The use of light traps in monitoring abundance of glass eel.

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Contents

NEDERLANDSE SAMENVATTING

Door de sterke afname van de glasaalintrek verkeert de jaarlijkse kruisnet bemonstering in de problemen. De kosten van het huidige arbeidsintensieve kruisnetprogramma zijn hoog en de sterke afname van de glasaalvangsten hebben negatieve gevolgen voor de statistische betrouwbaarheid van de gegevens en voor de motivatie van de betrokken medewerkers in het veld. De ontwikkeling van een nieuwe, betrouwbare en betaalbare methode om de jaarlijkse glasaalmonitoring uit te voeren is belangrijk voor het beheer van de in zorgwekkende toestand verkerende aalstand.

Tijdens de glasaal intrek in het voorjaar van 2009 zijn een aantal hevel constructies en een simpele lichtval getest. Uit dit onderzoek bleek dat de lichtval het meeste perspectief bood als alternatief voor het traditionele kruisnet in de jaarlijkse glasaalmonitoring. De in 2009 ontwikkelde lichtval was goedkoop, makkelijk hanteerbaar door één persoon en de vangsten toonden vergelijkbare (relatieve) trends met de vangsten van de kruisnetten.

In 2010 is er aanvullend onderzoek gedaan naar de mogelijkheid lichtvallen in te zetten als methodiek voor het monitoren van absolute dichtheden glasaal. Het onderzoek in 2010 heeft duidelijk aangetoond dat het twijfelachtig is of lichtvallen een goed alternatief zijn voor de kruisnetbemonstering.

In 2009 was er bijna geen verschil tussen de lichtval en het kruisnet in het temporele patroon van de aanwas aan glasaal. Echter in 2010 was er in april een groot verschil tussen de twee methoden, de pieken in aanwas waargenomen met het kruisnet werden slechts gedeeltelijk met de lichtvallen waargenomen.

Een tweede zorgelijke observatie was het ogenschijnlijke gemak waarmee glasalen in staat waren te ontsnappen uit een lichtval. In 2010 werden beiden typen lichtvallen herhaaldelijk gevuld met 15-25 glasalen en na 48 uur werd genoteerd hoeveel glasalen er nog in de lichtval aanwezig waren (retentie). Helaas wisten de glasalen relatief eenvoudig uit de lichtvallen te ontsnappen. Dit onverwachte resultaat toont echter aan dat de huidige lichtvallen niet geschikt zijn als een betrouwbare alternatieve methode voor de Glasaal Index die gebaseerd is op absolute aantallen.

Een probleem van het kruisnetprogramma is de toename in het percentage nul-vangsten (<5% 1960-1980 toegenomen tot 30-40% de laatste jaren) en het negatieve effect op de betrouwbaarheid van de data. Ook hier lijkt de lichtval geen oplossing te kunnen bieden. In 2009 en 2010 was het percentage nul-vangsten van de lichtvallen aanzienlijk hoger (80 tot 90% nul-vangsten) in vergelijking met de vangsten met het kruisnet (40% nul-vangsten in 2010).

De huidige lichtvallen lijken dus geen goed alternatief te zijn voor de kruisnetbemonstering en kunnen hoogstens gebruikt worden om een indruk te krijgen van relatieve patronen in de aanwas van glasalen. Gezien de vele onzekerheden en problemen met de lichtvallen is niet aan te bevelen dit onderzoek in 2011 grootschalig voort te zetten. Mogelijk kan er binnen het budget van de glasaalmonitoring nog op beperkte wijze worden gekeken of met kleine aanpassingen aan het ontwerp van de lichtval iets kan worden verbeterd aan het ontsnappen van glasaal uit de lichtval. In 2011 zal er waarschijnlijk meer aandacht moeten worden besteed aan het motiveren van de vissers en de vrijwilligers die meewerken aan de jaarlijkse glasaalbemonstering met behulp van een kruisnet.

