Breeding origins of wader populations utilizing the Dutch Wadden Sea, as deduced from body dimensions, body mass, and primary moult
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11.1 INTRODUCTION

My present-day work centres on using relevant ecological information in policy-making processes. Even when good information is available, implementing it does not always follow. Lawton (2007) listed eleven (partly overlapping) reasons why policy-makers and/or politicians fail to act even though ecologists have clearly demonstrated environmental degradation and the resulting damage to nature: (1) ecologists are not getting the message across clearly enough; (2) policy-makers and politicians do not know where to go for, since there is too much science; (3) the science is ambiguous and there are no clear answers; (4) there is not enough public support for what ‘ought’ to be done or politicians believe that there is insufficient electoral support; (5) policy has to be formulated to take into account many other legitimate issues and constraints, not least the cost of various options; (6) ecologists and policy-makers work to very different time-scales. The latter often need short-term solutions, whereas ecologists provide long-term and complex advice; (7) policy-makers and politicians are caught between the policy options that emerge from the science, and powerful interest groups with different agendas; (8) there is ‘institutional failure’ (wrong decision making bodies, poor government, contradictory policies in different parts of government); (9) the solutions require international agreement, while no nation wants to be first off the blocks; (10) scientific advice flies in the face of received political wisdom, dogma or deeply entrenched beliefs; (11) some politicians (or scientists or policy-makers - ME) are corrupt and out to make a fast buck. Lawton presented three examples of the interaction between science and environmental policy: the collapse of global marine fisheries, genetically modified crops and climate change. In the case of marine fisheries not enough could be done due to reasons 3, 5, 6, 7, 8, 9 and 11. The UK government was unable to facilitate genetically modified crops due to reasons 1, 3, 4, 7, and 10. And with respect to climate change Lawton stated, that the proposed policies run far ahead of science.

11.2 SITUATION IN THE CONTEXT OF THE WADDEN SEA

The results of our own studies clearly demonstrate the 6th reason presented by Lawton (2007): ecologists and policy-makers work at very different time-scales. Policy-making involves short time-intervals, and ecological studies a long time-frame. The topics of this thesis on waders illustrate this. This thesis provides information, collected over a time frame of 30 years, on breeding origins, population composition, staging numbers, age ratios, moult patterns and body masses. This information clarifies the function of the
Wadden Sea in the migration system of waders in the East Atlantic Flyway. Much of it is background knowledge. The catching activities presented in this study cannot provide annual results, but the counting activities, presented in Chapter 5, can provide such. With the catching studies, changes per 5- or 10-year intervals can be obtained. If shorter intervals are necessary in order to produce results on a yearly basis, the organization of the catching activities can be intensified. With the counting activities (also organized on a voluntary basis) yearly results can be obtained, which suits better the needs of policy-making. With extra investment in catching activities we might overcome Lawton’s 6th reason of the different time-scales.

Some more examples can be collected in the Wadden Sea. One example concerns a study performed by Tromp (2001). She studied the decision-making with respect to nature affairs by the various governmental bodies in the Wadden Sea during the 1990s. Her results are a demonstration of Lawton’s reason 8, since she showed that the process of decision-making was mainly directed towards increasing the influence of the ‘own’ governmental body. Finally, the cockle crisis in the area during (mainly) the 1990s demonstrated Lawton’s reasons 2, 3, 5 and 7 (e.g. Van Gils et al. 2006, Swart & Van Andel 2007).

In what way are the results in this thesis useful for policy-making? The answer to this question can be approached both from the perspective of decision-making in the Wadden Sea and from the ecological context.

### 11.3 DECISION-MAKING IN THE WADDEN SEA DURING THE 1990s

Tromp (2001) studied the decision-making process with respect to policies of nature affairs in the northern part of the Netherlands during the 1990s, and one of her case studies concerned decision-making in the Wadden Sea context. She defines decision-making in terms of value- and functional rationalization. Value-rationalized acting is based upon a set of political values in order to judge, whether a goal to be reached is desirable. Functionally rationalized actions were conceived as ‘concentrated on managing the proper means in order to reach an earlier defined goal’. According to Tromp value-rationalization is being superseded by functional rationalization in the present-day society. Politicians mostly use value-rationalization, i.e. when they strive for a nice quality landscape or for good living conditions. Tromp analysed the way the three governmental levels (national, provincial, local), co-operating in the ‘Coördinatiecollege Waddengebied’ (CCW), rationalized their
decision-making with respect to nature management and development in the 1990s, which ranged from environmental impact assessments to the exploration and exploitation of gas in the area. She concluded that the decision-making was functionally rationalized. However, little functional rationalization was evident with respect to the original goals: natural values of the area. Instead it was mainly re-directed to the influence of the ‘own’ governmental body. This is hard to accept, since a large majority of the Dutch inhabitants wants to live in a nice, sound and healthy environment. Therefore we should understand how this re-direction in functional rationalization can happen.

