1. Objectives And Expected Achievements

DISCBIRD will provide a detailed study of the impact of changes in discarding rates on seabird communities. This will permit management of fisheries to be designed to minimise adverse impacts on seabird communities, consistent with the stated objective of FAO, ICES and national governments to reduce discarding in order to manage fish stocks for sustainable fisheries. Research into seabird ecology shows that reproductive effort in the breeding season can affect winter survival, and also that winter feeding conditions can influence body condition and hence breeding success in the subsequent summer. In order to take account of such influences across seasons, DISCBIRD will use state of the art technological methods to study seabird winter migrations (birds fitted with transmitters will be tracked by satellite or birds will be fitted with a data logger permitting geolocation) and state of the art biochemical methods (stable isotope analysis and fatty acid analysis) to measure dependence on discards, and the influence on subsequent body condition and breeding success, of feeding on discards in winter (when discards tend to be most heavily exploited by seabirds). Biochemical (stable isotope signatures and fatty acid profiles) markers of diet are well established methods that will be adapted for the specific case of investigating the importance of discards in the diet. Quantification of feeding on discards in free-living seabirds from sampling of feathers and blood will be thoroughly validated by studies with captive scavenging seabirds fed on controlled diets in order to establish baseline reference signatures.

Long-term data sets on discard quantities and seabird diet composition will be compared in order to assess the ways in which seabird diets are altered by changes in technical measures, fishing effort or stock size/recruitment affecting amounts of discarding. In two geographical regions data on discarding and on seabird ecology are especially detailed and so permit this kind of analysis to be made with confidence. Studies of representative seabird species in North Sea and Mediterranean seabird communities will address the influence of discard availability on reproductive effort, breeding success, adult body condition and survival, and on long-term population trends of scavenging seabirds. The study species selected include several seabirds of considerable conservation concern and European importance. The great skua has a total population of only about 13,000 breeding pairs, and half of this small global population breeds at colonies in the northwestern North Sea. Audouin's gull *Larus audouinii* is a rare Mediterranean endemic species of high conservation concern, as is the Balearic shearwater (also known as Yelkouan shearwater or Mediterranean shearwater) *Puffinus yelkowan* which has a Balearic breeding population of only about 2,500 pairs, and has a much stronger tendency to feed at trawlers than is found in other Puffinus species. The great skua breeds in the north-western North Sea and feeds particularly on discards from the Scottish gadoid fishery which has been subject to detailed study of discard rates. Whiting and haddock form the bulk of these discards, and the numbers discarded have varied enormously over the period of years for which there are seabird ecology data, from 2,530 million fish in 1975 to only 360 million in 1998. With an almost ten-fold variation in amounts discarded in different years, one can expect to see clear relationships between discarding rate and seabird breeding ecology in this particular case study, since even quite large errors in estimates of discard rate would not cause much change in rankings of discard abundances from year to year. Western Mediterranean demersal fisheries and scavenging seabirds form the other main case study because in this case, although discarding rates have not been studied in much detail, the demersal fishery has been subject to complete closure for various periods in different years. Obviously the availability of discards is zero while the fishery is closed (given that illegal trawling during these moratoria has been negligible). Thus one can make comparisons of seabird breeding in years when discards are available (absolute abundances of discards being uncertain) and years when discards are not available (due to fishery closure). Furthermore,
the comparison between the contrasting management systems in the western Mediterranean and northwest North Sea will be highly instructive. The periodic complete closure of the western Mediterranean trawl fishery results in drastic changes in availability of discards to scavenging seabirds alternating between periods of high availability and periods of no availability. In contrast, in the northwest North Sea there has been a relatively gradual reduction in discard volume due to a combination of decreasing haddock and whiting stocks (and hence TACs) and some changes in technical measures. Comparisons of the impacts of these contrasting management regimes on the breeding populations of scavenging seabirds will help to elucidate consequences of specific management strategies on seabird communities.

One of the most important impacts of changes in discarding rates appears to be the impact on populations of vulnerable smaller seabirds of killing by large scavenging seabirds forced to switch diet to predation as a consequence of reductions in discarding by fisheries. This impact will be quantified in two case studies: one on great skuas and great black-backed gulls *Larus marinus* in Shetland and one on yellow-legged gulls in the western Mediterranean.