INTRODUCTION

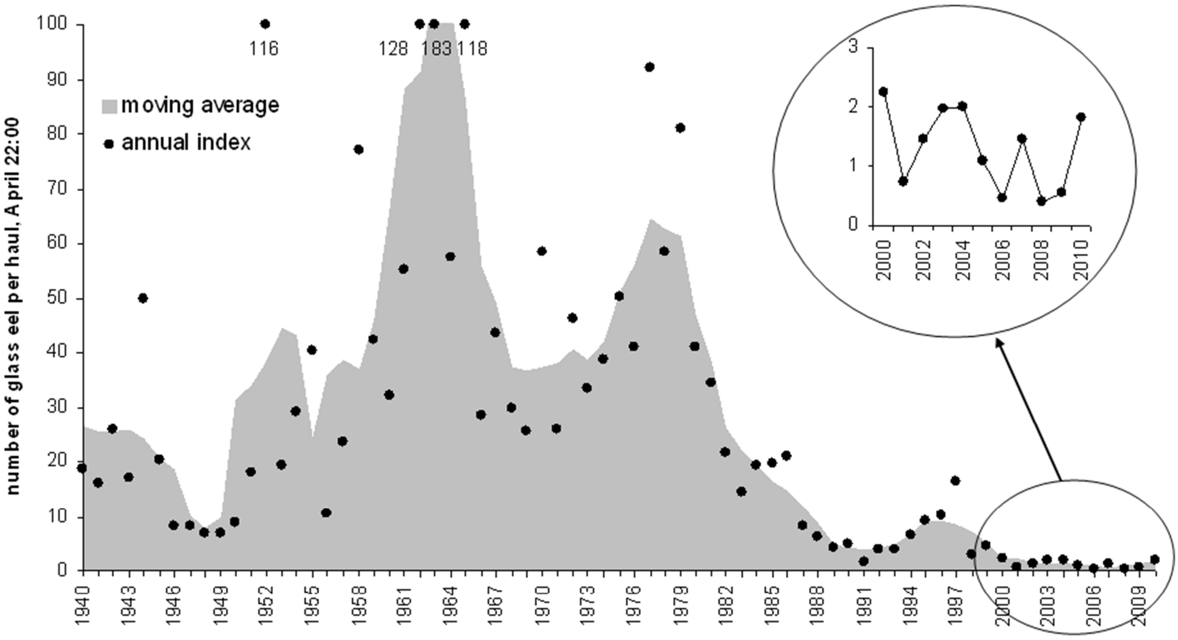

Figure 1. Time trend of glass eel at the sluices of Den Oever (de Graaf en Bierman 2010).

Glass eel recruitment has been monitored at Den Oever since 1938 using a lift net. Due to the dramatic decline of glass eel recruitment (Fig. 1), the annual lift net glass eel monitoring program is in serious trouble (Dekker 2004). Cost of the current labour-intensive lift net programme are high and the drastic decline of the glass eel catches have serious negative consequences for the statistical reliability of the collected data and for the motivation of the participating field staff. Dekker (2004) concluded that the development of a new, reliable and cost-effective method which provides a higher resolution at the low glass eel recruitment level was of utmost importance for the management of the depleted eel stocks.

Leijzer et al. (2009) tested several methods to monitor glass eel and their results indicated that light traps could maybe provide an alternative for lift nets in the glass eel recruitment programme. The light trap (Fig. 1, left) developed by Leijzer et al (2009) was cheap, easy to handle by one person. Also in the initial experiments the catches showed similar temporal patterns as the lift nets. Leijzer et al (2009) concluded, however, that before light traps could be deployed in the field to replace the lift net programme, the method required further fine tuning.

The objective of the 2010 KBWOT project was to gain further insight in the abilities of light traps to attract, capture and retain glass eels in a field situation. We were interested In the effect of depth, light source and light trap design on catch rates and the ability of light traps to retain glass eels after capture.