Decision-making in the area is a complicated affair, since five governmental levels are involved: European, trilateral, national, provincial and local. On every level four stages of policy-making are involved (Winsemius 1986, Boogerd 2005): (1) the signalling stage, (2) the stage of policy-development, (3) the solution stage, and (4) the control stage. The first stage concerns problem recognition. The second stage starts when the problem is defined and recognized and agreed upon. It continues with formulating an effective policy in order to find the solution. The third stage concentrates on the solution by bringing it into practice, whilst the final stage monitors whether the solution fulfilled the goal. Inherent to nature, this four-stage approach was used for the first time on a national scale in the Dutch Nature Management Plan (Ministry LNV 1990). The various governmental levels have somewhat different roles during these stages, resulting in somewhat different information needs (Winsemius 1986, Boogerd 2005). Whereas Winsemius felt that policy development was primarily a national responsibility, Boogerd concluded that each level inevitably has to cycle through all four stages. These four stages on five governmental levels complicate the decision-making and trigger the re-direction of functional rationalization. When one level has passed the signalling stage, the other still has to start: if one level considers a set of events as problematical, another level still has the option to deny the problematical character. It will never happen that for instance the European and the local level simultaneously cycle through the four stages of policy-making. This causes frictions between the levels resulting in opposing interests and re-direction in functional rationalization.

11.4 THE ROLES OF ECOLOGICAL SCIENCE

But apart of the decision-making, the ecological science also has its roles in the context of the Wadden Sea. Swart & Van Andel (2007) used the cockle controversy debate in the Wadden Sea to show that not only ecological knowledge, but also societal issues influence conservation research. They conclude on four types of science: autonomous
science, applied science, societal contextualized science and politicizable science. They considered the autonomous and applied science as the classic forms of science. Autonomous science is described as curiosity-driven and applied science as problem-driven. In societal contextualized science is not only the traditional scientific quality important, but also the societal quality, which is reflected by the involvement of stakeholders in the research process. Such a type of science needs so-called ‘boundary work’. In the words of Swart & Van Andel (2007): ‘Establishing a claim as scientific in such (contextualization - ME) situations requires active efforts of the people involved, which might also imply typifying the opposing claims as political or interest-driven’. So the fourth category, politicizable science, can be described as interest-driven; scientific uncertainties and social interests are both heavily involved. Swart & Van Andel consider it as a radical form of societal contextualization. These developments in both science and society contribute to Lawton’s reasons 2, 3 and 7 with too much ambiguous science related to heavy societal disputes, which cannot be followed easily by politicians and/or the general public without knowing the type of science. In the cockle-controversy, the ecological research itself became part of the debate and thus caused frictions resulting in opposing interests and again re-direction in functional rationalization.

11.5 DECISION-MAKING AT THE START OF THE 21ST CENTURY

Since the 1990s several organizational changes have stimulated the functional approach to policy-making among the national, provincial and local governmental levels with respect to the main objective for the area: ‘the long-term protection and development of the Wadden Sea as a nature area and the preservation of the unique open landscape’ (VROM 2007). Organizational activities include the development of a new management plan for the Wadden Sea: ‘Beheer- en Ontwikkelingsplan Waddengebied’ including the managements-plans for the EU-Water Directive and Nature 2000, and the ‘Uitvoeringsplan Waddenfonds’. This plan will include the first three stages of Winsemius (1986) (signalling, policy development, solution), but not yet systematically the fourth control stage with its relations to the second and third stage.