Results from this project will educate seabird conservation policy, and development of fisheries management to reduce to a minimum adverse impacts of changes in discarding rates on seabird communities.

The selected study species of scavenging seabirds are ones that rarely, or never, feed in terrestrial or freshwater habitats. This selection of study species was made to avoid the confounding problem that might be created if study seabirds were to feed on terrestrial or freshwater foods, which have distinctively different isotopic signatures from foods in marine ecosystems. While it would be of interest to evaluate the contribution of terrestrial foods to the diets of some scavenging seabirds, such as herring gulls *Larus argentatus* which are known to feed extensively on refuse tips, we decided that attempting to assess diets of seabirds feeding on such a wide mixture of foods, with differing isotopic and fatty acid compositions, would make any quantification of diet composition very difficult. Such work investigating the importance of terrestrial foods for a few species of scavenging seabirds should await future study, which will be made easier after the experience gained from the research carried out in DISCBIRD, where we focus on scavenging seabird species that feed on discards and pelagic fish but do not have the added complication of taking terrestrial foods as well.

2. Project Workplan

2.1 Introduction

The project will use a diversity of appropriate and complementary approaches; it will involve extensive and detailed field studies using state of the art technologies, experimental work with captive birds, collation and analysis of existing long-term data sets that have not previously been brought together, and sophisticated laboratory analyses of biochemical markers. This combination of powerful techniques is something that has never been achieved in previous studies of seabird-fishery relationships, partly because several of these technologies have only recently become available, but also because national funding would be unable to put together the necessary diversity of expertise for such work; this can be achieved through EU trans-national collaboration, and so represents a major synergy and opportunity for research progress through international teamwork.
2.2 Project structure, planning and timetable

The project will run for 42 months, as this duration will be the minimum required to permit three complete breeding seasons of the focal scavenging seabirds to be included in the research.

Coordinator: Professor Robert W. Furness, University of Glasgow, Institute of Biomedical and Life Sciences, Graham Kerr Building, Glasgow G12 8QQ, UK, telephone +44 141 330 3560, fax +44 330 5971, e-mail r.furness@bio.gla.ac.uk

Participants:

Partner 1. UG, University of Glasgow, Institute of Biomedical and Life Sciences, Graham Kerr Building, Glasgow G12 8QQ, UK, telephone +44 141 330 3560, fax +44 141 330 5971, e-mail r.furness@bio.gla.ac.uk, Professor R.W. Furness and Scottish Universities Research Reactor Centre (SURRC), Rankine Avenue, East Kilbride G75 0QF, UK, Dr S. Waldron.

Partner 2. UH, University of Hamburg, Zoological Institute and Zoological Museum, Hamburg, Germany, telephone +49 40 42838 4224, fax +49 40 42838 5980, e-mail sgarthe@ifm.uni-kiel.de, Dr S. Garthe.

Partner 3. CSIC, Consejo Superior de Investigaciones Científicas, Instituto Mediterráneo de Estudios Avanzados, Miquel Marques 21, 07190 Esporles, Mallorca, Spain, telephone +34 971611732, fax +34 971 611761, e-mail vieadod@clust.uib.es, Dr D. Óro.

Partner 4, UJ, University of Joensuu, Department of Biology, POB 111, FIN 80101 Joensuu, Finland, telephone +358 3 7635010, fax +358 13 2513590, e-mail Reijo.Kakela@joensuu.fi, Dr R. Käkelä.

Each Work Package will run in parallel with the others, except that WP6 (Feeding trials with captive seabirds) will be completed in month 18 as it represents a calibration and validation study in support of other Work Packages, while WP2 (Use of stable isotope and fatty acid signatures to quantify discard consumption in the diet and the relationship of this to body condition of individual birds) will begin in month 10, as it is appropriate to start this work after the calibration studies with captive birds have provided results. The final 6 months of the project will be devoted largely to the completion of papers for publication in quality international scientific journals and producing the final research report. Because of the seasonality of the relevant seabird ecology, it is highly desirable that the project starts just before the annual seabird breeding season gets underway (in May), rather than at any other time of year.