MATERIAL AND METHODS

LIGHT TRAP DESIGN

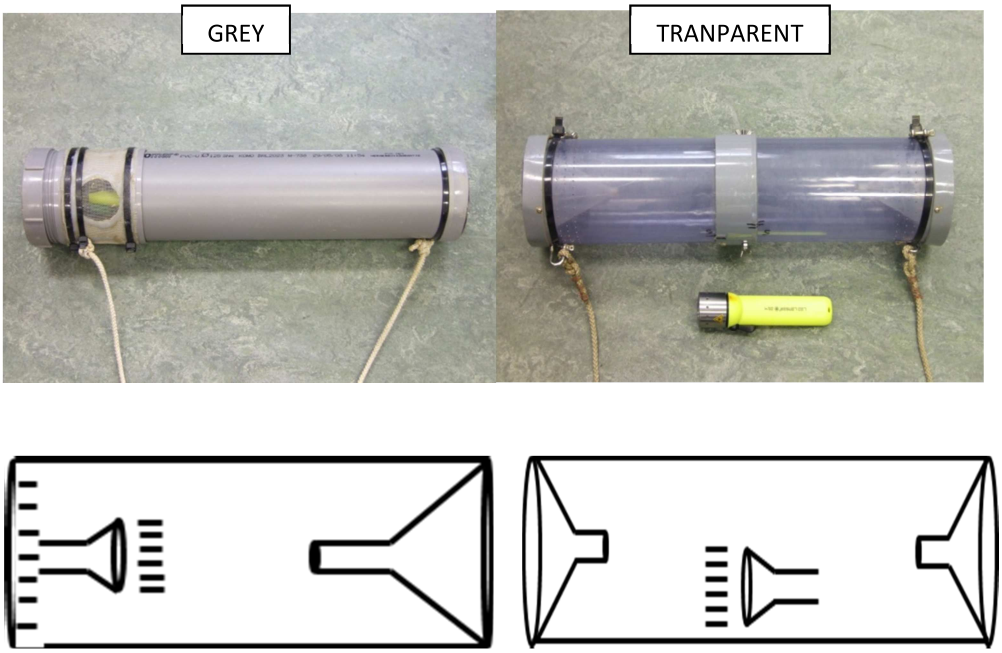

Figure 1: The two types of light traps used during the pilot studies in 2009 (left) and 2010 (left and right) to collect glass eel.

Two types of light traps were used during the 2010 glass eel season (Fig. 1). Both traps were ca. 55 cm long and with a diameter of 12.5 cm. One light trap was grey, with a funnel on one side and a light source at the opposite side. The second light trap was transparent, with two funnels through which glass eel could enter the trap on both ends and a light source in the middle. The opening of the funnel(s) in both traps was 10mm. Two types of light sources were used in the experiments, a krill light (Fig. 2) or a dive light (Fig. 3).

Figure 2. Krill light (green) 360° (http://www.kriana.com/how-to-choose)

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LED	High End Power LED
Length	160 mm
Weight	220 g
Luminous flux	150 lm*
Batteries	4 x AA
Energy tank**	16,8 Wh
Burning life	20 h*
Beam range	180 m*

Figure 3. Dive light Led Lenser D14.
(http://www.zweibrueder.com/ENG/produkte/html_highperformance/html_Dserie/d14.php?id=d14)

