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Analysis of Underwater Swimming World Record Gains Regularities (Finswimming)

Merited Coach of RSFSR, Doctor of Education, professor **O.N. Moskovchenko**[1,2]

Merited Coach of Russia, professor **I.A. Tolstopyatov**[2]

Merited Master of Sports **E.V. Redi**[2]

Assistant professor **V.V. Ivanitsky**[3]

Candidate of Pedagogic Sciences, assistant professor **L.V. Zakharova**[3]

[1]Krasnoyarsk State Pedagogical University named after V.P. Astafiev, Krasnoyarsk

[2]Siberian State University of Science and Technology named after Academician M.F. Reshetnev, Krasnoyarsk

[3]Siberian Federal University, Krasnoyarsk

The author's contact e-mail: moskovchenko7@mail.ru

Abstract

In the article we study the dynamics of underwater swimming (namely finswimming sports) world records. World records set in 1974 became a check point in the studies. That was the time when CMAS International Federation introduced particular changes into the contest rules, i.e. they abolished using wet suits, introduced 50-meter underwater dive for male and female, allowed using monofins, and made a decision to hold the first world finswimming championship in Hannover, Germany. We made a comparative analysis of world record gains within 30-year and 10-year periods. The represented research results prove the regularity of world record gains speed. We observed the fact that the most significant result gain was found in sprint races. The attained results allow estimating common factors of speed underwater sports development.

Keywords: athletes, swimmers, world records, underwater sport, finswimming, relative power zone, training administration.

Introduction. Finswimming is a cyclic kind of underwater sport, but it has its specifics. Use of snorkel and scuba is connected with muscle strain and psychological stress, heat losses and energy expenditure [2, 8, 11]. Excessive psychological stress and

significant energy expenditures are determined by intense motor activity and oxygen deficiency [4, 10]. During 50-meter underwater dive constant hypoxemia is reported; it influences the functional status of the central nervous system and demands higher emotional stability from a swimmer[1, 9]. Although finswimming was practiced since 1969, it still remains one of the mass and spectacular underwater sports acknowledged by the International Olympic Committee (IOC).

The research objective is to find the causalities of world records changes among male and female athletes who specialize in underwater finswimming for various distances.

Swimmers take part in the following competitions in a swimming pool: 50-meter, 100-meter, 200-meter, 400-meter, 800-meter and 1500-meter finswimming; 4x100-meter, 4x200-meter, 4x50-meter finswimming relay races (mixed relay), 4x100-meter swimming in classic fin flippers (mixed relay); swimming in classic fin flippers for 50-meter, 100-meter, 200-meter and 400-meter distances; 50-meter underwater dive; 100-meter and 400-meter underwater swimming. Since 1975 they started awarding the rank of Merited Master of Sports. Representatives of about 15 countries, including Russia, China, South Korea, Hungary, Italy, Ukraine, Colombia and others, are world leaders.

The following finswimming events are held: Russian national competitions and championships, European and World competitions and championships, national and world cup tournaments. The records are accepted among seniors and juniors [1, 4, 5, 11]. Are record-holder is a swimmer who set a new record that surpasses the already-existing record result [10]. At the same time it should be noted, that the analysis of the world records dynamics remains out of scope of attention from coaches and scientists which is also confirmed by other researchers [7, 11]. Most coaches do not realize that the analysis of the world records dynamics may allow revealing parameters that characterize the training level of athletes and applying an individual approach to the selection of specific checkup test [6, 8]. Record achievements parameters allow making a complex analysis of competitive activity and developing a strategy in preparation of highly qualified swimmers [3, 11, 13].

Research methods and arrangement. Taking into account the fact that the present problem of underwater sport is understudied, we based on the assumption that analysis of

10 best results recorded during European and World championships would let us investigate the world record dynamics regularities. At the preliminary stage we defined the rate of world record gains from 1970 till 1974. After that we analyzed world records of October, 1974, 2004 and 2014 with the help of content-analysis.

We chose a "velocity-time" limit relation to analyze the correlation between the distance covering time and velocity. The velocity of distance covering equals the ratio of the distance length to the time spent.

$$V = \frac{S(distancelength, m)}{T(time, sec)}$$

Results and discussion. At the preliminary stage we analyzed world records dynamics at random distances, i.e.: 100-meter, 200-meter, 400-meter and 800-meter female finswimming, 100-meter and 400-meter female underwater swimming, 100-meter, 200-meter, 400-meter, 800-meter and 1500-meter male finswimming, 100-meter and 400-meter male underwater swimming [8]. Thus, significant increase of results for both male and female athletes was observed at 100-meter and 200-meter finswimming and 100-meter and 400-meter underwater swimming from 1969 till 1971. The results growth at 800-meter female swimming and 1500-meter male swimming had a linear dependence from 1972 till 1974, the record results gain was not observed or was insignificant. That period of underwater sports development can be roughly divided into two stages. The first stage (1968-1972) is characterized by high rate of results gain. The second stage (1972-1974) shows deterred rate of results gain. This regularity is determined by a number of reasons. The sport in question originated during that period. Every year the equipment improved, a monofin was invented, athletes learnt a dolphin kick. From the end of 1969 until 1972 Nadezhda Turukalo set 16 world records using a monofin. At the second stage the results gain slowed down. It was caused by the factors that training methods became fixed then, the equipment improved still, but the progress was insignificant, because they only used glass fiber to make fins.