From the point-of-view of wader studies the long-term protection and development of the Wadden Sea as a nature area requires knowledge on (changes in) population numbers, population composition, mortality, productivity, and body condition in order to serve the various signalling and control stages of the five governmental levels. Important population
declines, poor body conditions or reduced reproduction ought to result in adequate actions of the governmental level best suited for it. Some of these activities are already organised, for instance, in the context of the trilateral Wadden Sea program TMAP: bird numbers and breeding success of Wadden Sea birds are monitored under this flag (e.g. Essink et al. 2005). However, when actions are needed it is not evident how the monitoring results affect the decision-making processes due to a lack of a-priori stated goals. This is changing with the implementation of the European Water Directive: functionally rationalized nature goals are formulated, monitoring these goals is mandatory, and the outcome must result in actions (if needed). Goals and monitoring include both a-biotic and biotic parameters. The biotic part of the program includes phytoplankton, phytobenthos, macrophytes, macrofauna and fishes. Functional rationalization with respect to goals for the higher level organisms is now also developing for the European Natura 2000 and the monitoring needs will follow soon. In other words: there are some locomotives and wagons, and the railway is under construction.

11.6 TOWARDS FUNCTIONAL RATIONALIZATION

Tromp (2001) showed why results of ecological research could not be very useful in the context of decision-making during the 1990s. It might well be a major reason, that even with all the efforts and good intentions of many people in the Dutch Wadden Sea, it has been impossible until recently to organize adequate early-warning systems and distributional and life-history studies in order to prevent major crises with respect to the natural life of the Wadden Sea. When we started the catching of waders in the 1970s, the specific problem was whether or not important parts of the Wadden Sea could be reclaimed. Apart of the reclamation topic, three other major perturbations with respect to birds took place since the 1960s: the dieldrin/ endrin/ telodrin/ DDE-affair in the late 1960s, the PCB-affair in the 1980s, and the over-exploitation by the shell-fisheries in the 1990s. They all had a negative impact on the natural functioning of the system. These events took us by surprise as for instance the poisoning with ‘drins’ of Sandwich Terns (Koeman in Saris 2007) and the starvation of Oystercatchers and Eider ducks due to too low food stocks (Camphuysen et al. 2002, Verhulst et al. 2004, Ens et al. 2004, Van Gils et al. 2006, Kats 2007, Swart & Van Andel 2007). Once the attention was raised by professional and volunteer ecologists, it took some years to take adequate measures. Reparation of the negative effects takes long. Forty years after date the population numbers of the Sandwich Tern are not yet on the levels of the 1950s. It is also expected, that it needs at least 40 years before the Wadden Sea mudflats are recovered from the shell-fisheries affair of the 1990s (Piersma pers. comm.).
The flaw of not having properly functioning early warning systems with respect to the huge public impact of these three crises still needs to be repaired. There is no early warning system including the body condition and reproductive output of species like Eider Duck, Oystercatcher, Red Knot or Sandwich Tern. The organization of such an independent monitoring system in case of the shell fisheries has never been achieved even though permits for harvesting were (and still are) needed and the industrial shellfish fisheries were in a healthy financial state. If a sound monitoring system had already been in place with the involvement of all relevant groups (stakeholders, politicians and biologists) dealing with the shell-fisheries problem, the disputes might well have been less severe resulting in less costly societal processes. Until recently, no functionally rationalized goals with respect to nature in the Wadden Sea were formulated. The ones being formulated invariably originated from the trilateral and European levels (see Chapter 11.5). None of the three national ministries involved (LNV, VROM and VW), none of three provinces (Groningen, Frieslân, Noord-Holland), none of the at least 14 municipalities and none of the inter-governmental commissions have ever had the intention or were able to organize such a monitoring system without the trilateral or European pressure. Until recently, these more than 20 public bodies have denied the necessity of such a monitoring system, failed to organize it or were able to put the responsibility somewhere else. They adopted a surprise-scenario and by doing so they put the ecologists (professionals as well as volunteers) in a signalling position.

11.7 FUTURE OPTIONS FOR WADER CATCHING

The type of wader research, analysed in this thesis, has a strong focus on the method: catching. When used efficiently, it combines different aims directed towards the solution of a set of problems. It may include for instance sampling for avian influenza and DNA-studies as well as catching for survival and population composition estimates. When wader catching adopts a multi-aim approach it can well be integrated with bio-monitoring tasks.