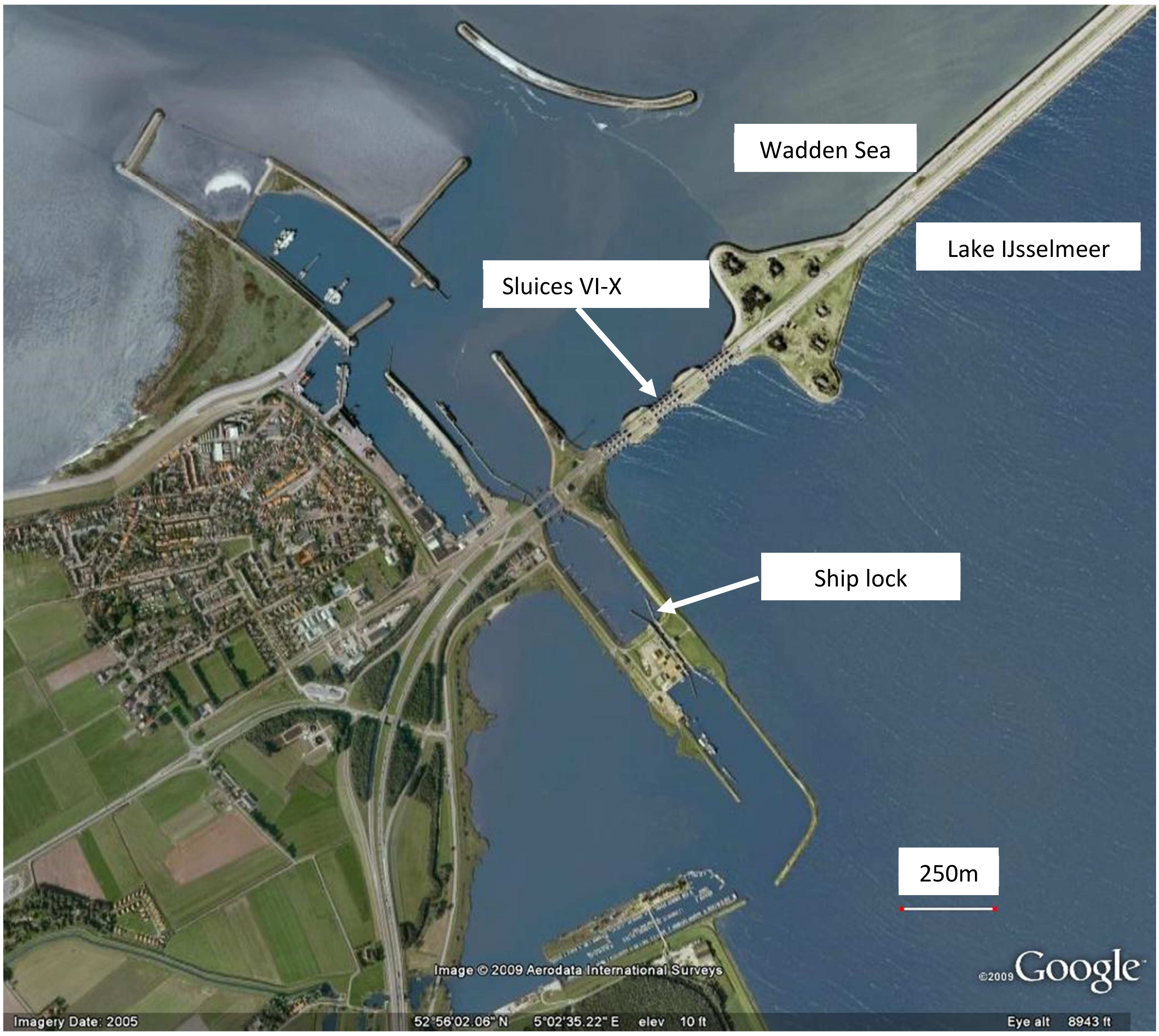

Figure 4. Location of the lift net (sluice VI) monitoring and light trap experiments (Sluices VII-X) at the first series of sluices in the Afsluitdijk at Den Oever and location of the light trap experiments at the ship lock.

SLUICES

From 1 April 2010 to 29 May 2010 light traps were deployed daily around 22:00 in the evening and retrieved after 7 hours at 5:00 the following morning parallel to the lift net monitoring at the sluices in the Afsluitdijk near Den Oever (Fig. 4). Captured glass eels were counted and recorded. The traditional lift net monitoring occurred in front of Sluice VI on the Wadden Sea side in the first set of five sluices (RWS no. VI-X).

Different set-ups of light traps were deployed in front of the other four sluices (Fig. 5):

- grey light trap with a dive light, depth 0.5 m,
- grey light trap with a dive light, deployed 1 m from the bottom
- transparent light trap with a dive light, 1 meter from the bottom, and
- transparent light trap with a krill light, 1 m above the bottom.

The location of each of the four light trap set-ups was rotated daily among sluices VI-X and every Sunday the batteries were replaced in all the light traps.

