus, wintering waterbirds at Lake IJsselmeer, like Bewick's Swan *Cygnus columbianus bewickii*, geese, mergansers and Goldeneye *Bucephala clangula* are less likely to be affected by aquatic recreation than birds that may also spend the summer there. On the other hand, lower waterbird numbers in summer may well be caused partly by the extensive recreational activities. Moreover, windsurfers have in recent years shown a distinct tendency to extend their activities well into October or even November and not to confine themselves to the coastal shallows but also use open water areas. Bewick's Swans particularly, which immediately after arriving in the area in mid-October forage in shallow water areas (Dirksen *et al.* 1991, Van der Winden *et al.* 1997), may thus have become more exposed to windsurfing activities than

they were used to in the 1980s (Biemans 1987). Still, most conflicts are likely to be of key importance for breeding birds (eg Great Crested Grebe, Cormorant, Coot and Common Tern), those in active wing-moult (eg Great Crested Grebe, Pochard and Tufted Duck) or birds staging in late summer (eg Common Tern and Black Tern).

Over the last 14 years, no overall negative influence has been detected between the number of sluice passages of recreational vessels and the total number of waterbird-days (all species included) spent in the IJsselmeer (Figure 11). Rather, there is a slightly positive correlation ($r^2=0.303$, $P<0.05$), possibly due to a simultaneous increase in recreational activities and food supplies for waterbirds as a consequence of eutrophication during the 1980s. It is therefore unlikely that recreational pressure in the IJsselmeer area has led to a decrease in the total numbers of visiting waterbirds. On the other hand, this overall relationship between sluice passages and bird days cannot be used as an indication that recreation has not been limiting access to natural resources for the birds. Indeed, the examination of the mappings of recreational use and waterbird distribution, suggests that disturbances do take place and may in some cases already have caused a re-allocation of the

birds' preferred roosts and/or foraging grounds within the area. Some bird species, particularly moulting diving ducks, Mute Swans and foraging Cormorants in the breeding season, may already be using parts of the area that could be considered sub-optimal with respect to foraging conditions, shelter and/or distance between roost or breeding site and feeding grounds. However, in all three of these examples the apparent avoidance by the birds of the most crowded sites can also be explained by their specific ecological needs. Thus, in order to investigate an impact of recreation on waterbird distribution patterns, it is not enough to demonstrate the existence of mutually exclusive patterns. Specific ecological factors also play an important part.

Nonetheless, the observations on the simultaneous distribution of recreation and waterbirds, and on the direct interactions between them, have shown that recreation might indeed interfere with the potential for avian use of (parts of) a wetland. In the long run, this may have serious consequences for individual physical condition and/or reproductive output of the birds affected (eg Platteeuw & Van Eerden 1995, Platteeuw *et al.* 1995). On the other hand, when disturbance causes birds to enhance their energy expenditure, they will try to increase their food intake as well, thereby causing an increase in predation pressure on the food resources or an increase in intraspecific competition for food, or both (Platteeuw & Henkens 1997).

A further uncontrolled increase in shore-based facilities for recreational use in the IJsselmeer area will undoubtedly lead to a higher recreational pressure on an ever larger proportion of the area, thereby ultimately threatening its function as an internationally important waterbird site. Future recreational development should therefore be planned carefully if the role of the IJsselmeer area as a nucleus in the Dutch 'ecological infrastructure' is to be taken seriously. The results presented here have also tentatively indicated in which ways recreation and waterbirds can coexist in the same area without excessive interference. Particularly along the Frisian shores in the north-east, important bird roosts are found in close

proximity to large yachting harbours and extensively-visited swimming and windsurfing beaches. Solutions consist of functional and spatial separation of these two uses of the area: the most suitable stretches of shore for breeding or resting birds are made inaccessible for visiting tourists, while recreational beaches are installed at less vulnerable sites. In this way, tourists will be concentrated at certain areas and not spread out evenly along the entire coastline.

Of course it is harder to organise a similar differential use of the open water. However, some of the species most vulnerable to disturbance, such as Pochard and Tufted Duck, are generally found during daytime at rather short distances from the coast. The main roosts of these birds can be made less approachable by recreational vessels by means of artificial obstacles and by keeping the main transition routes at large distances from the coast. Spatial separation of offshore fishing grounds for Cormorants and Great Crested Grebes from areas to be used by aquatic recreation will be virtually impossible. The best fishing sites are not fixed in time or space, so it will be impossible to steer recreational activity away from the preferred foraging sites in any consistent way.

Currently, attempts are being made to summarise our state of knowledge on competition in the IJsselmeer area between aquatic recreation and waterbirds in a GIS-based model. Such a model might eventually become a tool to be used for comparing different spatial options for both recreation and ecological protection and in the development of measures to alleviate possible conflict situations.

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