In my view the results of catching activities are especially effective during both the signalling and control stages of policy-making. When Eider Duck, Oystercatcher and Red Knot are involved, attention should be paid to (1) condition and juvenile ratios in the staging populations in November – December, and (2) their body condition prior to their breeding (Eider Duck and Oystercatcher) or to their departure to the breeding grounds (Knot).
The same is true for species like Dunlin, Bar-tailed Godwit and Redshank feeding on worms and shrimps. The abundance of these prey-types is just as well influenced by human activities, while the monitoring is on too small a scale and insufficiently standardized to be adequate. Information on body condition, toxic chemicals, survival and productivity can be collected with a systematically planned international catching program. The present-day organization of at least the wader catching activities is not adequate enough, while it can be re-organized to fulfil specific needs. This type of wader research will be valuable, if (1) it continues to be of scientific interest for ecology, systematics and ornithology, (2) it is more helpful to interpret the results of wader counts, (3) it helps in producing undisputed results when recognizing problems in the signalling stage of policy-making, (4) it is a monitoring activity in the control stage of policy-making for various governmental levels, or (5) it helps these levels to adopt long(er)-term policies with respect to the rationalization of nature goals for the area. Without being comprehensive, the following set of potential goals can be listed:

**Goals for (inter)national policies**

1. Monitoring effects of global change on waders in the Wadden Sea. Boere et al. (2006) plea for a continued update of information on population changes, distribution, and the processes involved, since the effects of global change become more and more visible. Global change, either natural or man-made, will affect most breeding grounds because of changes in vegetation patterns, temperature, rainfall, and prey availability. It will also affect most intertidal feeding areas because of higher sea levels or more storms resulting in less exposure of the feeding grounds and changes in the sedimentation processes. It will also affect most wintering grounds because of desertification, changing weather patterns and/or changing temperatures of seawater. Wader populations can thus be expected to be affected in several ways by the processes involved in global change throughout the annual cycle. This explains the plea for a continued update of information. The results are useful for science as well as the international and national level of policy-making. It requires a (partly internationally) organized system for monitoring and research. With respect to wader research organizations like the International Wader Study Group, CHASM, Wetlands International, the Arctic breeding bird survey and EURING have a potential to organize internationally co-ordinated efforts. Changes in population composition will be a major item in these efforts for understanding population changes. Co-ordination of the sampling programs in the arctic breeding regions as well as in the temperate and tropical regions can be reached when qualified organizations join, co-operate and co-ordinate their efforts to obtain collective databases based on standardized sampling.
Goals for (inter)national and provincial Wadden Sea policy-making

2. Recovery and permanent protection of the Wadden Sea as a nature area and the conservation of the unique open landscape. This value-rationalized goal is formulated in the ‘Derde Nota Waddenzee’ as a policy goal of fundamental importance and needs to be operationalized and controlled. With respect to birds it is operationalized as ‘the foraging-, breeding- and resting areas of birds have to be protected and preserved’. It thus needs to be clear when and where these areas are protected and preserved and when such is not the case and whether the degree of protection and preservation is adequate. The planning of human activities by the public authorities must take account of these values (amongst several others) according to resp. the ‘Flora- en faunawet’, the ‘Natuurbeschermingswet 1998’ and Nature 2000. Especially the European Nature 2000 is based on functional rationalization: numerical targets with respect to wader numbers per (sub) species and site are formulated and must be evaluated. These evaluative results will be useful for the various levels of policy-making, but if numerical targets are not reached, one needs to know cause-and-effect. Otherwise no proper solutions can be developed. This requires (in our situation) insight in population dynamics (yearly survival and productivity rates) and body condition in relation to the seasonal cycle and spatial distribution of waders. Thus, reliable population composition estimates and body condition parameters are required and can only be reached with good science.

3. Healthy Wadden Sea system. With value-directed rationalization a healthy Wadden Sea system can be maintained with a high bio-diversity and widely roaming flocks of waders throughout the area. But when is the Wadden Sea ecosystem ‘healthy’? It requires knowledge about (1) the numerical fluctuations of the various species throughout the years, (2) population levels, reproduction rates and conditions of the species involved, (3) the spatial distribution of waders throughout the area in order to know whether the Wadden Sea ecosystem is in good or bad health, and (4) the residues of poisonous chemicals. These results are useful for science as well as the various levels of policy-making. The aim of a healthy Wadden Sea system requires the organized monitoring of the status of at least Eider Duck, Oystercatcher and Red Knot in the area in order to serve the control stage of management. However some non-shellfish feeders are required as well in order to avoid the risk of a ‘tunnel-vision’. Worm-feeders like Grey Plover, Dunlin, Bar-tailed Godwit and Redshank are good candidates. The first three species were the species being hit the hardest in the Wadden Sea during the shell fisheries crisis of the 1990s (Camphuysen et al. 2002, Verhulst et al. 2004, Ens et al. 2004, Van Gils et al. 2006, Kats 2007).
Goals for ecology and ornithology