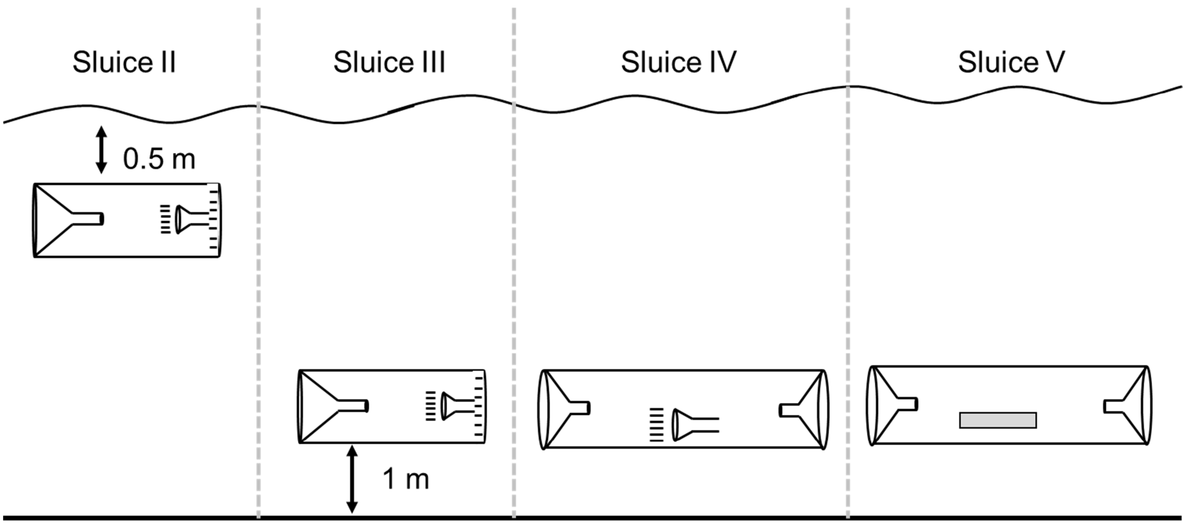

Figure 5. Experimental design light traps at the sluices in de Afsluitdijk near Den Oever.

SHIP LOCK

Between 1 April and 30 May 2010, light traps (Fig. 6) were also deployed at the ship lock (Fig. 7) near Den Oever. Three light traps were attached to the jetty every Monday, Wednesday Friday and lifted every 48 hours on Wednesday, Friday and Sunday. At each of these three days the number of glass eels in the traps was recorded and the batteries were replaced (every 48 hours) in all light traps. The three light traps rotated between the three locations were the traps were attached to the jetty.

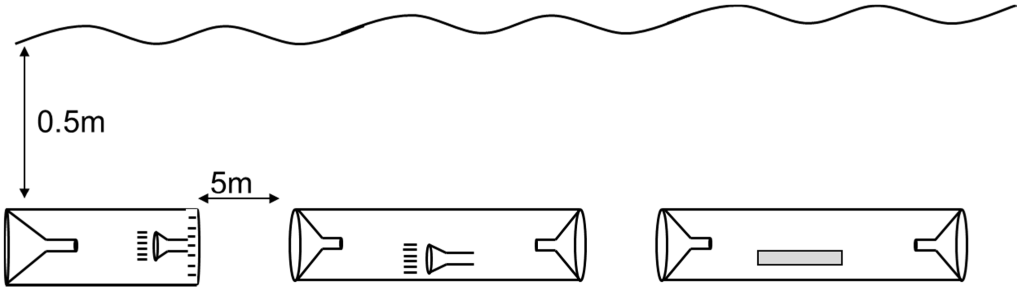

Figure 6. Experimental design light traps at Den Oever's ship lock.

Figure 7. Arrows indicate location of the light traps at the shiplock near Den Oever (Photo Jan van der Heul)

RETENTION EXPERIMENTS

In order to the determine the ability of both light trap designs to retain captured glass eels, light traps were (4-5 times) filled with 15-25 glass eels and after 48 hours the number of remaining glass eels was determined.

RESULTS

LIGHT TRAP AND EXPERIMENTAL DESIGN

Table 1. Overview of total catches en zero cathes of the light trap and lift experiments at the Sluices and Shiplock in the Afsluitdijk near Den Oever.

SLUICES (n=56)	**Grey Dive light, Surface**	**Grey Dive light, Bottom**	**Transparent Dive light, Bottom**	**Transparent Krill light, Bottom**	**Lift net**
# glass eels	21	18	9	3	1123
% zero catches	79%	88%	91%	96%	40%

SHIPLOCK (n=26)	**Grey Dive light Surface**	**Transparent Dive light Surface**	**Transparent Krill light Surface**
# glass eels	55	20	11
% zero catches	54%	58%	81%

The transparent light traps with the krill light as light source captured the least amount of glass eels both at the sluices and the ship lock. The transparent light traps with the dive light captured more than twice as much glass eels compared to the transparent light traps with the krill lights. However, both at the sluices (7 hour soaking time) and the ship lock (48-72 hours soaking time) the grey light traps with the dive lights captured by far the most glass eels, again more or less twice as much as the transparent light traps with the dive lights. However, in comparison with the lift net (1123 glass eels), the total catch of glass eels by the light traps was very low (3-21 glass eels).

Furthermore the zero catches of the light traps, especially at the sluices after a soaking time of 7 hours, were high compared to the lift net catches.

TEMPORAL PATTERNS IN RECRUITMENT

In 2009 the temporal pattern in glass eel recruitment as recorded by the lift net was similar to the pattern observed with the light traps (Fig. 8b). However, in 2010 the light traps appeared to have failed completely to pick up some of the earlier peaks in glass recruitment in April 2010 (Fig. 8a).