The contest rules got restricted. Previously we performed a comparative analysis of world record velocity gain during the period from 1974 till 2004 [13, p. 127] which showed that over a 30-year period the level of record results grew. It sets high

requirements to swimmer preparation and changes the training process itself, especially in sprint races, which is rarely taken into account by coaches. The dynamics of world record velocity gain for male and female swimmers over a 40-year period is shown in Tables 1 and 2.

Table 1. Comparative analysis of world record velocity gain for female athletes

Finswimming (distance, meters)	World records October, 1974		World records October, 2004		World records October, 2014		Velocity gain, m/sec
	Result min, sec	Velocity m/sec	Result min, sec	Velocity m/sec	Result min, sec	Velocity m/sec	2004-2014
100	49.8	2.00	39.73	2.51	38.11	2.60	0.58–0.09
200	1:50.2	1.81	1:32.24	2.16	1:25.9	2.30	0.35–0.14
400	4:03.2	1.67	3:17.78	2.02	3:12.90	2.03	0.35–0.01
800	8:29.6	1.60	6:57.82	1.91	6:46.79	1.92	0.31–0.01
1500			13:32.2	1.84	13:01.48	1.90	0.28–0.06
Underwater swimming (distance, meters)							
100	47.5	2.1	35.21	2.84	34.46	2.90	0.74–0.06
400	4:02.0	1.66	3:00.01	2.22	2:57.06	2.22	0.56–0.00

Table 2. Comparative analysis of world record velocity gain for male athletes

Finswimming (distance, meters)	World records October, 1974		World records October, 2004		World records October, 2014		Velocity gain, m/sec
	Result min, sec	Velocity m/sec	Result min, sec	Velocity m/sec	Result min, sec	Velocity m/sec	2004-2014
100	43.8	2.28	35.71	2.80	34.18	2.90	0.52–0.1
200	1:41.0	1.98	1:23.21	2.40	1:19.54	2.50	0.42–0.1
400	3:30.8	1.90	3:03.52	2.17	2:56.93	2.20	0.27–0.03
800	7:32.6	1.82	6:25.61	2.07	6:16.24	2.10	0.25–0.03
1500	14:32.6	1.75	12:29.59	2.00	12:13.52	2.04	0.25–0.04
Underwater swimming (distance, meters)							
100	43.2	2.31	32.40	3.08	31.52	3.10	0.77–0.02
400	3:24.0	1.96	2:47.41	2.38	2:42.9	2.40	0.47–0.02
800	7:16.0	1.83	5:53.49	2.26	5:46.96	2.30	0.43–0.04
Diving (distance, meters)							
50	19.2	2.60	14.8	3.37	13.85	3.60	0.77–0.23

Over a 30-year period the highest and similar velocity gains in both men and women occurred in 100-meter finswimming. 200-meter, 400-meter, 800-meter and 1500-meter distances represent a moderate result gain. The highest velocity gain was recorded in male and female 100-meter underwater swimming and in male 50-meter dive. Men and women

showed almost similar velocity gain in 400-meter underwater swimming (2.22 – 2.20 m/sec). World record results growth over a 30-year period can be described by a linear function which characterizes rapidly increasing results. The further ten-year dynamics f results gain is not so weighty. Velocity gain in all the distances amounts to 0.01 – 0.09 and only in male dive it is 0.23. Based on the world record velocity growth dynamics we can estimate a swimmer – a member of national squad who specializes in his best distance [12, 13].

Conclusion. Thus, world record velocity gain in sprint races in 2014 is described by a linear function, in long distances it is described by an exponent with a limit. Consequently, there will be an insignificant sportive result gain in 400-meter, 800-meter and 1500-meter finswimming in the coming years, provided that there will not occur any changes in contest rules restrictions and in instructional direction of training process. The coaches should take into account the fact that since 2014 the 100-meter underwater swimming distance moved by its time index from submaximal relative power zone with a glycolitic energy source to maximal power zone with an alactic-glycolitic energy source where work demand on oxygen, work oxygen debt and work oxygen cost are different.

This fact changes the approach to development of actual training process of swimmers who specialize in this distance. Swimmers training should correspond with the methods the athletes, who specialize in 50-meter finswimming and 50-meter dive, use in their work. And this imposes high requirements on mental and psychophysiological state as well as on the use of a well-thought-out training method.

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Olga Nikiforovna Moskovchenko, contact number: +79138305880, e-mail: moskovchenko7@mail.ru
Igor Anatolyevich Tolstopyatov, contact number: +79135398061, e-mail: tia965@mail.ru
Elena Vladimirovna Redi, contact number: +79833636242, e-mail: russlen90@mail.ru
Vladimir Vladimirovich Ivanitsky, contact number: +790229423032, e-mail: Vladimir.dianema@gmail.com
Larisa Vyacheslavovna Zakharova, contact number: +79029216502, e-mail: zaxarova.larisa.73@mail.ru