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Estimation of the productivity of
the NW African upwelling region

by

S. Schulz and W. Kaiser
Institute of Marine Research
Rostock-Warnemünde (GDR)



The data on primary productivity used for this calculation were collected during 5 expeditions of the GDR r/v "Alexander v. Humboldt" in 1970 to 1973 to the upwelling region off NW Africa. Table 1 shows the mean primary production at the seven standard sections. The highest values were recorded in the area off Cape Blanc and Nouakchott. North of Cape Blanc the values were relatively low, although at these sections nearly the whole year upwelling processes are prevailing.

Table 1 Mean primary production at the standard sections of the upwelling area off NW Africa (9° - 25° N) in connection with the duration of upwelling

Area	Duration of upwelling (month)	Mean primary production	
		$g\ C/m^2y$	$g\ C/m^2d$
B. de Garnet	10	98.9	0.275
B. de Gorrei	12	122.3	0.340
C. Blanc	12	211.9	0.590
Nouakchott	9	200.7	0.558
C. Vert	5,5	139.6	0.388
C. Roxo	3	153.0	0.425
C. Verga	1	122.4	0.340

The reason is obviously the low nutrient content of the upwelled water. At the southern sections the values were relatively high, although in these areas the upwelling period lasts only a short time. This is probably caused by the coastal water, containing comparatively high nutrient concentrations by river discharge. The coastal water fills up the shelf outside the upwelling period, mainly in summer and autumn, producing high phytoplankton growth.

By means of the calculated annual mean values for each station a map was drawn from which the annual mean production of the whole region was obtained by planimetry. The results are shown in table 2.

Table 2 The annual primary production of different regions off NW Africa

Area	km ² x10 ³	Annual primary production	
		t C/yx10 ³	g C/m ²
B.de Garnet- B.de Gorrei	83	9 165	0.306
B.de Gorrei C. Blanc	83	13 357	0.447
C. Blanc Nouakchott	108	22 676	0.583
Nouakchott - C. Vert	105	18 700	0.495
C. Vert - C. Roxo	96	14 219	0.411
C. Roxo - C. Verga	118	16 633	0.392
	593	94 750	0.443

In the whole investigated area the annual primary production amounts to about 95×10^6 t C, or a mean of $159.8 \text{ gC/m}^2\text{y}$.

or $0.443 \text{ g C/m}^2\text{d}$. If we compare these values with the calculated primary production of the world ocean given by KOBLENTZ-MISHKE, et al. (1970) of $23 \times 10^9 \text{ t C/y}$, 0,41 % of this amount are assimilated in the region under investigation, whereas the area covers only 0.16 % of the whole ocean. Because the main fishing area off NW Africa is the shelf region, the annual primary production was also calculated for this area. The numbers are given in table 3.

Table 3 Annual primary production in the different shelf regions off NW Africa and calculated possible fish production

Area	$\text{km}^2 \times 10^3$	Annual primary production Gross (Net) $\text{t C} \times 10^3$	gC/m^2	Possible fish growth $\text{t} \times 10^3$ (fresh weight)
B.de Garnet- B.de Gorrei	23	4070(2442)	0.492	977
B.de Gorrei- C. Blanc	23	5170(3102)	0.624	1240
C. Blanc - Nouakchott	39	9423(5654)	0.671	2262
Nouakchott - C. Vert	31	6653(3992)	0.596	1597
C. Vert -- C. Roxo	29	6310(3786)	0.604	1514
C. Roxo -- C. Verga	38	9108(5465)	0.665	2186
Total	183	40734(24441)	0.618	9776

Also by this estimation the C. Blanc - Nouakchott - region shows the highest productivity, although the differences between the single areas are much lower. The total amount represents 0.17% of the whole primary production of the oceans, whereas the area covers only about 0.05 % of the world ocean.

Well knowing and accepting all reserves of this method, we approximated the possible annual fish production by means of the primary production values, only to give an idea of the production potency of the area. The results are shown also in table 3.

According to our calculation the possible fish growth of the region between 9° to 25°N amounts to about $10 \times 10^6\text{t}$ fresh-weight per year. After actual landings of the main fishing fleets calculated ELWERTOWSKI et al. (1972) an annual catch in this region of about $2 \times 10^6\text{t}$. The FAO-statistics gave for 1971 in the Eastern Central Atlantic (mainly the region under investigation) a catch of $2.6 \times 10^6\text{t}$ and experts of this body asserted, that the catches could be doubled without danger of overfishing (except for *Scomber japonicus*).

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