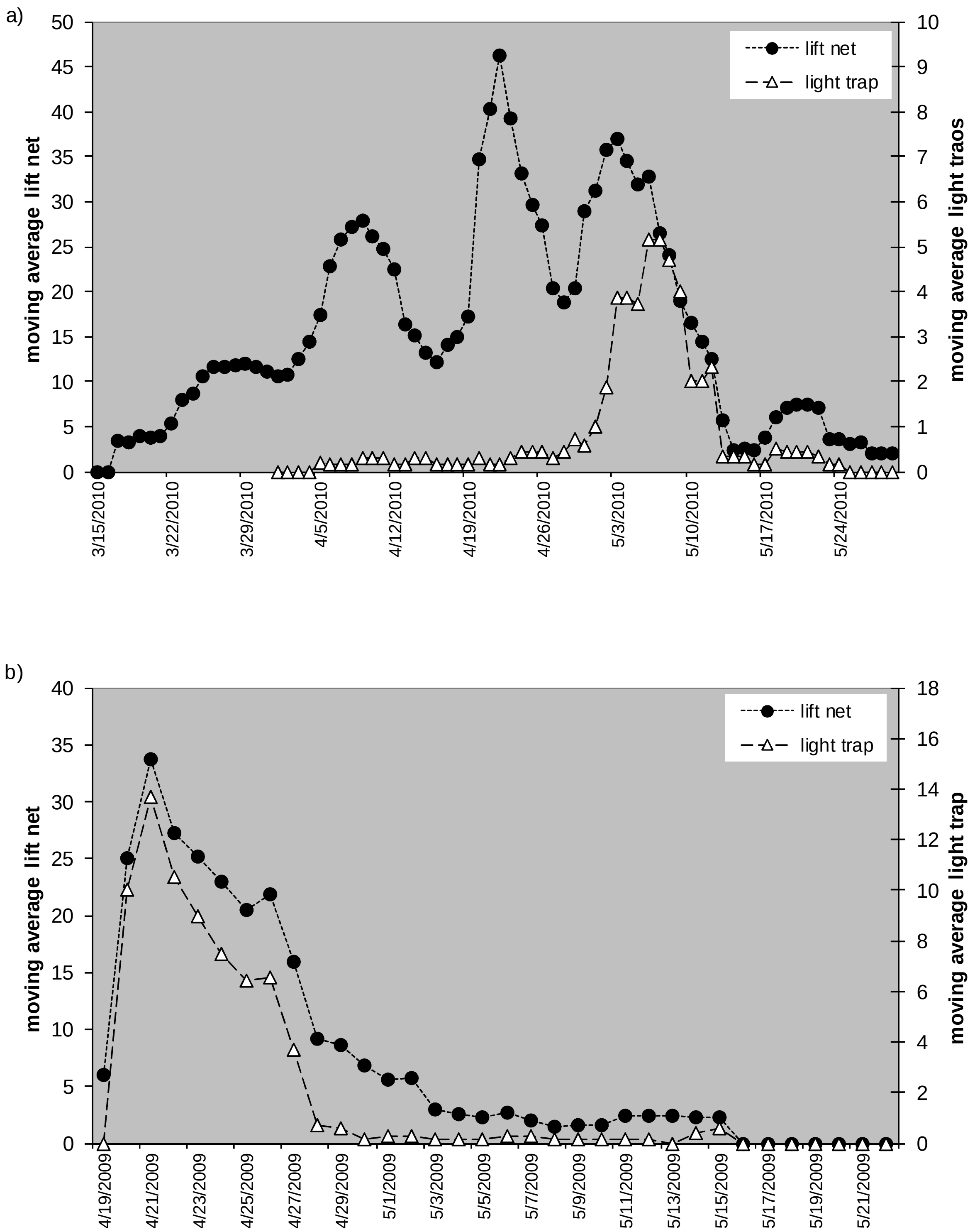

Figure 8. Comparison of seasonal changes in glass eel recruitment observed with lift nets and light traps in 2010 (a) and 2009 (b).