4. **Improving population composition estimates.** When the attention is focussed on measurements and plumage patterns with more discriminatory power than only wing- and culmen length, it must be possible to obtain better conclusions on population composition. The same is true when DNA-analysis and/or feather sampling for analysing stable isotopes (e.g. Atkinson et al. 2005) can be included more frequently. It also requires improvement of the statistical and computational tools, as this thesis showed.

5. **Sex-allocation.** Population composition estimates will become vastly improved once we are able to sex the birds caught. Captured birds can be sexed in a standardized way by using molecular sexing techniques based on blood or feather samples (e.g. Griffiths et al. 1998, Robertson et al. 1999, Russello & Amato 2001, Eason et al. 2001, Blomqvist et al. 2002, Lee & Griffiths 2003, Kenward et al 2004, Harvey et al. 2006, Lopes et al. 2006, Ottvall & Gunnarsson 2007, Rönkä et al. 2007). The results obtained are useful for science as well as the international and national level of policy-making.

6. **The collection of good body condition parameters.** Newly developed techniques with blood sampling (haematocrit) in order to obtain condition parameters (Bearhop et al. 1999, Verhulst et al. 2004, Cuervo et al. 2007) will be useful to investigate stress and cumulative effects of human activities in the Wadden Sea.

7. **Analysis of residues of toxic chemicals.** Such analyses might result in knowing the causes of population change due to increased mortality and/or decreasing productivity.

8. **Better information on survival and reproduction rates.** The material collected up to now still has to be analysed with respect to yearly survival and longevity. Several models are already developed (e.g. Lebreton et al. 1992). The outcomes obtained with these models will provide (1) species-specific yearly survival estimates during the past 30 years of both adults and first-winter birds, (2) knowledge (together with the recruitment estimates) to understand the population changes of the past 30 years, and (3) insight in the needed quality of sampling. Since most of the Wadden Sea staging populations breed in remote (sub) arctic areas, estimates on reproduction rates could better be collected in areas like the Wadden Sea. Better estimates on juvenile percentages in the Wadden Sea result in better knowledge on breeding performance in the (sub) arctic.

9. **Causation of diversification in numerical patterns.** Several populations are declining in the East Atlantic Flyway (Boere et al. 2006) as well as in the international Wadden Sea
Breeding origins of wader populations utilizing the Dutch Wadden Sea (Koffijberg et al. 2005), even though most of our studied species appeared to frequent the Dutch Wadden Sea more and more (Chapter 5). These might only be temporary, because of the series of mild winters since 1989, since the numbers present in the Wadden Sea during January are positively related to mean temperatures in the area (Fig. 16). Catching studies might reveal the causation of this discrepancy.

11.8 SUMMARIZING REMARKS

The future catching of waders in the Wadden Sea lies in international co-operation. It then becomes of great value for the signalling and control stages of policy making on the various governmental levels. Problem-oriented research, possibly including catching activities, is needed in the stages of policy development and solution seeking. The future catching of waders in the Wadden Sea will also advance ecological science itself if we succeed to improve: (1) the standardization of sexing procedures of the birds captured, (2) the condition measures of the birds captured, (3) the estimates of yearly survival of populations present, and (4) the reliability of the population composition estimates. Such needs organization and funding. The British situation might serve as an example. In the British Isles, many efforts of the British Trust for Ornithology concern the combination of -at least- ringing and counting work, which can be used in scenario- as well as cause-and-effect studies. Until recently, bird-ringing activities in the Netherlands have been co-ordinated from the Netherlands’ Institute for Ecological Research (NIOO). The responsibility for the co-ordination of the ringing activities is now being shared with SOVON Bird-research Netherlands, a large organisation with an active volunteer network. This is an excellent opportunity for implementing problem-oriented studies useful both during the various stages of policy-making as well as for the scientific world. It might well result in answers and solutions. Lawton (2007) formulated it as follows: ‘Ecologists must be seen not solely as bearers of bad tidings. We face the challenge to function not only in identifying problems but also in suggesting solutions!’