RETENTION EXPERIMENTS

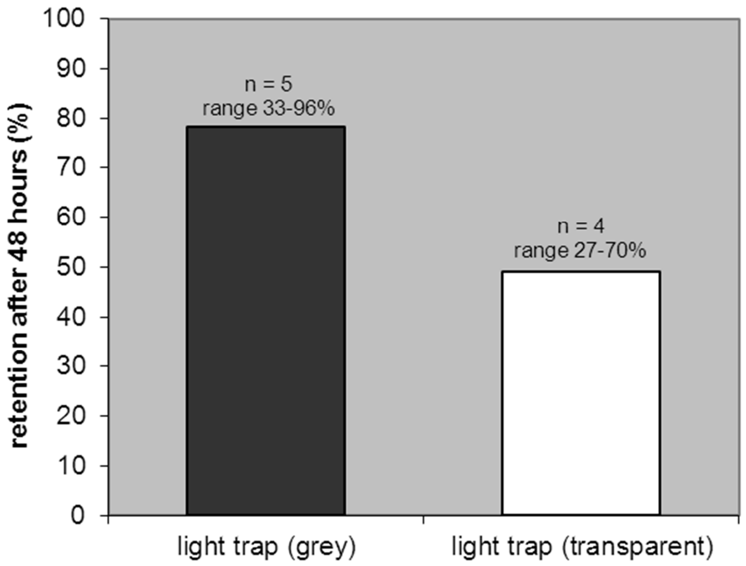

Figure 9. Retention of glass eel in both types of light traps after 48 hours.

The ability of both types of light traps to retain glass eels was low (Fig. 9). Especially the transparent light trap, with two openings, failed to retain glass eels.

CONCLUSIONS AND RECOMMENDATIONS

A few conclusions regarding the design of the light trap and the placement in the water column can be drawn. In the first place, the krill light does not appear to be a suitable light source in comparison with the dive light. Secondly, the optimal location of the light traps in the water column is not clear (Table 1). While in 2009 it appeared that the light trap positioned near the surface caught less glass eels (Leijzer et al. 2009), this pattern was not confirmed in 2010. Thirdly, while in 2009 the temporal pattern in recruitment was similar between light traps and lift net, this was not the case in 2010. In 2010 the light traps missed some of the clear peaks in recruitment in the first half of the season (April). Fourthly, within the limits of this methodology, the grey light trap design functioned better (higher catch rates, higher retention rates) than the transparent light trap.

One of the main problems identified by Dekker (2004) with the traditional lift net program was the increase in the percentage of zero catches (<5% 1960-1980 to 30-40% in recent years) due to dramatic decline of recruitment and its negative effect on the reliability of the data. The type of light traps used in these trials will not provide a suitable or reliable alterative to improve this issue of high zero-catches at low glass eel densities. In 2009 (~80%) and 2010 (~90%) the percentage of zero-catches of light traps at the sluices (soaking time 7 hours) were even higher compared to lift net catches in 2009 (79%) and 2010 (40%).

Soaking the light traps for periods (48-72 hours) reduced the percentage of zero-catches to around 60 percent. However, increasing soaking time revealed a major flaw with regards to the retention of glass eels after capture. The high number of zero catches in light traps may be partly due to the low and unpredictable retention of the light traps. The relative ease with which glass eels escaped from the light traps, raises serious concern about the ability of the current design to replace lift nets. The historical Glass Eel Index at Den Oever is based on the ability to reliably and consistently compare of glass eels between years.

In summary, the results of the 2010 study with the two light traps designs demonstrated that these light traps could, at most, be used to determine relative seasonal patterns glass eel recruitment but are not a suitable replacement for or even an improvement on the traditional lift net programme.

Due to many uncertainties surrounding the light traps as a method to reliably and accurately provide data on absolute abundance of glass eel, it is recommended that further extensive experiments with light traps are ceased. It is only recommended that, if possible within the existing budget of the glass eel monitoring, the retention issue could be addressed by testing minor changes in the design of the grey light traps. In 2011 more effort will need to be allocated to improve the motivation of the fishermen and volunteers participating in the lift net monitoring program.

ACKNOWLEDGEMENTS

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QUALITY ASSURANCE

IMARES utilises an ISO 9001:2008 certified quality management system (certificate number: 57846-2009-AQ-NLD-RvA). This certificate is valid until 15 December 2012. The organisation has been certified since 27 February 2001. The certification was issued by DNV Certification B.V. Furthermore, the chemical laboratory of the Environmental Division has NEN-AND-ISO/IEC 17025:2005 accreditation for test laboratories with number L097. This accreditation is valid until 27 March 2013 and was first issued on 27 March 1997. Accreditation was granted by the Council for Accreditation.

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JUSTIFICATION

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The scientific quality of this report has been peer reviewed by the a colleague scientist and the head of the department of IMARES.

Approved: Dr. S.M. Bierman
Researcher

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